



National Aeronautics and
Space Administration
Langley Research Center
Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

Volume 41

Issue 7

April 4, 2003

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The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 41, APRIL 4, 2003

01 AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

20030019125 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Aging Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Aging Air Vehicles *Les Mecanismes Vieillissants et le Controle: Reunions des Specialistes des Techniques de Gestion du Cycle de Vie pour Vehicules Aeriens Vieillissants*

February 2003; 416p; In English, 8-11 Oct. 2001, Manchester, UK; Also announced as 20030019126 through 20030019159; Original contains color illustrations

Report No.(s): RTO-MP-079(II); AC/323(AVT-085)TP/50; ISBN 92-837-1089-4; Copyright; Avail: CASI; C01, CD-ROM; A18, Hardcopy; A04, Microfiche; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement

The costs of maintaining ageing aircraft are draining the existing budgets. The Specialist Meeting provided guidance on strategies for the development and implementation of technologies and logistic management processes to reduce this economic burden. The emphasis was on military aircraft, but many of the principles could be applied to other defence systems. The papers covered the entire range of ageing problems including structural integrity, corrosion, avionics, mechanical subsystems, structures and wiring as well as the role of information management. Forty-two papers addressed the safety and economic implications such as fatigue cracking, corrosion, wear and material degradation. Key technologies were discussed, including non-destructive inspection, repair, modifications, prevention analysis, and health management. The shortcomings of current were highlighted and the investment required was identified. The need for research and development was clearly identified.

Author

Avionics; Aging (Materials); Degradation; Life (Durability); Mechanical Properties; Materials Science; Autonomy

20030019126 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

Managing the Aging Aircraft Problem

Lincoln, John W., Aeronautical Systems Div., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. KN-1 - KN-9; In English; Also announced as 20030019125; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Ageing aircraft face many challenges. Certainly, one of the most costly is corrosion. The USA Air Force (USAF) spends approximately \$800 million dollars a year for corrosion detection, prevention, and repair. Another major challenge is structural fatigue cracking. This problem has significant safety implications as well as economic. Aging mechanical subsystems constitute a challenge in that they can have such a severe impact on aircraft availability. Aging wiring is also a safety and economic problem. It has not been subject to the research effort that corrosion and fatigue cracking has had in the past. Consequently, it has taken time to initiate remedial actions. Aging avionics is also a major economic burden. The problem is so severe that many of the aging aircraft are not supportable. The aging aircraft problem may be thought of as a spiral. The number of repairs increases. This causes the depot flow rates to decrease. Consequently, the maintenance burden increases. Since there is a lack of funding, the mission capable rate decreases. The problems grow larger through each turn in the spiral. This means that money for modernization of

the fleet is not available. Consequently, the aging aircraft must be retained in the inventory longer than expected. Adequate funding combined with a well-conceived research and development program is essential to break the spiral.

Author

Avionics; Aging (Materials); Fatigue (Materials); Mechanical Properties; Corrosion Prevention; Management Methods

20030019127 Aeronautical Systems Div., Aging Aircraft System Program, Wright-Patterson AFB, OH USA

Setting up a Strategic Architecture for the Life Cycle Management of USAF Aging Aircraft

Carpenter, M., Aeronautical Systems Div., USA; White, J., Aeronautical Systems Div., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 1-1 - 1-6; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The average age of USA Air Force (USAF) aircraft is over 22 years and increasing. The USAF is buying only a fraction of the new aircraft necessary to simply stop the declining age trend. The real effects of aging are seen in increased costs of ownership, and decreasing availability of aircraft to accomplish their mission. With thousands of aircraft in the USAF fleet, managed by numerous agencies, the job of managing the affects of aging is as much a managerial and leadership challenge as it is a technical one. Considering the immensity of the USAF and its breadth of locations around the world, the effort to develop and implement a strategy for managing the USAF's aging fleet is enormous. This paper offers an overview of the management approach being taken by the USAF to manage it's aging fleet and to mitigate the unique effects of aging experienced by its aeronautical weapon systems. First, we offer an understanding and scope of the problem posed by the aging of air vehicles and the systems that support them. Naturally, a strategy for management and technology is developed accompanied by an implementation plan. to carry out the strategy, an execution plan is developed and implemented. to assure continuous refinement of plans and strategies, methodologies for feedback and measurement of metrics must be put in place. Finally, adjustments must be made to strategies and plans to reflect corrective actions necessary in response to metrics, feedback, and environmental changes to assure we continue to lower the cost of ownership, and increase the availability of the aircraft and their supporting systems. This paper will describe these steps and how they were developed in support of a Comprehensive Aging Aircraft Strategy for the USAF.

Author

Aircraft Maintenance; Avionics; Armed Forces (USA); Management Methods; Aging (Materials)

20030019128 Aeronautical Systems Div., Aging Aircraft Planning Div., Wright-Patterson AFB, OH USA

USAF Viable Combat Avionics Initiative

Carpenter, Michael, Aeronautical Systems Div., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 3-1 - 3-46; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

A slide presentation of the USA Air Force Combat Avionics Initiative is presented.

CASI

Avionics; Combat; Armed Forces (USA); Military Technology

20030019129 Aeronautical Systems Div., Wright-Patterson AFB, OH USA

USAF Strategy for Aging Aircraft Structures Research and Development

Grimsley, Frank M., Aeronautical Systems Div., USA; Lincoln, John W., Aeronautical Systems Div., USA; Zeigler, Michael L., Air Force Research Lab., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 5-1 - 5-15; In English; Also announced as 20030019125; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Many nations are now keeping aircraft in their inventories longer than ever before. In many cases, aircraft are left in the inventory longer because they are still operationally effective; however, in most cases, they remain in the inventory because the money is not available to replace them. Aircraft, which are seeing the effects of aging through corrosion and fatigue cracking, are causing their operators to bear a significant economic burden to keep them operational with the potential for degradation of flight safety of aging aircraft if they are not maintained properly. The USA Air Force (USAF) has maintained safety of their aircraft for the last thirty years through the application of damage tolerance principles to determine inspection intervals. This approach has on occasion been modified because of the onset of widespread fatigue damage (WFD) or the loss of material because of corrosion. In the case of WFD, the USAF has developed a modification program to alleviate the problem. In the event of corrosion damage, both modification and reduced inspection intervals have been used. The USAF has developed a strategy for the sustainment of their aircraft starting with the identification of user needs requiring research and development efforts. The strategy is based on identifying research and development opportunities that will have a favorable return on the investment through cost

savings or cost avoidance and increased aircraft availability. This has presented problems since it is difficult to determine the cost of maintaining aircraft in enough detail to determine the return on the investment accurately. The purpose of this paper is to provide a discussion of the aging concerns found in the structure of USAF aircraft and the approach the USAF is pursuing to alleviate these concerns.

Author

Aircraft Structures; Avionics; Economics; Aging (Materials); Research and Development

20030019130 Aeronautical Systems Div., ENFA, Wright-Patterson AFB, OH USA

USAF Strategy for Aging Aircraft Subsystem Research and Development

Kinzig, William C., Aeronautical Systems Div., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 6-1 - 6-7; In English; Also announced as 20030019125; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Like many other nations today, the USA Air Force (USAF) is retaining their existing aircraft longer than planned. It is estimated that the current average age of aircraft in the USAF inventory today is 22 years old. By 2005, 75% of the USAF inventory will be over 20 years old. As the age of our fleet continues to rise, aircraft mission capable rates degrade and there is a potential for increased risk to safety of flight should the aircraft not be properly maintained. Maintenance data indicates that air vehicle subsystems are one of the largest contributors to aircraft downtime due to in-service failures. Fortunately aircraft typically are not lost due to the subsystem failures. However, if one is not careful, this aspect can tend to foster an attitude that we should accept these failure rates. What this approach fails to recognize is that we no longer have the budget or the number of available aircraft to support this level of maintenance. The purpose of this paper is to discuss aging aircraft concerns found in air vehicle subsystems and the approach that the USAF is using to alleviate these concerns.

Author

Aging (Materials); Research and Development; Avionics; Aircraft Design; Armed Forces (USA)

20030019131 Italian Air Force, Logistics Command, Rome, Italy

Ageless Love Aging Fleets: A User's View

Giuliani, Pietro Antonio, Italian Air Force, Italy; Marradi, Francesco, Italian Air Force, Italy; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 7-1 - 7-11; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Today around the world there is great interest in old fleet and in ageing aircraft. The reason for this is due mainly to budget constraints but also to other reasons as safety, and environmental laws. Interesting is to note that today one of the more sparkling area in aerospace industry is related to the MRO activities. But this type of industry requires today and much more in the future the setting of rules and the development of a huge know-how, as well the a/c manufacturer which will introduce as design parameter the "age" and not only the flight cycles or flight hours, as it is today, during the design phase.

Author

Avionics; Aging (Materials); Logistics; Technology Utilization

20030019132 European Aeronautic Defence and Space Co., Military Aircraft Reliability Safety, Munich, Germany

Common Understanding of Life Management Techniques for Aging Air Vehicles

Vogelgaenger, Thomas, European Aeronautic Defence and Space Co., Germany; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 8-1 - 8-15; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Aging aircraft are a growing problem in both military and commercial aviation. With the economic constraints of keeping current military and civilian aircraft in service, and the growing demand for air travel worldwide, the problems of ageing aircraft will continue to worsen. The service life extension of equipment or a system over the initial design period is indeed a question of safety however, as the subsequent explanations show, this a question of efficiency and economy. In a general sense, ageing aircraft are characterized by the deterioration of structural strength properties and the related problems and the increasing maintenance costs. Some of these problems are time dependent, such as corrosion, which also depends heavily on the usage environment. Others are usage dependent, such as in fatigue cracking, which is naturally caused by the mechanical loads that are introduced into the structure and also in electronic devices. Often the damage state of an aircraft is the result of both time (calendar years) and usage (operating hours). to maintain structural integrity, steps must be taken toward the prevention, detection, repair and prediction of the initiation and growth of aircraft structural damage. What are now the valuation criteria for a decision for

or against the further extension of the service life of an ageing aircraft? The paper concludes with a view of future technologies, which could contribute to an expense optimized useful life extension.

Author

Ageing (Materials); Aerospace Vehicles; Civil Aviation; Life (Durability); Management Methods

20030019133 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Fishermans Bend, Australia

Management of Corrosion in Aging Military Systems

Clark, Graham, Defence Science and Technology Organisation, Australia; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 9-1 - 9-8; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

This paper discusses research in Australia into the impact of corrosion on structural integrity, and reviews the steps being taken to improve the capability of the Australian Defence Force to manage corrosion in aircraft. The aim of the research discussed is to develop useful methodologies which are similar to those already in place for fatigue management and which can therefore be introduced relatively easily, and the paper discusses some of the implications of pursuing this goal of absorbing corrosion into our structural integrity management approaches. The research has already achieved some useful developments in assessing the impact of some types of corrosion, and the paper will discuss these highlights briefly to illustrate the methodology being used.

Author

Corrosion; Aging (Materials); Military Technology; Management Methods; Structural Reliability

20030019134 Italian Air Force, Chemistry Dept., Rome, Italy

Corrosion Management of the Italian Air Force Fleet

Colavita, Mario, Italian Air Force, Italy; DePaolis, Fabrizio, Italian Air Force, Italy; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 10-1 - 10-7; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Economic, safety and logistic issues are strongly affected by military aircraft corrosion, more when it regards an aging fleet. Italian Air Force manages this matter by a Corrosion Control Register Program (CCR), a flexible and integrated support for making decisions both on prevention and operational measures. The Program was born in 1994 as a necessary instrument to enhance partnership, in Tornado maintenance, with the German and the Royal Air Forces, but was immediately extended to six more aircraft (AM-X, MB.339, C-130, F.104, G.222, and Br.1150) and to two helicopters fleets (HH-3F and AB.212). Some results of the activity carried out along these years, expressed in terms of useful information for the decision-makers, are shown.

Author

Corrosion; Logistics; Aging (Materials); Avionics; Italy; Economics; Military Technology

20030019135 Lockheed Martin Aeronautics Co., GA USA

Corrosion Management: A Statistical Approach

Bell, Robert, Lockheed Martin Aeronautics Co., USA; Shelton, Don, Lockheed Martin Aeronautics Co., USA; Falugi, Mike, Air Force Research Lab., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 11-1 - 11-13; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

One of the major cost drivers for any aging aircraft is the mitigation of corrosion damage. This problem has been exacerbated as aircraft are being kept in service beyond their original design service life in terms of both flight hours and calendar years. As this trend continues, the need to understand the impact corrosion has on reliability, maintainability, and the cost to maintain an aircraft becomes increasingly important. This paper will focus on these issues and the proposed methodologies by which they can be addressed in the Aircraft Structural Integrity Program (ASIP) today.

Author

Corrosion; Aircraft Structures; Aging (Materials); Statistical Analysis; Military Technology

20030019136 Department of the Air Force, Corrosion Prevention and Control Office, Robins AFB, GA USA

Improved Corrosion Maintenance Practices

Kinzie, R., Department of the Air Force, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 12-1 - 12-9; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The USAF, and much of the aerospace industry, currently manage corrosion by providing clear engineering direction that it will be found and fixed prior to becoming a structural or safety concern. New procurements have been reduced and current fleets are now at, or projected to be beyond, their original design lives. While there is significant fatigue life left, corrosion maintenance costs are escalating rapidly. Initial protection systems have broken down and corrosion is becoming the dominant factor in the life of the aircraft. Under the current engineering policy, often much of the corrosion cost is associated with the dismantling and reassembly of aircraft structure and not the repair itself. Where the corrosion is superficial many of these repairs could be done at a more opportunistic time were there the tools to assure there would be no compromises to the structural integrity. Likewise, there are currently no tools with which to quantify the structural impact of benefits from corrosion abatement technologies. The "find and fix" approach supports better prevention, detection, and repair technology development. However, it does not quantify the beneficial impacts nor facilitate the needed changes in maintenance practices to significantly reduce the rapidly growing corrosion repair costs.

Derived from text

Aerospace Industry; Corrosion; Aircraft Maintenance; Aircraft Structures

20030019137 National Research Council of Canada, Inst. for Aerospace Research, Ottawa, Ontario Canada

Life and Damage Monitoring-Using NDI Data Interpretation for Corrosion Damage and Remaining Life Assessments

Komorowski, Jerzy P., National Research Council of Canada, Canada; Forsyth, David S., National Research Council of Canada, Canada; Bellingier, Nicholas C., National Research Council of Canada, Canada; Hoepfner, David W., Utah Univ., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 13-1 - 13-14; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Holistic life prediction methodologies have been under development for at least the last 30 years. The ever-increasing availability of cheap computing power has now allowed HLPM to be implemented in practical analytical procedures. In the case of aircraft splice joints, the NDI technology required to implement HLPM is available today. The benefits of the implementation of HLPM into fleet management are immediate with current capabilities, and will increase as existing research programs come to fruition.

Derived from text

Corrosion; Damage Assessment; Life (Durability); Technology Utilization; Nondestructive Tests; Avionics

20030019138 Boeing Co., Saint Louis, MO USA

F-15 Structural Life Enhancement

McFarland, Jeff L., Boeing Co., USA; Perez, Rigoberto, Boeing Co., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 14-1 - 14-12; In English; Also announced as 20030019125; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

This paper summarizes the effort funded by the USA Air Force Research Laboratory at Wright Patterson Air Force Base to identify the problem structural areas on the F-15 and recommend appropriate solutions with the development of new technology. Recent modifications to the F-15 airframe structure have taken place or are under consideration to reduce honeycomb water corrosion, reduce maintenance costs, quickly produce spares, provide technology demonstration for future aircraft, and eliminating/reducing maintenance, including NDI inspections and problem fatigue cracking issues. The recommendations in the plan address solutions that can be integrated into an overall life extension plan for fighter aircraft.

Author

Aircraft Structures; F-15 Aircraft; Life (Durability); Technology Utilization; Nondestructive Tests

20030019139 QinetiQ Ltd., Structures and Materials Centre, Farnborough, UK

Life Extension Methodologies and Risk-Based Inspection in the Management of Fracture Critical Aeroengine Components

Boyd-Lee, A. D., QinetiQ Ltd., UK; Painter, D., QinetiQ Ltd., UK; Harrison, G. F., QinetiQ Ltd., UK; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 16-1 - 16-15; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

This paper briefly describes the main methodologies used in the assessment of fracture critical parts. The development of a procedure for the quantitative assessment of non-finite results is discussed and typical life extension levels are illustrated. Risk assessment is considered within the context of the safe life methodology. It is used to quantify the potential risks associated with the short-term continued operation of life-expired parts and to allow their managed withdrawal. The paper then considers risk assessment applied to the damage tolerance and retirement for cause life assessment. The significance benefits of risk based inspections intervals over standard fixed inspections are illustrated. Finally with regard to retirement for cause, it is shown that a risk based approach automatically sets an economical limit to retirement for cause but avoids the progressive risk levels associated with the current embodiment.

Author

Aircraft Engines; Fracturing; Life (Durability); Engine Parts; Risk; Methodology

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Life Cycle Management Strategies for Aging Engines

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Diminishing budgets for new weapon systems are creating pressure within NATO nations to keep legacy aero engines in operation well beyond their service life expectancy. Techniques for safely extracting maximum usage out of aging components in these engines, to reduce maintenance costs, are discussed. The mechanisms responsible for the aging of components are described. The different strategies that fleet managers may adopt for extending component lives economically and safely are identified and discussed from an operator's perspective. The paper borrows from recent NATO activities in this area and shares related Canadian experience. It presents and discusses a qualification methodology for component life extension developed in Canada for the Canadian Forces. The methodology incorporates an Engine Repair Structural Integrity Program (ERSIP), which is used to identify structural performance requirements and the qualification tests required to ensure component airworthiness throughout the extended life. Examples of life extension technologies applied to gas path components and critical rotating parts are described, including the use of protective coatings and repairs to increase component durability. The application of damage tolerance concepts that allow safety-critical components to be used beyond their conventional safe-life limit is also addressed.

Author

Aircraft Engines; Life (Durability); Aging (Materials); Tolerances (Mechanics); Fracture Mechanics

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Assessment of the Efficacy of Polish Air Force Engines for Life Extension vis-a-vis Technology and Practices Prevalent in other NATO Countries

Szczepanik, Ryszard, Polish Air Force Inst. of Tech., Poland; Witos, M., Polish Air Force Inst. of Tech., Poland; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 18-1 - 18-10; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The goal of the paper is to share PAF former and present experiences about dealing with aging engine structures and strategies for their repair versus technology and practices prevalent in other NATO countries. Some issues of safe operation of ageing aeronautical products have been presented on the grounds of the engine-operation model. Special emphasis has been put on some aspects of both: initial tolerances in components engineering and stochastic loads which occur in the course of engine performance

affect the rate of consuming the operational "fit-for-use" reserve of (sub) assemblies. The above-mentioned issues have been approached using predefined functions which represent "life" curves for individual engine components and the engine as a whole.

Author

Aeronautical Engineering; North Atlantic Treaty Organization (NATO); Technology Assessment; Life (Durability); Aging (Materials)

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Engine Life Extension through the Use of Structural Assessment, Non-Destructive Inspection, and Material Characterization

Vukelich, Sharon, Department of the Air Force, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 19-1 - 19-6; In English; Also announced as 20030019125; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

For over twenty years, the USAF has had a life extension program for major rotating hardware, such as rotors, seals, and shafts. This program was called Retirement-For-Cause (RFC). Damage tolerance philosophies are essential to this lifing technique. Damage tolerance has been applied to all new engine programs as part of the Engine Structural Integrity Program (ENSIP) within the USAF since 1984. An essential element of ENSIP and RFC is nondestructive evaluation (NDE). Not only is there a need for NDE equipment, but also the quantification of the NDE system/process. The RFC program provided state of the art NDE equipment and software to enable complex inspections. Due to these advancements low cycle fatigue no longer needs to be the governing factor in the retirement of engine hardware from service when you have a fracture control program. The process of fracture control or damage tolerance as it is also called governs the selection of material as well as the design and life management of the engine. Recent USAF experience clearly demonstrates that the damage tolerance philosophy has had a positive effect on safety within the design life and has shown with our limited experience in RFC that safety is maintained and it is cost effective when assessed on a life cycle cost basis. The initial RFC program had some problems and it is imperative for any future programs that we don't repeat those same mistakes. In order to make life extension of hardware more robust and more cost effective, a new program has been developed called the Engine Rotor Life Extension (ERLE) program. This paper will discuss the original RFC program and its shortcomings as well as our future needs.

Author

Nondestructive Tests; Aircraft Engines; Rotor Dynamics; Life (Durability); Structural Reliability

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Wire Integrity Field Survey of USAF Legacy Aircraft

Kuzniar, Joseph S., Air Force Research Lab., USA; Slenski, George A., Air Force Research Lab., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 20-1 - 20-6; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Wiring is so fundamental to current aerospace equipment that we often forget it is a system unto itself. The aging of a wire system can result in loss of critical functions in equipment powered by the system or in loss of critical information regarding the operation of certain parts of the equipment. Either result can lead to catastrophic equipment failure or to smoke and fire. Consequently, the safety of aerospace wire systems is an issue of major importance to us all.

Author

Aerospace Systems; Structural Reliability; Aging (Materials); Wire; Fighter Aircraft; Surveys

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Wiring System Diagnostic Techniques for Legacy Aircraft

Johnson, David H., Air Force Research Lab., USA; White, Edward L., Air Force Research Lab., USA; D'Angelo, Joseph J., Jr., GRC International, Inc., USA; Dicks, Dwayne, GRC International, Inc., USA; Decker, Adam L., GRC International, Inc., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 21-1 - 21-12; In English; Also announced as 20030019125; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

As aircraft continue to age, managing the overall wiring system is becoming an important issue. Over time, the accumulation of stresses from the operational environment, installation, and maintenance can induce wiring failures. In both design and maintenance, wiring is usually treated more as a commodity than a subsystem. A systematic process for managing wiring is only now just emerging. A major challenge is the development of wiring diagnostic equipment. The diagnosing and repairing of wiring failures can cause extensive downtimes for aircraft. Interconnection failures cannot be easily identified since most test equipment

is designed to locate failures in avionics and not the connector or wiring. Additionally, wiring failures tend to be intermittent in nature and can take considerable time to isolate. Significant reduction in maintenance costs can occur by moving from unscheduled maintenance to a scheduled, preventative, or opportunistic maintenance philosophy based on the ability to isolate and repair degraded electrical systems. This paper will address the wiring system maintenance issues and concerns, field maintenance diagnostic requirements (needs), and compare available diagnostic tools in terms of utility, ease of use, and setup time. It will also address efforts currently being accomplished to modify/adapt commercial off the shelf testers to meet the requirements that will enable the USA Air Force to more effectively manage wiring as an aging subsystem.

Author

Avionics; Wiring; Fighter Aircraft; Aircraft Equipment

20030019145 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA

Requirements for Risk Assessment Tools for Aircraft Electrical Interconnection Subsystems

Smith, Christopher, Federal Aviation Administration, USA; Pappas, Robert, Federal Aviation Administration, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 23-1 - 23-8; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The continued safe operation of aircraft well into their expected service life depends on the safe and effective transfer of electrical power and signals between aircraft electrical devices. This in turn requires the enduring physical integrity of the electrical interconnect subsystem (EIS), which is comprised predominately by wire, connectors, switching devices (including relays and solid state switches) and protective devices such as circuit breakers. Recently there has been speculation that, under some conditions, the EIS on older aircraft may degrade to the point that it is no longer capable of ensuring the safe transfer of electrical current. Though an EIS may be optimal with respect to aircraft design requirements, operational assumptions and the data existing at the time of certification, unanticipated demands on the EIS and changes to aircraft configuration can degrade EIS performance below acceptable limits. In addition, performance characteristics of the EIS over service lives of more than twenty years are difficult to predict. Inevitably, unanticipated failure modes will emerge requiring remedial action. The EIS in modern transport aircraft provides the means of communication and/or power for nearly every subsystem aboard the aircraft. Failures in the EIS could result in the loss of critical functions as well as the potential for fire or other physical damage to the aircraft. Hence, the FAA is conducting a number of research projects addressing aging EIS concerns. The particular focus of one project is the development of advanced EIS risk assessment tools for design optimization and life-cycle management.

Derived from text

Aircraft Equipment; Risk; Electric Power; Design Optimization; Aircraft Design; Connectors

20030019146 Dayton Univ. Research Inst., OH USA

The Pivotal Role and Current Status of Nondestructive Inspection Systems in the Maintenance of Aging Aircraft

Gallagher, J. P., Dayton Univ. Research Inst., USA; Hoppe, W. C., Dayton Univ. Research Inst., USA; Berens, Alan, Dayton Univ. Research Inst., USA; Stubbs, David, Dayton Univ. Research Inst., USA; Buynak, Charles, Air Force Research Lab., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 26-1 - 26-14; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

This paper discusses the pivotal role that Nondestructive Inspection (NDI) plays not only for maintaining safety through early crack detection in airframes and engines, but also for minimizing corrosion maintenance costs. The paper is based on multiple projects that have supported developing and validating NDI systems for crack detection in airframe and engine components and for corrosion detection in airframe structures. These projects have led to a new understanding of how to develop advanced (automated) NDI systems and how to quantify the capability of an inspection system for accurately detecting crack damage or corrosion damage in a maintenance environment. The paper also addresses the issues associated with how reliable, accurate NDI can also be used to detect (and quantify) the early stages of corrosion damage, so that corrosion control strategies can be implemented.

Author

Nondestructive Tests; Aircraft Maintenance; Aging (Materials); Avionics; Aircraft Structures

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Advances in Structural Integrity Analysis Methods for Aging Metallic Airframe Structures with Local Damage

Starnes, James H., Jr., NASA Langley Research Center, USA; Newman, James C., Jr., NASA Langley Research Center, USA; Harris, Charles E., NASA Langley Research Center, USA; Piascik, Robert S., NASA Langley Research Center, USA; Young,

Richard D., NASA Langley Research Center, USA; Rose, Cheryl A., NASA Langley Research Center, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 27-1 - 27-16; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Analysis methodologies for predicting fatigue-crack growth from rivet holes in panels subjected to cyclic loads and for predicting the residual strength of aluminum fuselage structures with cracks and subjected to combined internal pressure and mechanical loads are described. The fatigue-crack growth analysis methodology is based on small-crack theory and a plasticity induced crack-closure model, and the effect of a corrosive environment on crack-growth rate is included. The residual strength analysis methodology is based on the critical crack-tip-opening-angle fracture criterion that characterizes the fracture behavior of a material of interest, and a geometric and material nonlinear finite element shell analysis code that performs the structural analysis of the fuselage structure of interest. The methodologies have been verified experimentally for structures ranging from laboratory coupons to full-scale structural components. Analytical and experimental results based on these methodologies are described and compared for laboratory coupons and flat panels, small-scale pressurized shells, and full-scale curved stiffened panels. The residual strength analysis methodology is sufficiently general to include the effects of multiple-site damage on structural behavior.

Author

Aircraft Structures; Airframes; Crack Propagation; Fracture Mechanics; Metal Surfaces; Aging (Materials); Structural Analysis

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Widespread Fatigue Damage Assessment Approach

Tan, Paul W., Federal Aviation Administration, USA; Bigelow, Catherine A., Federal Aviation Administration, USA; Bakuckas, John G., Jr., Federal Aviation Administration, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 28-1 - 28-10; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

A methodology to assess the development of widespread fatigue damage (WFD) and its effect on the residual strength of aircraft structure has been developed. The three major components of the methodology are crack initiation, crack growth and linkup, and residual strength. The crack initiation methodology uses experimentally generated equivalent initial flaw size (EIFS) data and an analytical closure model to determine initial flaw sizes and distribution for multiple-site cracking. The crack-tip opening angle (CTOA) and the T* integral, and plastic zone touch (PZT) criteria were used to predict crack growth and linkup. Elastic-plastic finite element analyses were used with the CTOA or T* integral to determine the residual strength in the presence of multiple-site damage (MSD). The methodologies were verified through a comprehensive test program.

Author

Damage Assessment; Fatigue (Materials); Mathematical Models; Fracture Mechanics; Aircraft Structures; Methodology

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Programme for Life Extension and Widespread Fatigue Damage Evaluation to Ensure Continued Structural Integrity of Airbus Large Transport Category Airplanes

Trey, Hans, European Aeronautic Defence and Space Co., Germany; Schmidt, Hans-Juergen, European Aeronautic Defence and Space Co., Germany; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 29-1 - 29-15; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The Airworthiness Assurance Working Group (AAWG) has been chartered by FAA to enhance and develop rules for continued structural integrity of large transport category airplanes. The subgroup AAWG - RWG (Rule Writing Group) has completed a draft proposal for enhancement of AC91-56 and the introduction of operational rules of aircraft operated under 14 CFR Parts 91, 121, 125, 129 and 135. The Airbus activities to meet the new regulations are in progress for the Airbus types A300B2, A300B4-100, A300B4-200 and A300B4-600. This paper describes details of tests, analysis and procedures to meet the new requirements and recommendations. The presentation discusses especially the activities for the pressurized fuselage, which is mainly under the responsibility of Airbus Deutschland GmbH. The Airbus Life Extension activities include a general review of the fatigue and damage tolerance analysis prepared for type certification, interpretation of full scale fatigue test findings, tear down results and SB review with respect to extended service goals. Special emphasis will be given to the investigation and analysis of Widespread Fatigue Damage (WFD).

Author

Aircraft Reliability; Fatigue (Materials); Structural Failure; Life (Durability); European Airbus

20030019150 Defence Science and Technology Organisation, Airframes and Engines Div., Australia

Bonded Repair Technology for Aging Aircraft

Baker, Alan, Defence Science and Technology Organisation, Australia; Chester, Richard, Defence Science and Technology Organisation, Australia; Mazza, James, Air Force Research Lab., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 31-1 - 31-18; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

NATO weapons systems are being extended well beyond their design lives due to decreases in defence budgets and the rising costs associated with procuring new hardware. This situation makes it increasingly important that methods for extending the lives of these weapon systems in a cost-effective manner be developed and implemented to the greatest extent possible. Adhesive bonding technology, particularly bonded composite repairs/enhancements, has been successfully applied by several nations to extend the lives of aircraft by bridging cracks in metal structure, reducing strain levels, and repairing areas thinned by corrosion. Bonded composite reinforcements are highly efficient and cost effective when compared to conventional mechanically fastened approaches. In some cases, bonded repair technology is the only alternative to retiring a component. This technology has already resulted in the documented savings of hundreds of millions of dollars in Australia and the USA. This paper describes the advantages of bonded composite repairs over conventional repair methods. Bonded joint design/analysis, installation procedures, nondestructive inspection, certification issues, and other key aspects of the technology are generally addressed. Examples of applications to aircraft are used to illustrate these issues as well as demonstrate bonded repair advantages. The capabilities and resources required to successfully apply bonded repairs are discussed. Finally, several recent reviews of this technology area are summarized to indicate where the key scientific gaps remain and to suggest research that should be undertaken to further enhance the usefulness of the technology.

Author

Adhesive Bonding; Aircraft Structures; Technology Utilization; Aircraft Maintenance; Aging (Materials)

20030019151 Fatigue Technology, Inc., Seattle, WA USA

Sustaining an Aging Aircraft Fleet with Practical Life Enhancement Methods

Reid, Len, Fatigue Technology, Inc., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 32-1 - 32-12; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Extension of aircraft beyond their original design service life or operation in expanded or different roles pose challenges in continuing to operate these aircraft economically or safely. Management of the fleet generally entails increased structural inspection and maintenance, repair of inevitable fatigue damage or possible structural replacement. In a large number of cases structural elements become life limiting or require major rework due to fatigue cracks and damage originating at holes. Hole cold expansion to induce residual compressive stresses around the hole, and thereby minimize the stress concentration effect of the hole, is a proven method for retarding cracks at holes. Reworking existing structure using this technology can significantly extend the fatigue and damage tolerance life and ultimately reduce or eliminate the need for costly ongoing structural inspection while ensuring continued airworthiness without compromising performance or weapons systems capability. This paper discusses the hole cold expansion method as well as derivative technology used to repair fatigue cracked or corroded holes using high interference fit cold expanded bushings. Examples of where the technology is used to extend service lives and restore structural integrity on aging military and commercial aircraft will be presented.

Author

Aircraft Reliability; Commercial Aircraft; Tolerances (Mechanics); Life (Durability); Mechanical Properties; Aging (Materials)

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Recognition and Correction of Sonic Fatigue Damage in Fighter Aircraft

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High performance aircraft that fly aggressive low altitude or high-angle of attack maneuvers will experience high acoustic loading, especially in the presence of external stores. These high acoustic loads can lead to rapid sonic fatigue in thin gage metallic structure. As a means of prolonging fatigue life, while at the same time restoring structural load carrying capability in damaged structure, composite bonded repairs which incorporate damping layers have been developed. These damped composite bonded

repairs are installed on F-15 flight test aircraft. This paper describes ways to recognize sonic fatigue damage, and the design and flight test results of representative damped patches.

Author

Fighter Aircraft; Acoustic Fatigue; Loads (Forces); Flight Tests; Fatigue (Materials)

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SUSTAIN(tm): Sustainment Strategy for Avionics Information Needs

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SUSTAIN is being developed to be relevant to the needs of the user, and to provide accurate and complete data analysis in a timely and user friendly manner. The unique feature of the concept is that it takes advantage of the large amount of data available to the sustainer and processes that data in a manner that is most useful to him or her. Relevance is insured by using mission readiness as the primary metric for evaluating potential sustainment actions. Additional information comes from the automatic calculation of the sustainment cost for each assembly under consideration. Accuracy of the output is guaranteed if the analysis algorithms are correct and the input data are correct. by using only government approved or acknowledged databases, then the data accuracy is as good as can be obtained.

Derived from text

Avionics; Information Management; Military Technology; Computer Systems Programs

20030019154 Naval Air Warfare Center, Propulsion and Power Dept., Patuxent River, MD USA

A USN Strategy for Mechanical and Propulsion Systems Diagnostics and Prognostics, Life Usage Monitoring and Damage Tolerance: Applications to Aging Aircraft Problems

Hess, Andrew, Naval Air Warfare Center, USA; Ahne, Rebecca, Naval Air Warfare Center, USA; Hardman, William, Naval Air Warfare Center, USA; Fila, Leo, Naval Air Warfare Center, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 35-1 - 35-12; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

A US Navy strategy has been generated to develop and demonstrate diagnostics, prognostics, health management and life management for propulsion and mechanical systems. How this overall strategy has evolved and the current status will be presented. The SH-60 platform was selected for the first proof-of-concept effort to develop, demonstrate, and integrate available and advanced mechanical diagnostic technologies for propulsion and power drive system monitoring. Included in these technologies were various rule based and model-based analysis techniques that were applied to demonstrate and validate various levels of diagnostic and prognostic capabilities. These will be discussed and updated. Using past "seeded fault" tests as case examples, various diagnostic methods were used to identify the faults, and various means of applying prognostics, health management and life management are discussed. Other more recent examples of "seeded faults" and related tests will also be discussed as case studies, demonstrating various degrees of diagnostic, prognostic, health management and life management capabilities. Relative rating of the performance of some of the different analysis techniques evaluated will also be discussed. As used in this paper, prognostics is the capability to provide early detection of the precursor and/or incipient fault condition to a component or subelement failure condition; and to have the technology and means to manage and predict the progression of this fault condition to component failure.

Author

Damage; Propulsion System Performance; Tolerances (Mechanics); Aging (Materials); Life (Durability); Navy

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The Need for a Systems Engineering Approach for Measuring and Predicting the Degradation of Aging Systems and How It Can Be Achieved

Robinson, William, Georgia Tech Research Inst., USA; Welch, Gisele, Georgia Tech Research Inst., USA; O'Neill, Gary, Georgia Tech Research Inst., USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 36-1 - 36-12; In English; Also announced as 20030019125; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

This paper will explore the need for a comprehensive approach to measuring, and predicting, degradations in aging NATO aircraft and use of these predictions in a "systems approach" to solving the challenges faced in supporting these aircraft. Various groups within the NATO countries have already accomplished significant progress in this area, so this paper is an attempt to refine a more global process that will provide the most useful results in the least amount of time. We believe that the appropriate application of both emerging and seemingly unrelated technologies, coupled with a systems engineering management approach, may provide acceptable results.

Author

Degradation; Systems Engineering; Aging (Materials); Avionics; Mathematical Models

20030019156 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
F-111 Sole Operator Program: Maintaining the Structural Integrity of an Aging Fighter Aircraft

Watters, Kevin, Defence Science and Technology Organisation, Australia; Rose, Francis, Defence Science and Technology Organisation, Australia; Heller, Manfred, Defence Science and Technology Organisation, Australia; Callus, Paul, Defence Science and Technology Organisation, Australia; Madley, Bill, Aerostructures Australia, Australia; Connor, Paul, Royal Australian Air Force, Australia; Aging Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Aging Air Vehicles; February 2003, pp. 38-1 - 38-13; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The F-111 is a dual-seat, supersonic, variable-geometry-wing strike aircraft that has enjoyed RAAF and USAF service for the last 30 years. Approximately 550 aircraft were built between 1964 and 1973, with model variants from F-111A to F-111F. RAAF operations commenced in 1973 with the purchase of 24 F-111C aircraft and are planned to continue to 2020. Due to the age of the fleet and its changed circumstances following the retirement of the USAF F-111 fleets, a special program was initiated by the RAAF, to step back and take a fresh, holistic look at its F-111 aircraft structural integrity (ASI) management. It was titled the "F-111 Sole Operator Program" and the aim was to ensure that all the required capabilities and data were in place to support the structural integrity of the aircraft to 2020. The Sole Operator Program (SOP) sits in a framework of broader RAAF initiatives to ensure the supportability of all F-111 systems to the planned withdrawal date. This paper describes both the F-111 SOP and the broader RAAF initiatives on F-111 structural integrity.

Derived from text

F-111 Aircraft; Fighter Aircraft; Aging (Materials); Structural Reliability; Aircraft Structures

20030019157 Atomic Energy Research Inst., Budapest, Hungary

Research of Extension of the Life Cycle of Helicopter Rotor Blade in Hungary

Balasko, M., Atomic Energy Research Inst., Hungary; Endroczi, G., Hungarian Academy of Sciences, Hungary; Veres, J., Hungarian Air Force, Hungary; Molnar, G., Hungarian Air Force, Hungary; Korosi, F., Szent Istvan Univ., Hungary; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 39-1 - 39-15; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Combined measurements have been carried out at the Budapest research reactor, where the dimension of the radiography station was extended for the purpose the control the condition of helicopter rotor blades in the different period of their life time. High resolution radiography pictures were taken to find anomaly in the distribution of resin materials at the core-honeycomb-hull interfaces, failure at the "adhesive filling" and possible bondline flaws. Parallel to the radiographic visualisation vibration tests using the method of statistic energy analysis (focused on damping and energy distributions and propagation) served for control of dynamic behaviour of different aged structures. As a result of the work it is suggested that the combined application of the neutron-, X-ray radiography and vibration diagnostics might be a very useful method for the condition monitoring of helicopter rotor blades and other similar composite structures.

Author

Rotor Blades (Turbomachinery); Life (Durability); Hungary; Aircraft Structures; Helicopters; Radiography

20030019158 Boeing Co., Oklahoma City, OK USA

Life Cycle Cost Modeling and Simulation to Determine the Economic Service Life of Aging Aircraft

Sperry, K. R., Boeing Co., USA; Burns, K. E., Department of the Air Force, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 40-1 - 40-12; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Estimating the point at which the advantages of a modern aircraft alternative exceed the economic burden of maintaining aging aircraft is very complex. This paper presents a cost estimating methodology to forecast costs associated with maintaining an aging aircraft fleet, by combining traditional Operation and Support (O&S) cost elements from a USAF AFI 65-503 CORE model, with expert analysis to quantify maintenance cost growth due to aging. The result is an Economic Service Life (ESL) model that can be used to determine the economic service life of an aircraft. The uncertainties associated with long-range forecasting are considered by combining range estimates within a Monte Carlo simulation for each critical input variable. The model's cost output then becomes a useful fleet management tool to evaluate potential fleet costs while varying annual flying hours and/or aircraft inventory and aids in the evaluation of modernization/ retirement scenarios. Cost output from the model is presented in Constant-Year (CY), Then-Year (TY) and discounted or Net Present Value (NPV) dollars to allow further economic decision analysis.

Author

Aging (Materials); Economic Analysis; Life Cycle Costs; Mathematical Models; Service Life; Avionics

20030019159 Royal Navy, JSF Program Office, UK

The Joint Strike Fighter (JSF) PHM and the Autonomic Logistic Concept: Potential Impact on Aging Aircraft Problems

Henley, Simon, Royal Navy, UK; Hess, Andrew, Naval Air Warfare Center, USA; Fila, Leo, Naval Air Warfare Center, USA; Ageing Mechanisms and Control: Specialists' Meeting on Life Management Techniques for Ageing Air Vehicles; February 2003, pp. 41-1 - 41-8; In English; Also announced as 20030019125; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

In today's world, as defense budgets continue to shrink, it is becoming increasingly more difficult to maintain a constant level of force structure through new acquisitions. A direct result of these shrinking budgets and decreased purchases is a current fleet of increasingly aging aircraft. We are forced to use the existing fleet assets much longer than originally projected and more often, in new and unanticipated roles. No longer will mass purchases of many models of new aircraft ensure that there are plenty of assets to meet all operational requirements. Much of today's aircraft fleet is well over 20 years old, which presents a new variety of problems in maintaining those aircraft that are nearing their operational life when there is no immediate sign of a replacement. All too frequently degraded equipment, assisted by inadequate maintenance practices, lead to preventable incidents in which people are injured or killed. This situation also ensures additional and very high operational and support costs; since older systems are less reliable, and harder and more costly to maintain. A discussion of the Joint Strike Fighter's (JSF) Prognostics and Health Management (PHM) system will be presented in this paper, with an emphasis on its capabilities and its aims to enhance aircraft safety; significant reduce operation and support costs; as well as minimize the impacts of the enviable aging fleet. The PHM system is, by design, envisioned to provide an information rich and highly intelligent aircraft. A major tenet of this discussion will be that robust information sources provided by the PHM system can and will be used to mitigate aging aircraft problems.

Derived from text

Aging (Materials); Systems Health Monitoring; Fighter Aircraft; Autonomy; Logistics

20030020346 Universities Space Research Association, Advanced Design Program, Houston, TX USA

Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Aeronautics Design Program and Advanced Space Design Program, 1992-1993

Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993]; 501p; In English, 14-18 Jun. 1993, Houston, TX, USA; Sponsored by NASA Johnson Space Center, USA; Also announced as 20030020347 through 20030020393

Contract(s)/Grant(s): NASW-4435

Report No.(s): EP-309; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

The NASA/USRA University Advanced Design Program was established in 1984 as an attempt to add more and better design education to primarily undergraduate engineering programs. The original focus of the pilot program encompassing nine universities and five NASA centers was on space design. Two years later, the program was expanded to include aeronautics design with six universities and three NASA centers participating. This year marks the last of a three-year cycle of participation by forty-one universities, eight NASA centers, and one industry participant. The Advanced Space Design Program offers universities an opportunity to plan and design missions and hardware that would be of use in the future as NASA enters a new era of exploration and discovery, while the Advanced Aeronautics Design Program generally offers opportunities for study of design problems closer to the present time, ranging from small, slow-speed vehicles to large, supersonic and hypersonic passenger transports. The systems approach to the design problem is emphasized in both the space and aeronautics projects. The student teams pursue the chosen problem during their senior year in a one- or two-semester capstone design course and submit a comprehensive written report at the conclusion of the project. Finally, student representatives from each of the universities summarize their work in oral

presentations at the Annual Summer Conference, sponsored by one of the NASA centers and attended by the university faculty, NASA and USRA personnel and aerospace industry representatives. As the Advanced Design Program has grown in size, it has also matured in terms of the quality of the student projects. The present volume represents the student work accomplished during the 1992-1993 academic year reported at the Ninth Annual Summer Conference hosted by NASA Lyndon B. Johnson Space Center, June 14-18, 1993.

Derived from text

Conferences; University Program; NASA Programs; Aircraft Design; Aeronautical Engineering; Commercial Aircraft

02 AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.

20030018892 NASA Langley Research Center, Hampton, VA USA

Hyper-X Stage Separation Wind-Tunnel Test Program

Woods, William C., NASA Langley Research Center, USA; Holland, Scott D., NASA Langley Research Center, USA; DiFulvio, Michael, NASA Langley Research Center, USA; Journal of Spacecraft and Rockets; November 2001; ISSN 0022-4650; Volume 38, No. 6, pp. 811-819; In English; AIAA 18th Applied Aerodynamics Conference, 14-17 Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-4008; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

NASA's Hyper-X research program was developed primarily to flight demonstrate a supersonic combustion ramjet engine, fully integrated with a forebody designed to tailor inlet flow conditions and a free expansion nozzle/afterbody to produce positive thrust at design flight conditions. With a point-designed propulsion system the vehicle must depend on some other means for boost to its design flight condition. Clean separation from this initial propulsion system stage within less than a second is critical to the success of the flight. This paper discusses the early planning activity, background, and chronology that developed the series of wind-tunnel tests to support multi-degree-of-freedom simulation of the separation process. Representative results from each series of tests are presented, and issues and concerns during the process and current status are highlighted.

Author

Stage Separation; Wind Tunnel Tests; Supersonic Combustion Ramjet Engines; Simulation

20030018955 Manchester Univ., UK

Design, Fabrication and Test of a Wind-Tunnel Model for an Efficient All-Movable Fin Design for Military Aircraft *Final Report, 19 Sep. 2001- 19 Sep 2002*

Cooper, Jonathan E.; Sep. 21, 2002; 32p; In English; Original contains color images

Contract(s)/Grant(s): F61775-01-W-E081

Report No.(s): AD-A410003; EOARD-SPC-01-4081; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report results from a contract tasking University of Manchester as follows: A generic all-movable vertical tail will be developed to investigate Diverging Flexible Vertical Tail Technology (DFVT). This model will be a modified version of an existing (U. of Manchester) carbon fiber composite transonic model. This model will have its boundary conditions adjusted based upon results of a previous analytical optimization study that examined weight, performance and observable benefits. A number of different parameters including: Mach number- both sub and supersonic speeds, attachment position, and variable attachment stiffnesses will also be examined experimentally in the wind tunnel at the University of Manchester, UK.

DTIC

Aircraft Design; Tail Assemblies

20030018966 Human Systems Information Analysis Center, Wright-Patterson AFB, OH USA

Human Systems IAC Gateway. Volume 12, Number 1, 2001

Jan. 2001; 25p; In English; Original contains color images

Report No.(s): AD-A410023; No Copyright; Avail: Defense Technical Information Center (DTIC)

This newsletter contains information on Aviation Systems, Cognitive Engineering, Cognitive Systems and how they should be engineered for aviation domains, balancing research and design, Cognitive Work Analysis for Air Defense Applications in

Australia, Cognitive Cockpit Engineering, and analyzing the cognitive system from a perceptual control theory point of view. The letter also has a calendar of upcoming, and human systems events.

DTIC

Cognition; Aeronautics; Human Factors Engineering

20030019194 Purdue Univ., Research Foundation, West Lafayette, IN USA

Unsteady Aerodynamics and Aeromechanics of Multi-Stage Turbomachinery Blading *Final Report, Nov. 1996-Aug. 2002*

Fleeter, Sanford; Nov. 30, 2002; 200p; In English

Contract(s)/Grant(s): F49620-97-1-0009

Report No.(s): AD-A409566; AFRL-SR-AR-TR-02-0436; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

An integrated experiment-theory approach included collaboration between Pratt & Whitney, Duke University, and Purdue University. A benchmark-standard multistage transonic research compressor was developed by modifying the Purdue High-Speed Axial Compressor to feature new IGV and stator rows representative of modern high pressure compressors. A quantitative understanding and predictive capability for multi-stage blade row forced response was developed by analytically and experimentally investigating the fundamental flow phenomena. Experiments at Purdue investigated and quantified the interacting blade row unsteady aerodynamics and resulting vane vibration and stress response. Duke University developed a new computationally efficient unsteady aerodynamic analysis of multistage flows associated with flutter and forced response. The inherently small damping of complex higher order modes was addressed by investigating techniques to control the flow induced vibrations. The issue of robustness was also considered.

DTIC

Aircraft Engines; Aeroelasticity; Rotors; Rotor Aerodynamics; Unsteady Aerodynamics

20030019202 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA

F-15 8.33-Percent Model Internozzle Dynamic Pressure Environment *Final Report, 1-31 May 1986*

Shaw, L. L.; Otto, C. J.; Banaszak, D. L.; Plzak, G. L.; May 1986; 54p; In English

Report No.(s): AD-A409895; AFWAL-TM-86-198-FBIG; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The F-15 Strategic Programs Office (ASD/TAF) requested the Structural Vibration and Acoustics Branch to record and analyze data from a wind tunnel test on an 8.33-percent model F-15 aircraft. The objective was to assess the effect various model configurations had on the aeroacoustic loads around the aft nozzle region.

DTIC

Aerodynamics; Fighter Aircraft

20030019867 Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH USA

F-15 Model Internozzle Dynamic Pressure Acquisition *Final Report, 1 Nov. 1982-1 Aug. 1983*

Bolds, Phyllis; Banaszak, David; Shaw, Leonard L., Jr.; May 1984; 182p; In English

Contract(s)/Grant(s): AF Proj. 2307

Report No.(s): AD-A410139; AFWAL-TM-83-214-FIBG; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

A dynamic pressure survey of a 4.7-percent model of the F-15 aircraft was conducted during buffeting of F-15 afterbody nozzle in the NASA LaRC's 16-foot tunnel to obtain insight into the internozzle dynamic pressure phenomena germane to closely spaced engine installations. This test consisted of varying the Mach number from 0.48 to 1.2, the nozzle pressure ratio from 1 to 5, and the angle of attack from 0 to 6 degrees. These conditions were measured at six locations on the afterbody using strain gauge pressure transducers. It was determined that the measured data were broadband random, strongly stationary, and correlated.

DTIC

Dynamic Pressure; F-15 Aircraft; Pressure Ratio; Pressure Sensors; Exhaust Nozzles

20030020472 Montpellier Univ., Dept. of Mathematics, France

Optimization of Aerodynamic and Acoustic Performance of Supersonic Civil Transports

Mohammadi, Bijan, Montpellier Univ., France; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 285-296; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We present a shape-optimization problem under acoustic, aerodynamic and geometric constraints. The acoustic specification concerns the generated sonic boom. The aim is to see the validity of incomplete sensitivities when a nonlinear CFD model is coupled with a nonlinear wave-transport model to define pressure rise on the ground.

Author

Aeroacoustics; Aerodynamic Characteristics; Supersonic Transports; Acoustic Properties

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.

20030020303 NASA Glenn Research Center, Cleveland, OH USA

Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review

Martzaklis, K. Gus, Compiler, NASA Glenn Research Center, USA; January 2003; 819p; In English, 5-7 Jun. 2001, Independence, OH, USA; Sponsored by NASA Glenn Research Center, USA; Also announced as 20030020304 through 20030020345; Original contains color illustrations

Contract(s)/Grant(s): RTOP 728-40-30

Report No.(s): NASA/CP-2003-210964; E-12817; NAS 1.55:210964; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

The Second NASA Aviation Safety Program (AvSP) Weather Accident Prevention (WxAP) Annual Project Review held June 5-7, 2001, in Cleveland, Ohio, presented the NASA technical plans and accomplishments to the aviation community. NASA-developed technologies presented included an Aviation Weather Information System with associated digital communications links, electronic atmospheric reporting technologies, forward-looking turbulence warning systems, and turbulence mitigation procedures. The meeting provided feedback and insight from the aviation community of diverse backgrounds and assisted NASA in steering its plans in the direction needed to meet the national safety goal of 80-percent reduction of aircraft accidents by 2007. The proceedings of the review are enclosed.

Author

Aircraft Safety; Cockpit Weather Information Systems; Airborne Radar; Atmospheric Turbulence; Conferences; Aircraft Control; Accident Prevention; Weather Forecasting

20030020304 NASA Glenn Research Center, Cleveland, OH USA

Aviation Safety Program: Weather Accident Prevention (WxAP) Project Overview and Status

Nadell, Shari-Beth, NASA Glenn Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 1-17; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents a project overview and status for the Weather Accident Prevention (WxAP) aviation safety program. The topics include: 1) Weather Accident Prevention Project Background/History; 2) Project Modifications; 3) Project Accomplishments; and 4) Project's Next Steps.

CASI

Weather; General Overviews; Aircraft Safety; Accident Prevention; NASA Programs

20030020305 NASA Glenn Research Center, Cleveland, OH USA

Aviation Safety Program: Weather Accident Prevention (WxAP) Development of WxAP System Architecture and Concepts of Operation

Grantier, David, NASA Glenn Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 18-32; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents viewgraphs on the development of the Weather Accident Prevention (WxAP) System architecture and Concept of Operation (CONOPS) activities. The topics include: 1) Background Information on System Architecture/CONOPS Activity; 2) Activity Work in Progress; and 3) Anticipated By-Products.

CASI

Aircraft Safety; Systems Engineering; Accident Prevention; Weather

20030020310 NASA Langley Research Center, Hampton, VA USA

NASA Langley WINN System Operational Assessment

Jonsson, Jon, NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 101-111; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

An operational assessment of the NASA Langley Weather Information Network (WINN) System is presented. The objectives of this program include: 1) Determine if near real-time weather information presented on the flight deck improves pilot situational awareness of weather; and 2) Identify pilot interface issues related to the use of WINN system during test flights. This paper is in viewgraph form.

CASI

Information Systems; Weather; Communication Networks; Flight Operations; Technology Assessment; NASA Programs

20030020311 United Air Lines, Inc., Flight Operations Technology, USA

United's SKY-PAD(tm) Project

Burns, Joe, United Air Lines, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 112-133; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents a general overview of United Airlines Sky-pad project. The topics include: 1) Previous AWIN project; 2) Current AWIN/AFB Activity-Phase I; and 3) UAL Future "Sky-Pad" activity-Phases 2-4.

CASI

Airline Operations; Commercial Aircraft; General Overviews; Information Systems; Weather

20030020319 NASA Langley Research Center, Hampton, VA USA

Decision-Making in Flight with Different Convective Weather Information Sources: Preliminary Results from the Langley CoWS Experiment (CONvective WEather Sources)

Chamberlain, Jim, NASA Langley Research Center, USA; Latorella, Kara, NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 229-256; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on an airborne experiment designed to test the decision making of pilots receiving different sources of meteorological data. The presentation covers the equipment used in the CONvective WEather Sources (CoWS) Experiment, including the information system and display devices available to some of the subjects. It also describes the experiment, which featured teams of general aviation pilots, who were onboard but did not actually fly the aircraft used in the experiment. The presentation includes the results of a survey of the subjects' confidence.

CASI

Meteorological Parameters; Information Systems; Decision Making; General Aviation Aircraft; Aircraft Pilots; Display Devices

20030020322 Johns Hopkins Univ., Information Transfer Group, Laurel, MD USA

FIS Architecture Study Plan

Nichols, Robert, Johns Hopkins Univ., USA; Kasch, William, Johns Hopkins Univ., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 308-322; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on possible communication architectures and technologies to support a Flight Information System (FIS). Included are a methodology and criteria for evaluating architectures. The presentation diagrams a communications system development spectrum, and lists architecture requirements.

Author

Information Systems; Aircraft Communication; Architecture (Computers); Telecommunication

20030020323 Federal Aviation Administration, Weather Policy Div., USA

TAMDAR Development Strategy Tri-Agency Team

Schmidt, Sandra, Federal Aviation Administration, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 323-327; In English; Also announced as 20030020303; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche

This paper is a viewgraph presentation on the Tropospheric Airborne Meteorological Data Reporting (TAMDAR) development strategy Tri-Agency Team.

CASI

Troposphere; Civil Aviation; Meteorological Radar; Data Acquisition; Weather; Airborne Equipment

20030020324 NASA Langley Research Center, Hampton, VA USA

TAMDAR Capabilities Development

Daniels, Taumi, NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 328-363; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

In this viewgraph presentation, information is provided on a collaboration between NASA, the FAA (Federal Aviation Administration), and NOAA (National Oceanographic and Atmospheric Association), particularly regarding the development of a TAMDAR Sensor system. TAMDAR is envisioned to downlink weather data such as icing, temperature, pressure altitude, humidity, magnetic heading, eddy dissipation rate, true airspeed, dew point, density altitude, and winds at altitude from non-jet aircraft. The weather data will be sent to FSL (Forecast Systems Laboratory), FSS (Flight Service Station), ATC (Air Traffic Control), AWC (Aviation Weather Center), and others via a ground-based infrastructure and to other aircraft. New weather products will be generated and uplinked to the cockpit.

CASI

Flight Conditions; Flight Instruments; Weather; Sensors; Systems Engineering

20030020326 Old Dominion Univ., Dept. of Engineering Management, VA USA

Overview: Business Feasibility of the TAMDAR System

Kauffmann, Paul, Old Dominion Univ., USA; Ozan, Erol, Old Dominion Univ., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 379-412; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the business considerations to be made in regard to the development of the TAMDAR (Tropospheric Airborne Meteorological Data Reporting) system. Topics covered include: the mechanics of the system, the capabilities of the system, the cost of the system. Particular coverage is given to the economic analysis of the system regarding its feasibility as a working business model.

CASI

Economic Analysis; Feasibility; Meteorological Instruments; Systems Engineering; Airborne Equipment

20030020328 NASA Dryden Flight Research Center, Edwards, CA USA

Airborne Turbulence Warning System Development

Bogue, Rod, NASA Dryden Flight Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 429-432; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the development of a system by which aircraft pilots will be warned of turbulence. This networked system of in situ sensors will be mounted on various aircraft all of which are linked through a ground based parabolic antenna. As its end result, this system will attempt to reduce the number of accidents arising from turbulence.

CASI

Airborne Equipment; Systems Engineering; Atmospheric Turbulence; Warning Systems; Meteorological Instruments; Flight Conditions

20030020338 NASA Dryden Flight Research Center, Edwards, CA USA

Secure Cabin Exercise Briefing

Bogue, Rod, NASA Dryden Flight Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 701-712; In English; Also announced as 20030020303; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of a simulation exercise designed to determine the estimated time required to configure a commercial aircraft cabin for safe transit of atmospheric turbulence. Simulations are to be carried out in a number of wide-body and narrow-body aircraft cabins using professional cabin crews and paid passenger subjects. A number of variables are considered including passenger load, flight attendant compliment, cabin class and cabin activities. Various scenarios are also being played out in the exercises.

CASI

Aircraft Compartments; Atmospheric Turbulence; Aircraft Safety; Simulation; Flight Operations

20030020341 NASA Glenn Research Center, Cleveland, OH USA

NASA-FAA-NOAA Partnering Strategy

Colantonio, Ron, NASA Glenn Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 746-757; In English; Also announced as 20030020303; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of NASA-FAA (Federal Aviation Administration) and NOAA (National Oceanic and Atmospheric Administration) collaboration efforts particularly in the area of aviation and aircraft safety. Five technology areas are being jointly by these agencies: (1) aviation weather information; (2) weather products; (3) automet technologies; (4) forward looking weather sensors and (5) turbulence controls and mitigation systems. Memorandum of Agreements (MOU) between these agencies are reviewed. A general review of the pros and pitfalls of inter-agency collaborations is also presented.

Author

Aircraft Safety; Turbulence; Research Management; Project Management

20030020344 Honeywell International, Inc., USA

FIS Implementation

Joyce, Jim, Honeywell International, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 781-790; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of FIS implementation across the country. Topics covered include: preliminary groundstation site map, system integration efforts, FIS Supercell frequency/Time Slotting, subscription control, operational challenges and future technologies.

CASI

Aircraft Safety; Cockpit Weather Information Systems; Airborne Equipment; Turbulence; Systems Integration

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications; Spacecraft Communications, Command and Tracking, and 32 Communications and Radar.

20030019318 Oklahoma Univ., Dept. of Psychology, Norman, OK USA

Aiding Planning in Air Traffic Control: An Experimental Investigation of the Effects of Perceptual Information Integration Final Report

Moertl, Peter M.; Canning, John M.; Gronlund, Scott D.; Dougherty, Michael R.; Johansson, Joakim; Dec. 2002; 7p; In English Contract(s)/Grant(s): 97-G-037

Report No.(s): AD-A409992; DOT/FAA/AM-02/22; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Prior research examined how controllers plan in their traditional environment and identified various information uncertainty by perceptually representing important constraints. This included integrating spatial information on the radar screen with discrete information (planned sequences of air traffic). Canning et al. (1999) and Moertl et al. (2000) reported improved planning performance and decreased workload in the planning aid condition. The purpose of this paper was to determine the source of these performance improvements. Analysis of computer interactions using loglinear modeling showed that the planning interface led to less repetitive, but more integrated, information retrieval gave rise to the performance improvements. Potential applications

of this research include the design and evaluation of interface automation that keeps users in active control by modification of perceptual task characteristics.

DTIC

Air Traffic Control; Information Retrieval; Radar Equipment; Active Control; Human-Computer Interface

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.

20030018920 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
Helicopter/Ship Qualification Testing, Volume 22 *Les Essais de Qualification Helicoptere/Navire, Volume 22*
Carico, G. D., Naval Air Systems Command, USA; Fang, R., National Aerospace Lab., Netherlands; Finch, R. S., QinetiQ Ltd., UK; Geyer, W. P., Jr., Naval Air Systems Command, USA; Krijns, H. W., Royal Netherlands Navy, Netherlands; Long, K., Naval Air Systems Command, USA; February 2003; 126p; In English; Original contains color illustrations
Report No.(s): RTO-AG-300-Vol-22; AC/323(SCI-038)TP/53-Vol-22; ISBN 92-837-1093-2; Copyright; Avail: CASI; C01, CD-ROM; A07, Hardcopy; A02, Microfiche; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement

The purpose of this AGARDograph is to document the preparation, execution, and data analysis of helicopter/ship flight-testing. The attention is focused on helicopter take-off and landing which constitutes the main part of the test programme. Described are: The factors influencing the helicopter/ship operations; How these factors are determined in various qualification programme elements; How these factors are used to set up a flight test programme on board the ship; How the ship-borne flight tests, within the constraints of safety and efficiency, are carried out; In what way, during the tests, repeated use is made of the data obtained in the previous qualification programme elements and of the experience of the test team, resulting in the smallest possible number of flying hours without affecting the quality of the results. A brief outline of helicopter-ship qualification programmes as carried out by the Netherlands National Aerospace Laboratory (NLR), by QinetiQ (formerly the UK Defence Evaluation & Research Agency (DERA) at Boscombe Down in the UK and by the US Naval Air Warfare Center Aircraft Division (NAWCAD) at Patuxent River is given. It describes how detailed information of the helicopter capabilities, ship's motion characteristics and the wind-climate above the ship's flight deck, is used to set up and to execute a safe and efficient flight test programme. The programme leads to a safe and maximum operational availability of the helicopter on board the ship in terms of take-off and landing capabilities as a function of relative wind and sea-state.

Author

Military Helicopters; Flight Tests; Ships; Performance Tests; Navy

20030018924 Eloret Corp., Moffett Field, CA USA

Simulations of 6-DOF Motion with a Cartesian Method

Murman, Scott M., Eloret Corp., USA; Aftosmis, Michael J., NASA Ames Research Center, USA; Berger, Marsha J., New York Univ., USA; Jan. 09, 2003; 34p; In English; AIAA ASM Conference, Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): F19620-00-0099; RTOP 704-40-21

Report No.(s): AIAA Paper 2003-1246; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Coupled 6-DOF/CFD trajectory predictions using an automated Cartesian method are demonstrated by simulating a GBU-32/JDAM store separating from an F-18C aircraft. Numerical simulations are performed at two Mach numbers near the sonic speed, and compared with flight-test telemetry and photographic-derived data. Simulation results obtained with a sequential-static series of flow solutions are contrasted with results using a time-dependent flow solver. Both numerical methods show good agreement with the flight-test data through the first half of the simulations. The sequential-static and time-dependent methods diverge over the last half of the trajectory prediction. after the store produces peak angular rates. A cost comparison for

the Cartesian method is included, in terms of absolute cost and relative to computing uncoupled 6-DOF trajectories. A detailed description of the 6-DOF method, as well as a verification of its accuracy, is provided in an appendix.

Author

Cartesian Coordinates; Numerical Analysis; Computational Fluid Dynamics; Time Dependence; Acoustic Velocity; Angular Velocity

20030019062 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA

A New Approach to Prediction of Aircraft Spin Final Report, Jun. 1999-Jun 2002

Squires, Kyle D.; Jun. 2002; 53p; In English

Contract(s)/Grant(s): F49620-00-1-0050

Report No.(s): AD-A410100; AFRL-SR-AR-TR-03-0003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Unsteady Reynolds-averaged Navier-Stokes and Detached-Eddy Simulation are used to predict the flow around a forebody cross-section modeled by a rounded-corner square. The inlet velocity is inclined at 10 degrees to the main flow, the configuration modeling the massively separated flow around the forebody of a jet fighter rotating at high angle of attack. Simulations are performed at sub- and super-critical Reynolds numbers, corresponding to either laminar or turbulent boundary layer separation from the forebody. DES predictions show that following flow detachment, a chaotic and three-dimensional wake rapidly develops. The temporal evolution of the streamwise and lateral (side) forces acting on the body exhibit strong modulation due to the spanwise variation of the flow. Grid refinement deepens the structure of the resolved range of turbulent scales, predictions using unstructured meshes are also demonstrated to be equally accurate as those on structured grids. For the super-critical flow, the pressure distribution is close to the measured values, both the streamwise and side forces are in adequate agreement with measurements, and the effect of numerical parameters are well-understood. For the sub-critical flow, DES side-force predictions do not follow the experimental measurements far enough to achieve reversal. Possible causes for the discrepancy are discussed.

DTIC

Aircraft Spin; Navier-Stokes Equation; Reynolds Averaging; Unsteady Aerodynamics; Computational Fluid Dynamics

20030019173 Sest, Inc., Middleburgh Heights, OH USA

User's Guide for the Updated EST/BEST Software System Final Report

Shah, Ashwin, Sest, Inc., USA; February 2003; 24p; In English

Contract(s)/Grant(s): NASA Order C-76751-J; RTOP 708-90-53

Report No.(s): NASA/CR-2003-212127; NAS 1.26:212127; E-13779; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This User's Guide describes the structure of the IPACS input file that reflects the modularity of each module. The structured format helps the user locate specific input data and manually enter or edit it. The IPACS input file can have any user-specified filename, but must have a DAT extension. The input file may consist of up to six input data blocks; the data blocks must be separated by delimiters beginning with the \$ character. If multiple sections are desired, they must be arranged in the order listed.

Author

Input/Output Routines; User Manuals (Computer Programs)

20030019269 Department of the Army, Washington, DC USA

Operator's Manual for UH-60A Helicopter, UH-60L Helicopter, EH-60A helicopter

Shinseki, Eric; Hudson, Joel; Oct. 31, 1996; 794p; In English; Original contains color images

Report No.(s): AD-A409934; DA-TM 1-1520-237-10-CHG-9; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

No abstract.

DTIC

Military Operations; UH-60A Helicopter; Manuals

20030019277 Naval Postgraduate School, Monterey, CA USA

Experimental Analysis of Integration of Tactical Unmanned Aerial Vehicles and Naval Special Warfare Operations Forces

Butner, Joseph C., IV; Dec. 2002; 119p; In English; Original contains color images

Report No.(s): AD-A409922; No Copyright; Avail: Defense Technical Information Center (DTIC)

An experimental investigation was conducted to examine the use of small, expendable, endurance UAVs to enhance the combat effectiveness of Naval Special Warfare Forces (NSW). The experiment involved UAVs (Unmanned Aerial Vehicles), NSW forces, and a red team in a downed-pilot rescue mission. Models were developed to determine Optimum flight patterns for all UAVs. Models were also developed and utilized to determine experimental variables and measures of effectiveness. Simulation

of the exercise was conducted to determine adequacy of the experiment plan. It was found that UAVs significantly enhanced force protection, provided direct improvement in C2, significantly enhanced situational awareness, and provided the ability to track blue forces. It was found that video feed to blue force foot patrols may not be as valuable as having the C2 element dedicated to viewing the feed provide real-time COMS relay to the patrol. The exercises demonstrated that NSW forces do not need to launch and fly UAVs in order to utilize their capabilities; rather UAVs can be located and launched at the Forward Operating Base. The data obtained imply that small, expendable, endurance UAVs may do more than enhance capabilities for current missions, they may enable NSW Forces to conduct missions previously considered too high-risk.

DTIC

Drone Aircraft; Military Operations; Armed Forces (USA)

20030019300 Boeing Co., Huntington Beach, CA USA

Nonlinear Aeroelasticity for Hypersonic Flight Vehicles Final Report, 15 Apr. 2000-30 Nov. 2002

Zillmer, Scott; Ortega, Daniel; Mendoza, Raul; Kuruvila, Geojoe; Nov. 26, 2002; 45p; In English

Contract(s)/Grant(s): F49620-00-C-0018

Report No.(s): AD-A409571; CRAD-2002NOV02; AFRL-SR-AR-TR-02-0428; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Built a multidisciplinary system for nonlinear, trimmed, static aeroelastic analysis of air vehicles. Integrated all modules - CFL3D Performs aero (Euler/ Navier-Stokes) analysis - COMETAN Maps aero forces to structural nodes - PATRAN Maps temperatures to structural nodes - NASTRAN Performs structural analysis -Spline3D Maps structural deformation to aero grid - CSCMDO or Perturbs aero volume grid RexMesh - TRIM Finds control surface deflections to zero-out pitching moment - DEFLECT Deflects control surfaces and perturbs aero grid.

DTIC

Aeroelasticity; Nonlinear Systems; Hypersonic Flight; Hypersonic Vehicles

20030019492 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Failure Analysis, Cadmium Brush Plate Qualification and Salt Fog Testing of the AH-64 Shock Strut Mount, P/N 7-311113409 Final Report, 1997-Jan. 2002

Pepi, Marc; Nov. 2002; 84p; In English

Report No.(s): AD-A409732; ARL-TR-2870; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A failure analysis was performed on a shock strut mount from an AH-64 Apache attack helicopter. It was concluded that the failure was attributed to stress corrosion cracking and/or corrosion fatigue and had initiated at a region where the protective cadmium plating was worn away in service. Based upon this conclusion, it was necessary to qualify two facilities (Hunter Army Air Field, Savannah, GA and Ft. Lewis, Dupont, WA) for the cadmium brush plating rework of these components found to have worn coatings during routine inspections. The U. S. Army Research Laboratory was involved in the qualification process for both facilities, and the results of each quality audit are included. Finally, the results of salt fog testing of cadmium brush plated specimens, plated at the respective facilities, are also included, as well as a comparison of the grain size of the material in the failed component vs. the material from the struts plated at each facility. a

DTIC

AH-64 Helicopter; Failure Analysis; Performance Tests; Failure

20030020347 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA

High-Speed Rotorcraft Design: Rotor/Wing Configurations

Wells, V. L., Arizona State Univ., USA; Laananen, D. H., Arizona State Univ., USA; Shi, Jian, Arizona State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 3-14; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Advanced Design Program at Arizona State University has considered the design of high-speed rotorcraft which can take off and land vertically, yet can achieve relatively fast forward velocities. Two design missions were considered--a military ground attack mission and a civil commuter transport mission. The design groups selected the rotor/wing configuration for each of these applications. The design groups utilized their own software to perform design tradeoff studies to determine the optimum design point. Once the design points were determined, more detailed design of the various components was undertaken. The paper outlines the need for a high-speed VTOL aircraft, and describes the aircraft designed to meet those needs. Several technology areas unique to the rotor/wing design are discussed.

Author

Helicopter Design; Rotary Wing Aircraft; Vertical Takeoff Aircraft; Body-Wing Configurations

20030020348 California Polytechnic State Univ., Dept. of Aeronautical Engineering, San Luis Obispo, CA USA

Exploring Subsonic Flight of Advanced Commercial and Military Transports

vantRiet, Robert, California Polytechnic State Univ., USA; Soban, Danielle, California Polytechnic State Univ., USA; Hoang, Ty, California Polytechnic State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 15-25; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This year Cal Poly challenged 37 students (six design teams) with four modern subsonic transport projects. Two groups chose to tackle the Boeing 737 and McDonnell Douglas MD-90 series replacement. One group took the challenge for a new mid-size (Boeing 767) commercial transport. A fourth group attempted to market an 800 plus passenger (PAX) aircraft that would rival Boeing's and Airbus' upcoming mega-transport. Finally, the next two groups were given the problem of designing a global range military transport with 800,000 pounds cargo capacity. Their solution includes ample use of low and high risk technologies. These include: higher usage of composites, more efficient propulsion units, high lift devices and unique configurations.

Author

Aircraft Design; Cargo Aircraft; Military Aircraft; Boeing 737 Aircraft; Boeing 767 Aircraft; Subsonic Speed

20030020349 Embry-Riddle Aeronautical Univ., Dept. of Aerospace Engineering, Daytona Beach, FL USA

The Design of a Primary Flight Trainer using Concurrent Engineering Concepts

Ladesic, James G., Embry-Riddle Aeronautical Univ., USA; Eastlake, Charles N., Embry-Riddle Aeronautical Univ., USA; Kietzmann, Nicholas H., Embry-Riddle Aeronautical Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 26-37; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Concurrent Engineering (CE) concepts seek to coordinate the expertise of various disciplines from initial design configuration selection through product disposal so that cost efficient design solutions may be achieved. Integrating this methodology into an undergraduate design course sequence may provide a needed enhancement to engineering education. The Advanced Design Program (ADP) project at Embry-Riddle Aeronautical University (EMU) is focused on developing recommendations for the general aviation Primary Flight Trainer (PFT) of the twenty first century using methods of CE. This project, over the next two years, will continue synthesizing the collective knowledge of teams composed of engineering students along with students from other degree programs, their faculty, and key industry representatives. During the past year (Phase I), conventional trainer configurations that comply with current regulations and existing technologies have been evaluated. Phase I efforts have resulted in two baseline concepts, a high-wing, conventional design named Triton and a low-wing, mid-engine configuration called Viper. In the second and third years (Phases II and III), applications of advanced propulsion, advanced materials, and unconventional airplane configurations along with military and commercial technologies which are anticipated to be within the economic range of general aviation by the year 2000, will be considered.

Author

Concurrent Engineering; Training Devices; Aircraft Configurations; General Aviation Aircraft; Flight Training

20030020350 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA

Integrated Design and Manufacturing for the High Speed Civil Transport

Schrage, Daniel P., Georgia Inst. of Tech., USA; Mavris, Dimitri N., Georgia Inst. of Tech., USA; Hale, Mark, Georgia Inst. of Tech., USA; Rohl, Peter, Georgia Inst. of Tech., USA; Abel, Reginald, Editor, Georgia Inst. of Tech., USA; Marx, William, Editor, Georgia Inst. of Tech., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 38-47; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In June 1992, Georgia Tech's School of Aerospace Engineering was awarded a NASA University Space Research Association (USRA) Advanced Design Program (ADP) to address "Integrated Design and Manufacturing for the High Speed Civil Transport (HSCT)" in its graduate Aerospace Systems Design courses. This report summarizes the results of the five courses incorporated into the Georgia Tech's USRA ADP program. It covers AE8113: Introduction to Concurrent Engineering AE4360: Introduction to CAE/CAD, AE4353: Design for Life Cycle Cost, AE6351: Aerospace Systems Design I, AE6352: Aerospace Systems Design II. AE8113: Introduction to Concurrent Engineering was an introductory course addressing the basic principles of Concurrent Engineering (CE) or Integrated Product Development (IPD). The design of a total system was not the objective of this course. The goal was to understand and define the "up-front" customer requirements, their decomposition, and determine

the value objectives for a complex product, such as the High Speed Civil Transport (HSCT). A generic CE Methodology developed at Georgia Tech was used for this purpose.

Author

Aerospace Engineering; Manufacturing; Civil Aviation; Systems Integration; Concurrent Engineering; Supersonic Transports

20030020351 Kansas Univ., Dept. of Aerospace Engineering, Lawrence, KS USA

Operational Design Considerations for an Oblique All-Wing Supersonic Transport

Roskam, Jan, Kansas Univ., USA; Jones, Valerie, Kansas Univ., USA; Downen, Troy, Kansas Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 48-56; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The design of an Oblique All-Wing (OAW) supersonic transport presents several unique problems relating to the integration of the passenger cabin, landing gear, engines, and structure into the airplane. Because the airplane is a flying wing, the cabin height determines the wing dimensions. Doors for passenger and cargo loading and unloading, as well as emergency exits, must be located in the leading and trailing edges of the aircraft, requiring that the spars be cut. The engines and landing gear of the Oblique All-Wing often conflict during taxi and take-off ground run conditions. Burst plane locations and cabin noise also affect the placement of the engines. Directional control of the OAW is provided by drag rudders.

Author

Oblique Wings; Supersonic Transports; Aircraft Design; Flight Operations; Aircraft Engines

20030020353 Naval Postgraduate School, Monterey, CA USA

Aircraft Design at The Naval Postgraduate School: Tactical Waverider/Long-Range Cargo Aircraft

Newberry, Conrad F., Naval Postgraduate School, USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 66-80; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The graduate program of the Department of Aeronautics and Astronautics at the Naval Postgraduate School uniquely supports a comprehensive design program in aircraft, avionics, spacecraft, missile, helicopter, and engine design. This paper is focused on four aircraft configuration designs proposed by AA 4273 Military Aircraft Design course team members. The AA 4273 course is, in turn, supported by a growing research program to enhance and further develop the methodology of aircraft design. This design effort has received considerable support from the NASA/USRA Advanced Design Program in Aeronautics. Specifically, two design solutions for a long-range, carrier based, tactical, waverider configured fighter/interceptor aircraft are reviewed herein, as are two solutions for a global range military transport. Both types of aircraft were developed as a graduate student team response to specific design RFPs.

Author

Aircraft Design; Cargo Aircraft; Waveriders; Navy; Avionics; Military Aircraft

20030020354 Notre Dame Univ., Dept. of Aerospace and Mechanical Engineering, IN USA

Gaining the Competitive Edge: Design for Manufacturing

Batill, Stephen M., Notre Dame Univ., USA; Pinkelman, Jim, Notre Dame Univ., USA; Sellar, Richard, Notre Dame Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 81-92; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The successful design of a commercial aircraft which is intended to be in direct competition with existing aircraft requires a market analysis to establish design requirements, the development of a concept to achieve those goals, and the ability to economically manufacture the aircraft. It is often the case that an engineer designs system components with only the perspective of a particular discipline. The relationship of that component to the entire system is often a minor consideration. In an effort to highlight the interaction that is necessary during the design process, the students were organized into design/build teams and required to integrate aspects of market analysis, engineering design, production and economics into their concepts. In order to facilitate this process a hypothetical "Aeroworld" was established. Having been furnished relevant demographic and economic data for "Aeroworld", students were given the task of designing and building an aircraft for a specific market while achieving an economically competitive design. Involvement of the team in the evolution of the design from market definition to technical development to manufacturing allowed the students to identify critical issues in the design process and to encounter many of the conflicting requirements which arise in an aerospace systems design.

Author

Manufacturing; Aircraft Design; Commercial Aircraft; Systems Engineering; Aerospace Systems

20030020355 Ohio State Univ., Dept. of Aeronautical and Astronautical Engineering, Columbus, OH USA

The Design of Three Experimental Hypersonic Test Vehicles

Gregorek, Gerald M., Ohio State Univ., USA; Detwiler, Duane T., Ohio State Univ., USA; Zuppardo, Joseph, Ohio State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 93-100; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Three different Experimental Hypersonic Test Vehicles (X-HTVs) were designed by separate student teams. These X-HTVs were designed to provide a platform to test advanced configuration and propulsion concepts under hypersonic flight conditions. The design requirements given for this project state that these vehicles must be capable of testing an airbreathing propulsion system at a speed of Mach 12-15 and an altitude of 100,000-120,000 ft. for one minute at steady state conditions. It was decided that this type of mission could be effectively accomplished by a remotely piloted vehicle. Therefore, all three vehicles were unmanned due to the hazardous nature of test flights. Three separate conceptual designs were developed to study different operational possibilities. One vehicle is a lifting-body configuration which takes off and lands as a conventional aircraft. Another is a lifting-body configuration which is vertically rocket launched and parachutes to splashdown landing. The third vehicle is a waverider which is airdropped from another aircraft. This paper provides the details of all three vehicles along with an overview of the design process for high-speed aerospace vehicles.

Author

Aerospace Vehicles; Air Breathing Engines; Hypersonic Vehicles; Test Vehicles; Remotely Piloted Vehicles

20030020356 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA

The Design of an Ultra High Capacity Long Range Transport Aircraft

Weisshaar, Terrence A., Purdue Univ., USA; Bucci, Gregory, Purdue Univ., USA; Hare, Angela, Purdue Univ., USA; Szolwinski, Matthew, Purdue Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 101-111; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper examines the design of a 650 passenger aircraft with 8000 nautical mile range to reduce seat mile cost and to reduce airport and airway congestion. This design effort involves the usual issues that require trades between technologies, but must also include consideration of: airport terminal facilities; passenger loading and unloading; and, defeating the 'square-cube' law to design large structures. This paper will review the long range ultra high capacity or megatransport design problem and the variety of solutions developed by senior student design teams at Purdue University.

Author

Transport Aircraft; Passenger Aircraft; Aircraft Design

20030020357 Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace and Ocean Engineering, Blacksburg, VA USA

Design of a Vehicle-Based Intervention System to Prevent Ozone Loss

Mason, William H., Virginia Polytechnic Inst. and State Univ., USA; Kirchbaum, Nathan, Virginia Polytechnic Inst. and State Univ., USA; Kay, Jacob, Virginia Polytechnic Inst. and State Univ., USA; Benoliel, Alexander M., Virginia Polytechnic Inst. and State Univ., USA; Lynn, Sean R., Virginia Polytechnic Inst. and State Univ., USA; Bunker, Deborah, Virginia Polytechnic Inst. and State Univ., USA; Hesbach, Thomas D., Jr., Virginia Polytechnic Inst. and State Univ., USA; Howerton, Everett B., Virginia Polytechnic Inst. and State Univ., USA; Hreinsson, Gudbjorn, Virginia Polytechnic Inst. and State Univ., USA; Mistr, E. Kirk, Virginia Polytechnic Inst. and State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 112-123; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Reduced quantities of ozone in the atmosphere allow greater levels of ultraviolet (UV) radiation to reach the earth's surface. The 1992/1993 project goals for the Virginia Tech Senior Design Team were to 1) understand the processes which contribute to stratospheric ozone loss, 2) examine ways to prevent ozone loss, and 3) define the requirements for an implementation vehicle to carry out the prevention scheme. A scheme proposed by R.J. Cicerone, et al late in 1991 was selected because of its supporting research and economic feasibility. This scheme uses hydrocarbon injected into the Antarctic ozone hole to form stable compounds with free chlorine, thus reducing ozone depletion. A study of the hydrocarbon injection requirements determined that 130 aircraft traveling Mach 2.4 at a maximum altitude of 66,000 ft. would provide the most economic approach to preventing ozone loss. Each aircraft would require an 8,000 nm. range and be able to carry 35,000 lbs. of propane. The propane would be stored in a three-tank high pressure system. Modularity and multi-role functionality were selected to be key design features. Missions originate from airports located in South America and Australia.

Author

Ozone Depletion; Prevention; Hydrocarbons; Antarctic Regions

20030020358 Worcester Polytechnic Inst., Dept. of Mechanical Engineering, MA USA

Design and Analysis of a Radio-Controlled Flying Wing Aircraft

Alexandrou, A. N., Worcester Polytechnic Inst., USA; Durgin, W. W., Worcester Polytechnic Inst., USA; Olinger, D. J., Worcester Polytechnic Inst., USA; Crivelli, Paul, Worcester Polytechnic Inst., USA; Boucher, Michelle, Worcester Polytechnic Inst., USA; Carvajal, Hernando, Worcester Polytechnic Inst., USA; Frank, Benjamin, Worcester Polytechnic Inst., USA; Hill, Bruce, Worcester Polytechnic Inst., USA; Hilliard, Barry, Worcester Polytechnic Inst., USA; Jeffers, Matthew, Worcester Polytechnic Inst., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 124-132; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The development of new-high speed, high-capacity public air transportation is one of the challenges facing commercial aviation today. One possible solution to this challenge is a supersonic oblique flying wing aircraft. This project involves the design and construction of a radio-controlled model of such an aircraft as a means of examining some of the aircraft's unique problems, especially its natural instability. The different areas of aerodynamics, propulsion, stability, controls, and structures, are analyzed in the context of the aircraft as a whole. The design relies heavily upon computer modeling and analysis to overcome the technical challenges encountered. Since the size of the model prohibits the use of automatic control systems, the wing is designed to be as inherently stable as possible, and an airfoil is designed to provide the necessary characteristics. Finally, the optimum design is chosen and constructed using composite materials.

Author

Radio Control; Tailless Aircraft; Pilotless Aircraft; Aircraft Design; Design Analysis; Aircraft Models

20030020390 Wisconsin Univ., Dept. of Engineering Mechanics, Madison, WI USA

UW-3S900 Dark Horse Joined Wing Global Transport

Thomson, Ron, Wisconsin Univ., USA; Corr, David, Wisconsin Univ., USA; Fleming, Mark, Wisconsin Univ., USA; Jones, Daniel, Wisconsin Univ., USA; Lewis, Chris, Wisconsin Univ., USA; McLandress, Andrew, Wisconsin Univ., USA; Millan, Marcelle, Wisconsin Univ., USA; Marthaler, Brad, Wisconsin Univ., USA; Roloff, Ryan, Wisconsin Univ., USA; Rudolph, Laura, Wisconsin Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 471-478; In English; Also announced as 20030020346; Partial sponsorship from General Dynamics; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A global transport is needed to meet the needs of the military to rapidly deploy large numbers of troops and equipment from the continental USA to potential trouble spots throughout the world. The primary mission profile is to fly 6,500 nautical miles with full payload (typically 800,000 pounds), off load, and return with 15% of payload without refueling and while using existing military and commercial facilities for takeoff and landing. To meet the design requirements, a tri-surface transport has been designed. The three lifting surfaces, the canard, the fore wing, and the aft wing, are mounted on the front of the elliptical fuselage, mid-fuselage, and tip of the tail, respectively. To meet the stringent takeoff requirements, nine GE-90 ultra-high bypass turbofan engines are employed to generate 900,000 pounds of thrust. The aft wing tip joins the fore wing at 70% of its span, with an engine located between each set of wings. The resulting configuration, resembling a joined wing and a biplane hybrid, reduces interference effects and structural complexity at the joint and provides an increase in wing stiffness and a reduction in weight. The remaining engines are mounted underneath the fore wing with one in the tail.

Author

Transport Aircraft; Canard Configurations; Wings; Fuselages

20030020400 Department of the Air Force, Wright-Patterson AFB, OH USA

Extending Aircraft Engine Lives

Davenport, Otha B., Department of the Air Force, USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. KN2-1 - KN2-6; In English; Also announced as 20030020397; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The first item of business is to accomplish planning to provide for the aging engine upgrades, maintenance and fixes. It was developed plans called "Engine Life Management Plan" for all of our fielded engines. The plan incorporates information relative to the engine design, the fielded usage, the technical criteria to keep the engines operational, and planned fixes and upgrades. The plan is updated on approximately a two-year cycle. The plan provides us with the information necessary to manage the program. It does not prevent surprises and believe me we get our share of surprises, but the plan helps provide the guidance and control for the program. The gas turbine plan is much like the human life plan where we spend a big portion of health care expenditures during the infant period and an even bigger expenditure, as we grow older. The cost to bring a new engine into the system is high at the beginning and aging engines are like aging people. How many of you have budgeted for maintenance cost increases of

approximately 300% for engines in the last 20 percent of their life? If we want gas turbines to work effectively, we need to be prepared to expend the necessary monies for parts, assemblies, and upgrades to provide safe and reliable operation.

Derived from text

Aircraft Engines; Gas Turbines; Aging (Materials)

20030020425 MTU Aero Engines, Munich, Germany

Forecasting of the Effect of Potential Aero Engine Modifications on Life Cycle Cost

Heitmeir, F., MTU Aero Engines, Germany; Summerer, H., MTU Aero Engines, Germany; Fendt, E., MTU Aero Engines, Germany; Ageing Mechanisms and Control Symposium; February 2003, Part A and B, pp. 2-1 - 2-5; In English; Also announced as 20030020397; Copyright; Avail: CASI; A01, Hardcopy; Distribution within the U.S. granted by agreement

The life-time of an engine normally extends to over 50 years. During this long period engine technology moves on. New materials, new calculation procedures and new design features become available. Introducing new technological elements is relatively easy during the early engine design phase. The more mature the engine design becomes, the more difficult it is to introduce new features, because they affect numerous other components or design parameters. It is not possible to incorporate a great number of new features into an engine which is already being operated by customers for financial reasons as well as from a logistical point of view. During the operation phase the benefit of introducing modifications must be thoroughly weighed with respect to quite a number of parameters. However, some modifications are important to be implemented due to flight safety reasons or due to cost saving aspects. The latter aspect will be discussed in this paper.

Author

Aircraft Engines; Design Analysis; Life Cycle Costs

20030020426 MTU Aero Engines, Munich, Germany

Long-Term Operation and Maintenance of Engine Monitoring Systems - Recommendations Derived from 15 Years of OLMOS Use by the GAF

Pfoertner, Hugo, MTU Aero Engines, Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 3-1 - 3-15; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Some aspects of the operation of a monitoring system over a time of several decades are discussed. It is shown, that the classical system design approach with well-defined definition, development, introduction and operation phases has to be replaced by a network of parallel activities. These activities are driven by the requirements to maintain fleet readiness and safe operation under the constraints of shrinking budgets and personnel reduction. Other factors driving the need for adaptations and enhancements are the obsolescence problems caused by the significantly different time scales for IT system components used in commercial or consumer oriented applications and for military applications. The most important source for modifications in an engine monitoring system is the engine itself. A well-coordinated approach is necessary to match the introduction of new engine hardware with the required consequential changes in all components of the monitoring system. High quality of the monitoring results produced during operation can only be maintained by well-designed data handling procedures, user interfaces and appropriate documentation and training. There remains a practically unavoidable small percentage of data errors introduced by human data handling. Due to the potentially severe consequences of undetected errors in the life usage data of fracture critical engine components, it is necessary to apply suitable plausibility checks that are derived from statistical models of the life usage process in a fleet of engines.

Author

Maintenance; Engine Monitoring Instruments; Engine Parts; Augmentation

20030020427 Ministry of Defence (Navy), Warship Support Agency, Foxhill, UK

Through Life Management of Naval Gas Turbines for Extended Service Lives and Reduced Lifetime Costs

Bolwell, Richard, Ministry of Defence (Navy), UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 4-1 - 4-15; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Marine gas turbines have been used for many decades in a diverse range of commercial and naval marine vessels, almost exclusively for main propulsion duties in a number of different configurations. As well as providing an outline of the scope of operation, this paper aims to discuss the key Life Extension Programmes and Cost Reduction Strategies developed by the UK Ministry of Defence in support of the two international collaborative Memoranda of Understanding (MoU) for the marine Olympus, Tyne and Spey gas turbines. Where available, discussion is supported with evidence from emerging equipment maintenance policies, equipment modifications and data collected from components and engines returned from the fleet for repair

or overhaul. In addition, and in terms of the economy of scale advantages that the arrangements offer, an assessment of accumulated savings and projected financial return is provided with an insight into the operational benefits and improved capability that the programmes realise. The UK Warship Support Agency (WSA) provides overarching in-service gas turbine support and cooperation through two Memoranda of Understanding (MoU) involving 4 European nations, 21 years of collaboration and 3 million shared running hours of operation. The membership of the Olympus TM3B and Tyne RM1C MoU, in place since 1980, comprises of the UK, The Netherlands, France and Belgium. The MoU for the Spey SM1A, signed in 1989, is between the UK and The Netherlands. In addition, the Royal Navy (RN) also operates the Rolls Royce Spey SM1C and, from 2002, will be accompanied by The Royal Netherlands Navy (RNLN) under an extended Spey MoU to encompass the engines installed in their new class of Logistic Command Frigates.

Derived from text

Accumulations; Maintenance; Life Cycle Costs; Life (Durability); Gas Turbine Engines

20030020429 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Centre De Villaroche, Moissy-Cramayel, France

Cost Reduction and Engine Life Extension Through Engine Life Monitoring at SNECMA

Genot, Frederic, Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Ageing Mechanisms and Control Symposium; February 2003, Part A and B, pp. 6-1 - 6-8; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The current market of the military Aircraft Gas Turbine Engines imposes reductions in the support costs. It has now become necessary to adapt our maintenance policy to comply with the new requirements. The present tendency focuses on a better knowledge of the real engine operation conditions to better relate damage to mission types. Our former maintenance policies for military engines were too expensive. SNECMA adopted the damage tracking on the ATAR, the flight recorder for the LARZAC and a life monitoring system for the M53 and the M88. It has become necessary to be more aware of the importance of feedback information on real engine operation conditions in order to specify design missions. After the control of engine parts life, it is now necessary to control the consumed life of fracture-critical rotating components in operation. Finally, the use of life monitoring system for the damage parts tracking in association with an adequate maintenance plan lead reduced support costs and improved engine parts life.

Author

Aircraft Engines; Cost Reduction; Engine Parts; Gas Turbine Engines; Maintenance

20030020430 MTU Aero Engines, Munich, Germany

Engine Vibration Monitoring and Diagnosis Based on On-Board Captured Data

Barragan, Jorge Moreno, MTU Aero Engines, Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 7-1 - 7-14; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

An advanced vibration monitoring system (VMS) consisting of on-board and on-ground tasks is presented in this paper. The on-board part of the VMS includes the detection of vibration incidents by monitoring of defined vibration amplitude values and comparison with prescribed absolute and relative vibration limits, where the relative vibration limits are specific for each particular engine. Exceedence of defined vibration alarm limits trigger a cockpit warning. The processing and acquisition of different vibration data sets using several algorithms are additional tasks of the on-board vibration monitoring function. The on-ground part of the VMS comprises the trend analysis of vibration signals as well as sophisticated methods based on artificial intelligence for the diagnosis of vibration events which includes data generated on wing, test-bed and the results of numerical simulations performed using extensive structural Finite Element whole engine models. In this paper the vibration data sets which are necessary to carry out the vibration monitoring function are described in detail. Finally experience gained during the application of the presented VMS to EJ200, the engine of the Eurofighter EF2000, are reported and discussed.

Author

Vibration; Monitors; Finite Element Method; Diagnosis; Engine Tests

20030020435 Scientific Monitoring, Inc., Tempe, AZ USA

Tracking and Control of Gas Turbine Engine Component Damage/Life

Jaw, Link C., Scientific Monitoring, Inc., USA; Wu, Dong N., Scientific Monitoring, Inc., USA; Bryg, David J., Scientific Monitoring, Inc., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 12-1 - 12-14; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

This paper describes damage mechanisms and the methods of controlling damages to extend the on-wing life of critical gas turbine engine components. Particularly, two types of damage mechanisms are discussed: creep/rupture and thermo-mechanical fatigue. To control these damages and extend the life of engine hot-section components, we have investigated two methodologies to be implemented as additional control logic for the on-board electronic control unit. This new logic, the life-extending control (LEC), interacts with the engine control and monitoring unit and modifies the fuel flow to reduce component damages in a flight mission. The LEC methodologies were demonstrated in a real-time, hardware-in-the-loop simulation. The results show that LEC is not only a new paradigm for engine control design, but also a promising technology for extending the service life of engine components, hence reducing the life cycle cost of the engine.

Author

Control Equipment; Creep Properties; Damage; Engine Control; Engine Parts; Gas Turbine Engines; Service Life

20030020441 QinetiQ Ltd., Structures and Materials Centre, Farnborough, UK

Risk Assessment Methodologies for Fracture-Critical Components

Boyd-Lee, A. D., QinetiQ Ltd., UK; Shepherd, D. P., QinetiQ Ltd., UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 18-1 - 18-13; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Within gas-turbine aeroengines, fracture-critical components are defined as those whose in-service failure would hazard the entire aircraft. For these components, airworthiness regulations require that a maximum permitted service life be identified, such that the probability of failure occurring before this life is reached is extremely remote. However, although the intent behind the derivation of these lives is to minimise the possibility of in-service failure, the procedures used to establish them are not usually specified in terms of this probability of dysfunction itself. For example, under the conventional "safe life" methodology, it is the probability of a component exceeding some identifiable fraction of its total life, rather than of the total life, which is used as a fundamental criterion. The portion of the life remaining beyond this point is regarded as an additional, unspecified, safety factor, which ensures the probability of actual failure is acceptably small. Similar considerations apply to most other methods of component life determination. There are, however, many instances that can arise during the service life of an engine fleet, in which it becomes very desirable to ascertain the actual probability of a service component failure. This is often prompted by the occurrence of some unforeseen or unpredictable event, which indicates that the actual failure probabilities are higher than those that should be achieved under the normal airworthiness procedures. In such circumstances, informed decisions concerning the appropriate action can only be made if accurate estimates of the resulting failure probability (usually referred to as the risk) are estimated. For example, if the safe life for a certain component is cut during the service life of an engine (which can happen for a variety of reasons) a situation may result where over life components are being operated in service. Since the immediate rejection of these components may present severe operational difficulties, the question as to how fast they must be removed whilst maintaining acceptable safety levels becomes extremely important. Similarly, very occasionally, components belonging to a particular set or batch are discovered subsequent to entry into service to be substandard. Again, the affected components should be dealt with as quickly as possible, but how this process should be managed depends heavily on how seriously they impact on safety. For these and other cases of risk exposure, the required action can only be properly assessed if the reduction in the level of safety is estimated in terms of effective measures of the probability of actual failure over specified time periods. To illustrate, some of the considerations associated with estimation of probabilities of failure, the next section discusses several scenarios associated with engine service operation for which such assessments become desirable. Aspects commonly encountered in deriving the appropriate estimates are described, and solution methods are discussed briefly. These are illustrated by examples of actual risk assessment exercises, which have been conducted in support of UK military engine operation. Subsequent sections analyse how judgements of the significance of airworthiness risks are made. Particularly, the manner in which the risks are to be related to the RAF Hazard Risk Index (HRI) are discussed. It is emphasised that these may vary significantly depending on the situation being addressed. Finally, these issues are related to UK current and future safety requirements at the aircraft platform level and the implications discussed.

Author

Aircraft Engines; Aircraft Reliability; Component Reliability; Fracturing; Safety Factors; Service Life

AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.

20030019314 Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA

Assessment of Advanced Cockpit Displays for General Aviation Aircraft - The Capstone Program *Final Report*

Williams, Kevin W.; Yost, Alan; Holland, Jeff; Tyler, Robert R.; Dec. 2002; 36p; In English

Report No.(s): AD-A409997; DOT/FAA/AM-02/21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Since the inception of the Capstone Program, approximately 150 aircraft in the area of Bethel, Alaska have received a suite of ADS-B displays. Despite the opportunity provided by the large number of ADS-B-capable aircraft in the Bethel area, very little information has been collected from the owner/operators and pilots of these aircraft that might help in transitioning the technology to the rest of the country. To remedy this situation, a team of human factors experts was tasked with travelling to Bethel in March 2002 to collect data regarding the use of these displays in day-to-day flight activities. A total of 41 pilots participated in the interview process, representing nine different flight companies in the Bethel area. All of the pilots were male. The average age was 37, ranging from 21 to 58. The average number of flight hours for the pilots was 4,962 hours, ranging from 950 hours to 30,000 hours. The median number of total flight hours was 3,250. Over 95% (39) of the pilots were instrument rated. Results from the pilot interviews and self-administered questionnaires revealed a number of human factors design, safety, and training issues. Discussion of these results will focus on display design and training recommendations for ADS-B displays that will ease the training burden, mitigate safety hazards, and accentuate safety improvements.

DTIC

Cockpits; Display Devices; General Aviation Aircraft

20030019855 Department of Defense, Joint Strike Fighter Office, Arlington, VA USA

Integrated Helmet Audio Visual System *Final Report Briefing Final Report*

Chapman, Donald; Derald, Jim; Corey, Brian; Oct. 03, 1996; 62p; In English; Original contains color images

Report No.(s): AD-A409865; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report evaluates HMD weapon sensor imagery on HMD weapon delivery potential, evaluates performance, and evaluates 3-D audio threat management.

DTIC

Weapons Delivery; Helmet Mounted Displays

20030020312 Rockwell Collins, Inc., Advance Technology Center, USA

Enhanced Weather Radar and Aviation Weather Awareness and Reporting Programs

Kronfeld, Kevin, Rockwell Collins, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 134-145; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A viewgraph presentation on the various reporting programs developed to enhance weather radar and aviation weather awareness is presented. The topics include: 1) Motivation; 2) Background; 3) Enhanced Weather Radar (EWxR) 4) EWxR Processing; 5) EWxR Display; 6) Aviation Weather Awareness and Reporting (AWARE); 7) AWARE Processing; 8) AWARE Display; 9) Airborne Hazard Avoidance System (AHAS); and 10) Further Studies and Evaluations.

CASI

Flight Conditions; Meteorological Radar; Civil Aviation; Weather; Information Systems

20030020318 Ohio Univ., Avionics Engineering Center, OH USA

Preliminary VDL Mode 2 Bench and Flight Test Results

Skidmore, Trent A., Ohio Univ., USA; Wilson, Aaron A., Ohio Univ., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 203-228; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on bench and flight tests of the VHF Datalink Mode 2 (VDLM2). The presentation covers a description of the VIPER ground and airborne equipment, the bench test configuration, TX characteristics and Rx mode characteristics, flight test configuration and profile, and performance prediction.

CASI

Airborne Equipment; Flight Tests; Data Links; Very High Frequencies; Performance Tests

20030020337 Old Dominion Univ., VA USA

Market Assessment of Forward-Looking Turbulence Sensing Systems

Kauffmann, Paul, Old Dominion Univ., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 667-700; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides a cost benefit analysis of three next-generation forward-looking turbulence sensing systems: X band turbulence radar system for convective turbulence, LIDAR based turbulence systems to sense clear air turbulence and a combined hybrid system. Parameters for the cost benefit analysis were established using a business model which considered injury rates, cost of injuries, indirect costs, market penetration rate estimates and product success characteristics. Topics covered include: study approach, business case equations, data acquisition, benchmark analysis. Data interpretation from the cost benefit analysis is presented. The researchers conclude that the market potential for these products is based primarily on injury cost reduction and that X band radar systems have the greatest chance for commercial success.

Author

Turbulence; Market Research; Cost Analysis; Optical Radar; Airborne Radar; Data Processing

20030020343 United Air Lines, Inc., Flight Operation Technology, USA

Airline Implementation of Cockpit Weather Systems

Sambrano, David, United Air Lines, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 770-780; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of United Airlines' efforts to implement cockpit weather systems. Topics covered include: United Airlines' background research, testing and evaluation of the Honeywell Weather INformation Network (WINN), benefits of having such technology in the cockpit and implementation issues.

CASI

Commercial Aircraft; Cockpits; Cockpit Weather Information Systems; Evaluation

07

AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

20030018884 Imperial Coll. of Science, Technology and Medicine, London UK

Effect of Inlet Geometry on the Turbine Blade Tip Region Heat Transfer Coefficient and Effectiveness *Final Report, 17 May-17 Aug. 2002*

Yoon, J. H.; Martinez-Botas, R. F.; Dec. 05, 2002; 14p; In English; Original contains color images

Contract(s)/Grant(s): F61775-02-WE003

Report No.(s): AD-A410004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental investigation of the local film cooling effectiveness and heat transfer coefficient downstream of a row of elongated holes in a simulated axial turbine blade tip is presented. Film cooling is needed to protect the turbine blade tip region from high heat transfer rates, especially when cooling by convection is insufficient to keep the temperature distribution of the blade within the limits required. Accurate heat transfer predictions in this region of the blade are particularly difficult given the dimensionality of the flow and the narrow passage typical of turbine blades. The effect of inlet geometry film cooling injection point and blowing ratio are examined for an injection on the blade tip itself close to the pressure surface corner. Additionally the corner radii between the pressure surface and the tip were varied. The experimental method uses the steady state liquid crystal technique. Film cooling injection provides the tip with a blanket of protection from the hot leakage flow. This extends far downstream of the holes at higher blowing ratios. Inlet curvature provides greater local film cooling effectiveness but it lacks

streamwise film cooling coverage. It is important to have direct injection onto the separation bubble for greater lateral film cooling coverage.

DTIC

Film Cooling; Blade Tips; Heat Transfer Coefficients

20030018910 NASA Glenn Research Center, Cleveland, OH USA

Kalman Filtering With Inequality Constraints for Turbofan Engine Health Estimation

Simon, Dan, Cleveland State Univ., USA; Simon, Donald L., Army Research Lab., USA; February 2003; 36p; In English
Contract(s)/Grant(s): RTOP 704-30-02; DA Proj. 1L1-61102-AF-20

Report No.(s): NASA/TM-2003-212111; NAS 1.15:212111; E-13765; ARL-TR-2899; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Kalman filters are often used to estimate the state variables of a dynamic system. However, in the application of Kalman filters some known signal information is often either ignored or dealt with heuristically. For instance, state variable constraints (which may be based on physical considerations) are often neglected because they do not fit easily into the structure of the Kalman filter. This paper develops two analytic methods of incorporating state variable inequality constraints in the Kalman filter. The first method is a general technique of using hard constraints to enforce inequalities on the state variable estimates. The resultant filter is a combination of a standard Kalman filter and a quadratic programming problem. The second method uses soft constraints to estimate state variables that are known to vary slowly with time. (Soft constraints are constraints that are required to be approximately satisfied rather than exactly satisfied.) The incorporation of state variable constraints increases the computational effort of the filter but significantly improves its estimation accuracy. The improvement is proven theoretically and shown via simulation results. The use of the algorithm is demonstrated on a linearized simulation of a turbofan engine to estimate health parameters. The turbofan engine model contains 16 state variables, 12 measurements, and 8 component health parameters. It is shown that the new algorithms provide improved performance in this example over unconstrained Kalman filtering.

Author

Turbofan Engines; Aircraft Engines; Kalman Filters; Quadratic Programming; Systems Health Monitoring

20030019246 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA

A Multidisciplinary Study of Pulse Detonation Engine Propulsion Final Report, 30 Apr. 1999-1 Oct. 2002

Santoro, Robert J.; Yang, Vigor; Shepherd, Joseph E.; Law, Chung K.; Jan. 2003; 125p; In English; Original contains color images
Contract(s)/Grant(s): N00014-99-1-0744

Report No.(s): AD-A409967; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Penn State-led MURI effort on Pulse Detonation Engine (PDE) Research is detailed in this report. The multidisciplinary research effort brought together a team of leading researchers in the areas of the initiation and propagation of detonations, liquid hydrocarbon spray detonation, combustion chemistry, injector and flow field mixing, and advanced diagnostics to study the fundamental phenomena of importance under both static and dynamic conditions representative of actual pulse detonation engine operation. The team focused its effort on conducting key experiments and analysis in the areas of (a) Fundamental Detonation Studies, (b) Injection, Mixing and Initiation, (c) Inlet-Combustor-Nozzle Performance, (d) Multi-Cycle Operation, and (e) Computer Simulation and Cycle Analysis. These study areas are five of seven topic areas that have been delineated by the Office of Naval Research (ONR) in their roadmap on pulse detonation engine research necessary for developing the technologies needed for the design of an air-breathing pulse detonation engine. The results obtained in these five study areas under this effort by researchers at Penn State, Caltech and Princeton University, coupled with the results of the effort by the sister MURI team led by the University of California at San Diego in some of the aforementioned study areas and in the remaining two study areas of (a) Diagnostics and Sensors, and (b) Dynamics and Control provide the foundation needed for the development of a PDE system. The overall success of the program stems from ONR led coordination that fostered collaboration between the two MURI research efforts and government laboratories and industry research through a series of progress workshops held at six-month intervals.

DTIC

Detonation; Combustion Chemistry; Pulse Detonation Engines; Hydrocarbon Combustion; Dynamic Control

20030019305 Air Force Research Lab., Edwards AFB, CA USA

The Ideal Constant Volume Limit of Pulsed Propulsion

Talley, Doug; Oct. 25, 1999; 10p; In English

Report No.(s): AD-A409975; AFRL-PR-ED-TP-1999-0200; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A constant volume limit of pulsed propulsion is formulated which applies when blow down times are much longer than characteristic wave transit times in the combustion chamber. Under this limit, the combustion chamber is approximated as being

time varying but spatially uniform, and the nozzle is approximated as being one dimensional but quasi-steady. Some analytical solutions for this limit with fixed expansion ratio nozzles are explored for the isentropic blow down of a constant ideal gas. The results are compared with a variable expansion ratio case where the expansion ratio is continuously varied to match the pressure ratio during blow down. The major conclusions are that constant volume devices should optimize at approximately the same mixture ratios as constant pressure devices, and that using fixed expansion ratio results in only a modest impulse penalty, not exceeding 3% for the cases examined, compared to using a variable expansion ratio, as long as the fixed expansion ratio has been optimized to produce the maximum possible impulse for the blow down.

DTIC

Ideal Gas; Impulses; Blowing; Propulsion System Configurations

20030019490 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Initial Growth Rate and Visual Characteristics of a Round Jet into a Sub-to Supercritical Environment of Relevance to Rocket, Gas Turbine, and Diesel Engines

Chehroudi, B.; Talley, D.; Coy, E.; Nov. 20, 1998; 18p; In English; Presented at the AIAA Aerospace Sciences Meeting (37th)
Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409800; AFRL-PR-ED-TP-FY99-0024; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The combustion chamber temperature and pressure in many liquid rocket, gas turbine, and diesel engines are quite high and can reach levels above the critical point for the injected fuels and/or oxidizers. A high pressure chamber is used to investigate and understand the nature of the interaction between the injected fluid and the environment under such conditions. Pure N₂, He, and O₂ fluids are injected. Several chamber media are selected including, N₂, He, and mixtures of CO+N₂. The effects of chamber pressure ranging from a subcritical (i.e. relative pressure, $P(\text{sub } r) = P/P(\text{sub injectant critical})$ is less than 1) to a supercritical ($P(\text{sub } r)$ is greater than 1) value at a supercritical chamber temperature (relative temperature $T(\text{sub } r) = T/T(\text{sub injectant critical})$ is greater than 1) are photographically observed and documented near the injector hole exit region using a CCD (charge coupled device) camera illuminated by a short-duration back-lit strobe light. At low subcritical chamber pressures, the jets exhibit surface irregularities that amplify downstream, looking intact, shiny, but wavy (sinuous) on the surface that eventually break up into irregularly-shaped small entities.

DTIC

Propulsion; Combustion Chambers; Supercritical Flow; Fluid Mechanics; Subcritical Flow; Engine Parts

20030020398 Pennsylvania State Univ., University Park, PA USA

Technical Evaluation Report

Morris, Philip J., Pennsylvania State Univ., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. T1-1 - T1-9; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

In the past five to ten years computational aero- and hydro-acoustics (CAA and CHA) have emerged as fields with tremendous potential for physical understanding and prediction of the noise generated by unsteady flows. Many of these advances have been due to the extraordinary increases in computational power that have occurred. In addition, new algorithms, specifically designed for acoustics problems, have been developed. The NATO/AVT Symposium, held in the Manchester Town Hall, on October 8-11, 2001, provided an opportunity for the assessment of the most promising approaches for the prediction of noise from air and sea vehicles. The program committee, chaired by Prof. Ir. Joop Slooff of the National Aerospace Laboratory/NLR, recognized that the acoustic characteristics of both air and sea vehicles are important in both wartime as well as peacetime operations. In particular, they noted the following four areas of importance: 1. "Acoustic fatigue loads and their consequences for structural integrity are important factors in the design and operation of vehicles, air vehicles in particular. 2. The acoustic signature of sea and air vehicles is of great importance for military operations in wartime. 3. For air vehicles the contribution to community noise during peacetime operations is of growing concern. 4. For sea and air as well as land vehicles the inboard noise level and, for air vehicles, the near field acoustic environment is important for the effective and efficient operation of the vehicle and its systems." The papers presented at the Symposium all contributed in some way to one or more components of the theme. The papers were grouped into sessions focused in the following areas: 1. Propulsion and Power Noise. 2. Fluid Flow Noise. 3. Noise Propagation. 4. Structural Response and Acoustic Loads Suppression. In addition, there were three invited lectures. The Symposium schedule originally included 29 technical presentations and 3 invited lectures. Prior to the meeting 11 papers were withdrawn or the authors failed to attend. Some of this significant reduction in the number of presented papers was clearly due to the tragic events of September 11, 2001 that put constraints on travel: particularly for government employees or military personnel. However, not all the withdrawals could be obviously blamed on these events and this was very disappointing for the Symposium organizers. In any event, the quality and relevance of the remaining papers provided a sound basis for discussions and conclusions. In this evaluation

it is not intended to provide a detailed summary of the presentations or questions and responses, though some comments are made on each paper presented at the Symposium. Rather, an emphasis will be placed on those areas where further progress is necessary or where particular advances have been made. The evaluation begins with a review of the invited lectures. This is followed by a discussion of the presentations grouped by the first three technical areas listed above.

Author

Acoustic Fatigue; Acoustic Properties; Human Performance; Noise Pollution; Noise Prediction

20030020399 Ministry of Defence, Ship Support Agency, Bath, UK

Marine Use of Gas Turbines

Botley, M., Ministry of Defence, UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. KN1-1 - KN1-7; In English; Also announced as 20030020397; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The paper discusses the use of marine gas turbines, the strategic issues that impact on their in-service support and the environment within which they operate. This environment will be a familiar one to many here - one that demands high standards of reliability and availability whilst at the same time being subject to substantial pressures to drive down the overall cost of ownership of these expensive equipments. There are, of course, many elements that contribute to the life cycle costs, some of which will be touched on this morning and others that will be the subject of presentations later in the seminar. This invitation offers the opportunity of giving a short insight into how the Royal Navy has developed marine gas turbines over the last 50 years and how their use has been developed up to the present day including a comparison of the requirements of marine and aero gas turbine engines. It discusses the characteristics of the marine support environment and the strategy adopted by the Royal Navy to take marine propulsion forward into the 21st century. It summarizes how the Royal Navy arrived at where they are today with every modern major surface warship powered by gas turbine engines.

Derived from text

Gas Turbine Engines; Reliability; Navy; Marine Environments; Life Cycle Costs

20030020433 Hellenic Air Force Technology Research Center, Athens, Greece

Application of Multiple Handle Gas Path Analysis on a Twin Spool Turbofan Engine

Kleinakis, Eftychios, Hellenic Air Force Technology Research Center, Greece; Kotsiopoulos, Petros, Hellenic Air Force Academy, Greece; Pilidis, Pericles, Cranfield Univ., UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 10-1 - 10-12; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

In this paper the development of multiple handle gas path analysis, an analytical approach that has two advantages over linear gas path analysis is described. Firstly, it allows all instruments to be used for diagnostics purposes, without having to use one to determine the baseline. The other advantage is that diagnostics can be crosschecked against one another to allow greater faith in the result. A conclusion that can be drawn regarding multiple handle gas path analysis is that it appears to be a promising technique. For some faults it appears to give better diagnostics than linear gas path analysis, without going to the complexity of non-linear gas path analysis. The latter is however more accurate. The analysis of a high performance twin spool turbofan engine, gave rise to a very useful diagnostic. Several fault sets were analysed and several instrumentation sets were examined, ranging from the minimum available in the cockpit to a much more comprehensive one.

Author

Turbofan Engines; Gas Path Analysis; Diagnosis

20030020436 National Research Council of Canada, Inst. of Aerospace Research, Ottawa, Ontario Canada

Damage Tolerance Assessment of Aging Nene X Turbine Discs

Beres, W., National Research Council of Canada, Canada; Koul, A. K., Life Prediction Technologies, Inc., Canada; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 14-1 - 14-16; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The paper describes the application of the damage tolerance methodology to predict a safe inspection interval (SII) for the Nene-X engine turbine disc. The fracture critical location was established on the basis of stress analyses performed using 2D and 3D finite element models. to establish the stress intensity factor dependence on crack size in the fracture critical location of the disc, finite element based fracture mechanics analyses were conducted for both through-thickness and thumbnail cracks with different surface-length to depth ratios. Fatigue crack growth rate data were generated on compact tension (CT) specimens

machined from a high time disc. Deterministic fracture mechanics (DFM) and probabilistic fracture mechanics (PFM) calculations were performed to compute a safe inspection interval for the disc.

Author

Turbines; Tolerances (Mechanics); Stress Intensity Factors; Fracture Mechanics; Fatigue (Materials); Crack Propagation

20030020437 Naval Air Systems Command, Patuxent River, MD USA

Critical Part Life Extension Efforts in a Military Engine

Kiang, Robert L., Naval Air Systems Command, USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 15A-4 - 15A-11; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Three specific schemes aimed at increasing critical part lives of a military engine are described. Quantitative life extensions, as a result of implementing these schemes, are given when appropriate. Any of these schemes could be applicable to other engines when sufficient field usage data are available.

Author

Life (Durability); Jet Engines

20030020438 QinetiQ Ltd., Structures and Materials Centre, Farnborough, UK

The Assessment of Engine Usage Data

Shepherd, D. P., QinetiQ Ltd., UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 15B-1 - 15B-15; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Within aero gas turbine engines, fracture critical parts are defined as those whose failure could hazard the entire aircraft. Because of the potentially catastrophic impact of such a failure, a fundamental airworthiness requirement on all aero gas turbine engines is that the operational life of these parts is managed to ensure this does not happen. Consequently, considerable effort is devoted to deriving methods for estimating the usable life of such components, to ensure that the probability of in-service failure is acceptable low. Such methods must accurately account for the basic material properties, the impact of the various manufacturing processes employed, and the operational loads the components will be subjected to during service usage. In general terms, the lives are derived on the basis of laboratory specimen test and/or full scale component rig tests, finite element stress analyses, together with appropriate statistical models of fatigue behaviour. A vigorous and ongoing research activity is devoted to developing and refining these methods, and to ensure that they are kept up to date with changes in the basic engine technology. From the available information, these estimation procedures will produce component lives quoted in terms of some reference stress cycle. Once this has been done, however, there remains the problem of relating these reference cycle lives to operationally measured parameters. For civil applications, there is only minor throttle movement once the aircraft has reached cruise conditions, and the engines see a standard, relatively simple operational cycle. For this reason, reference cycles can fairly accurately be related to flights on a one-to-one basis. However, for military operation, the problem is considerably more complex. In many military sorties, the output from the engines requires constant adjustment, which inflicts considerable amounts of minor cycle damage on the engine components. Moreover, the level of this minor cycle damage will itself vary considerably from mission to mission, even for the same type of sortie. Thus, it is essential to account for these fluctuations in usage to ensure adequate life consumption tracking. The issue of relating complex mission profiles to the consumption of reference cycles involves two separate technical problems. The first of these is the physical monitoring of how the engine is being used in practice, and the recording of this information. This is achieved by fitting the engines with instrumentation that measures a number of important parameters, such as spool speeds, gas temperatures and so on, which are recorded on data logging equipment. The second problem involves the development of engine usage algorithms, which interpret the recorded data and provide an assessment of the resulting usage. These algorithms translate the recorded parameters into mechanical and thermal loads, which are then converted to reference cycles through damage accumulation models. Using these techniques, it is possible to provide an equivalent reference cycle count for any mission, no matter what the complexity of the maneuvers undertaken. However, the instrumentation of the engines, together with the collection and management of the data generated, represent considerable costs to the operator. For this reason, it has traditionally been the case (at least in the UK), that only a sample of engines from the fleet have been monitored in this way. Whilst this approach clearly represents an immediate cost benefit, it introduces a third element in the life tracking process; namely, that of relating the data on life consumption from the monitored aircraft to that of the rest of the fleet. To do this, it is necessary to exploit the fact that a number of parameters relating to the operation of the aircraft, such as sortie type and duration, are routinely recorded for all missions part of the fleet management process. By developing a relationship for the monitored engines between cycles recorded and flight parameters, cycle count predictions can be estimated for all unmonitored situations. However, this introduces a further difficulty, due to the fact that the damage recorded from individual flights can vary significantly, even under

nominally identical conditions. Thus, the relationship between the cycles consumed and the flight parameters is probabilistic in nature, and a statistical model must be developed to represent this relationship. Moreover, the manner in which this model is related to the rest of the fleet must also, therefore, be statistical in nature. In this paper, a statistical model for the analysis of engine usage data generated from a sample of monitored aircraft is developed, and its application to a set of cycle counts is described. In section 2, the UK experience in military aircraft monitoring is described, and the calculation methods used in the application of these data are discussed. Next, a set of usage data, taken from a current UK military engine programme, is introduced, and the results from an initial analysis are illustrated. An appropriate statistical model describing the relationship between consumed cycles and relevant operational parameters is then developed, and fitted to the data. Current and future practice with regard to the prediction of life consumption for unmonitored aircraft is considered in the light of this. Finally, areas where further work is required are highlighted.

Author

Gas Turbine Engines; Aircraft Reliability; Data Acquisition; Finite Element Method; Mathematical Models; Stress Analysis

20030020439 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

Incorporating Residual Stresses in Life Prediction of Turbine Engine Disks

John, Reji, Air Force Research Lab., USA; Larsen, James M., Air Force Research Lab., USA; Buchanan, Dennis J., Dayton Univ. Research Inst., USA; Ashbaugh, Noel E., Dayton Univ. Research Inst., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 16-1 - 16-14; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The U.S. Air Force has initiated a technology development initiative known as Engine Rotor Life Extension (ERLE), which has the goal of extending the useful lifetime of major, fracture-critical components in currently fielded gas turbine engines, without increasing the risk of component failure. Full achievement of this goal will require improvements in a broad range of technologies, including life prediction and fracture mechanics, nondestructive evaluation, engine usage and health monitoring, and component repair. This paper focuses on a key aspect of the life prediction process - the incorporation of residual stress effects. The benefits of compressive residual stresses in improving fatigue life, retardation of crack growth and resistance to foreign object damage have been demonstrated. Hence, these beneficial surface treatments are extensively employed in the turbine engine components. However, current damage-tolerance-based life management practices do not explicitly account for the residual stresses induced by surface enhancement procedures. Significant increase in predicted damage tolerance can be obtained if residual stresses are included in the life prediction methodology. This paper provides an assessment of the role of residual stresses in the durability of the component and identifies critical issues to be addressed during implementation in life prediction methods.

Author

Augmentation; Compressibility; Crack Propagation; Engine Parts; Fatigue Life; Gas Turbine Engines; Life (Durability)

20030020440 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

The Role of Spectrum Loading in Damage-Tolerance Life-Management of Fracture Critical Turbine Engine Components

Larsen, James M., Air Force Research Lab., USA; Rosenberger, Andrew H., Air Force Research Lab., USA; Hartman, George A., Dayton Univ. Research Inst., USA; Russ, Stephan M., Air Force Research Lab., USA; John, Reji, Air Force Research Lab., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 17-1 - 17-14; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Recent developments in experimental and computational capabilities suggest an opportunity to develop improved models of crack growth for use in life management of materials and components in advanced gas turbine engines. Improvements in such models have potential benefits in the sustainment of aging engines, as well as the design of more durable future engines. Current approaches for life management of engine components tend to ignore potential increases in crack propagation lifetime that may occur as the result of load interaction phenomena under variable amplitude spectrum loading. In effort to quantify these potential benefits, a study of updated mission profiles was performed. A variety of engine usage spectra were surveyed to document their cycle content statistically, including characterization of the fundamental load sequence events and the expected severity of damage produced by these events, using data from the advanced nickel-base superalloy IN100.

Author

Crack Propagation; Damage; Engine Parts; Gas Turbine Engines; Variable Amplitude Loading

20030020443 National Aerospace Lab., Emmeloord, Netherlands

Integrated Living Analysis of a Film-Cooled Turbine Blade

Tinga, Tiedo, National Aerospace Lab., Netherlands; deWolf, Wim B., National Aerospace Lab., Netherlands; Visser, Wilfried

P. J., National Aerospace Lab., Netherlands; Woldendorp, Sandor, National Aerospace Lab., Netherlands; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 20-1 - 20-13; In English; Also announced as 20030020397; Original contains color illustrations

Contract(s)/Grant(s): NIVR-01613N; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

A method to predict gas turbine component life based on engine performance analysis is demonstrated on a hot section gas turbine component. The mechanical and thermal loading of the first stage high pressure turbine rotor blade of the F100-PW-220 engine, one of the most severely loaded components in the engine, is analyzed and a life assessment is performed. For this analysis, engine performance history is obtained from in-flight monitored engine parameters and flight conditions and downloaded for processing by a tool integrating a number of software tools and models. Data acquisition is performed by the FACE system installed in a large number of RNLAFF F-16 fighter aircraft. Data then is processed by a thermodynamical engine system model, calculating gas properties like pressure and temperature at the required station in the engine. A computational fluid dynamics model, including the blade film cooling, is used to calculate the heat transfer to the blade. A thermal finite element model calculates the temperature distribution in the component and the stress distribution is obtained with a structural finite element analysis. Finally a life consumption model is used to determine the creep and fatigue damage accumulation in the component. The tool has significant potential to enhance on-condition maintenance and optimize aircraft operational use.

Author

Turbine Blades; Structural Analysis; Reliability Analysis; Creep Properties; Data Acquisition

20030020446 QinetiQ Ltd., Structures and Materials Centre, Farnborough, UK

New Lifting Methodology for Engine Fracture Critical Parts

Shepard, D. P., QinetiQ Ltd., UK; Williams, S. J., Rolls-Royce Ltd., UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 23-1 - 23-14; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Within gas turbine aeroengines, fracture critical parts are defined as those whose failure would hazard the entire aircraft. Consequently, it is of central importance to the airworthiness of these engines that the probability of such a component suffering an in-service failure is kept below acceptable levels. In order to achieve this, lifting methodologies have been devised which provide a means for calculating the required limits. These methodologies consist of a material test requirement, together with a calculation process based on a statistical characterisation of the material/component behaviour. The outstanding safety record achieved by commercial and military aeroengines is in large part due to the success of these lifting methods. Over the last 30 years or more, considerable research activity has been devoted to developing these methodologies, and the models and assumptions that underlie them. This has ensured that the methods have kept pace with the developments in gas turbine technology, and provide safe lives which fully reflect the characteristics of the relevant components. However, the commercial pressure on engine manufacturers to produce engines with improved performance and reliability at lower cost is at least as great today as at any previous time. Consequently, the rate of development of the technologies on which engine design and manufacture is based is, if anything, increasing. The introduction of new techniques in materials development and processing, component manufacture and design analysis is ongoing and rapid. In view of these developments, the lifting methods themselves must constantly be re-evaluated and updated if the safety record achieved to date is to be maintained and improved. Recently, the trends in aero gas turbine design have raised questions with regard to the applicability of the lifting methods used previously within the UK. The fact that engine temperatures and speeds continue to rise has meant that the components, and the materials from which they are manufactured, have been operating closer to the limit of their capability than ever before. One result of this has been that certain parameters, previously seen to have little effect on the fatigue life, are now observed to play a significant role. Moreover, the interactions between these parameters are observed to be increasingly important, and must be characterized and understood if accuracy is to be ensured. Furthermore, since these effects are also observed to have differing characteristics during the initiation and propagation phases of fatigue life, it is becoming increasingly important to distinguish between the two. All of these effects mean that significant developments in lifting methodology are required if the required accuracy of estimation is to be ensured. In this paper, a new lifting methodology is described, which combines several features of lifting analysis in a novel way. The main elements of this methodology are, firstly, a 3-D non-linear finite element stress analysis, which is used to estimate the actual stresses experienced in service by the component. Secondly, both the crack initiation and propagation phases of life consumption are modelled explicitly, so that the most appropriate behaviour models can be used throughout the fatigue process. Finally, it explicitly includes a statistical model for the size effect in fatigue, so that any component feature can be assessed from plain specimen data alone. The methodology has been extensively validated against a database of fatigue results for a typical engine

alloy, and has been demonstrated to provide accurate estimates of specimen and component life under extreme combinations of both stress and volume.

Author

Stress Analysis; Mathematical Models; Gas Turbine Engines; Fatigue Life; Crack Initiation; Aircraft Engines

08

AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also 05 Aircraft Design, Testing and Performance and 06 Avionics and Aircraft Instrumentation.

20030020339 Boeing Commercial Airplane Group, Seattle, WA USA

Feasibility Study of Transport-Aircraft Control Systems for Turbulence Effects Mitigation

Borland, Christopher J., Boeing Commercial Airplane Group, USA; Walton, Vincent M., Boeing Commercial Airplane Group, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 713-737; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides the results of a feasibility study conducted with four objectives: (1) use turbulence inputs from injury-accident FDR data; (2) assess capability of current aircraft control systems to reduce turbulence-induced acceleration response in the cabin; (3) assess new control law strategies with current (on-board) and advanced (forward-looking) turbulence sensors; (4) identify key issues to practical implementation of these systems. Topics covered include: data analysis of the FDR data, general review of current aircraft systems and requirements, control system development and performance, control system design model, and sensitivity studies.

CASI

Feasibility Analysis; Aircraft Control; Turbulence; Control Systems Design; Data Processing

20030020432 National Technical Univ., Lab. of Thermal Tubomachines, Athens, Greece

Optimizing Diagnostic Effectiveness of Mixed Turbofans by Means of Adaptive Modelling and Choice of Appropriate Monitoring Parameters

Kamboukos, P., National Technical Univ., Greece; Oikonomou, P., National Technical Univ., Greece; Stamatis, A., National Technical Univ., Greece; Mathioudakis, K., National Technical Univ., Greece; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 9-1 - 9-13; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Methods for the optimal selection of measurements and health parameters used for diagnostic purposes in aircraft gas turbine engines are presented. Principles of aerothermodynamic diagnostic techniques are first briefly reviewed. The problem of optimal selection of measurements and health parameters is examined from two different standpoints: (1) how to select out of all available measurements the minimum set that will be capable to provide sufficient information to assess engine health condition; and (2) when a set of measurable quantities from an operating engine is given, how to select the combination of health parameters, in order to provide in an optimal way the information about the condition of the engine. The present paper concentrates mainly on the second type of problem since it is related to the handling of an existing fleet. Methods based on sensitivity analysis are discussed, but it is shown that the most substantial information is produced by analyzing the properties of the Jacobian matrix, interrelating parameters and measurement deviations. Finally, results of condition estimation for a number of turbofans in service are presented.

Author

Turbofans; Aerothermodynamics; Gas Turbine Engines; Sensitivity Analysis

20030020434 MTU Aero Engines, Munich, Germany

Advanced Engine Monitoring and Diagnosis Systems: Actual System for the EJ200 Engine of the EuroFighter 2000 Aircraft and Future Trends

Zoller, Thomas, MTU Aero Engines, Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 11-1 - 11-15; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The EJ200 engine for the EuroFighter 2000 military aircraft will, like other modern military jet engines, operate in usage scenarios characterized by increased complexity and reduced turn-around times. Additionally, the limited defense budgets force the need for a continuous reduction of maintenance effort and cost and for methods for reducing the engine life cycle costs. These

requirements and the increased complexity of the engine system stimulate the continuous improvement of the associated control and monitoring systems. Ground based Engine Health Monitoring (EHM) Systems in conjunction with on-board monitoring systems form an essential part of the whole system to aid the fulfillment of the above requirements. Key areas for the ground-based systems to better contribute to the fulfillment of these requirements are a better automation of the monitoring tasks, improved fault diagnosis and localisation and a better guidance of maintenance personnel. The new and comprehensive Engine Health Monitoring System, which is planned to be used for the EJ200 engine of the EuroFighter 2000 aircraft, is described. This system will provide engine health monitoring and diagnosis for areas like life usage monitoring, engine performance monitoring, supervisory and diagnosis of engine vibration and an advanced fault detection and location system. Engine related logistics and maintenance tasks will also be supported. The EHM will be part of the EuroFighter Ground Support System (GSS), which will be shortly described. Critical areas and possible improvements of actual engine monitoring systems are described and their potentials to better fulfill the requirements are discussed. This includes the extension of the monitoring functionality as well as improvements of the EHM architecture related to the inclusion of the EHM into the overall Ground Support System of the aircraft and the development process for future engine monitoring, diagnosis and logistic support systems.

Author

Detection; Diagnosis; Engine Monitoring Instruments; Error Analysis; Maintenance

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see 03 Air Transportation and Safety. For astronomical facilities see 14 Ground Support Systems and Facilities (Space).

20030019468 Sandia National Labs., Airworthiness Assurance Ndi Validation Center, Albuquerque, NM USA

Mechanical Systems Characterization of Boeing 747 Aging Systems Test Bed Aircraft

Dec. 2002; 10p; In English

Report No.(s): AD-A409728; DOT/FAA/AR-TN02/119; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

As part of the Federal Aviation Administration (FAA) Aging Aircraft Program, the FAA purchased a Boeing 747 to be used as a test bed aircraft for investigating aging mechanical and electrical systems. When retired, the airplane was decommissioned in a way to preserve the functionality of the mechanical and electrical systems. Total Aircraft Services, Inc., under contract to the FAA Airworthiness Assurance Nondestructive Validation Center located at Sandia National Laboratories, was charged with assessing the status of the aircraft's systems. The purpose of the assessment was to determine the condition of the mechanical systems on the airplane and to determine what would be required to make any nonworking systems functional. This report documents the results of this assessment. This assessment determined that most of the mechanical systems that are significant to the Aging Mechanical & , p01/ 06Systems Project are operational or are capable of easily being made operational.

DTIC

Commercial Aircraft; Aircraft Maintenance; Aircraft Reliability

12

ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration, see 91 Lunar and Planetary Science and Exploration.

20030019218 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Preliminary Analysis of Contamination Measurements from the ESEX 26 kW ammonia Arcjet Flight Experiment

Spanjers, G. G.; Schilling, J. H.; Engelman, S. F.; Dulligan, M. J.; Bromaghim, D. R.; Oct. 14, 1999; 23p; In English; Presented at the Int'l Electric Propulsion Conf. (26th), held in Japan

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409834; AFRL-PR-ED-TP-1999-0188; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The USA Air Force Research Laboratory's Electric Propulsion Space Experiment (ESEX) was launched and operated in early 1999 in order to demonstrate the compatibility and readiness of a 30-kW class ammonia arcjet for satellite propulsion applications.

As part of this flight, an array of on-board contamination sensors was used to assess the effect of the arcjet and other environments on the spacecraft. The sensors consisted of microbalances to measure material deposition, radiometers to assess material degradation due to thermal radiation, and solar cell segments to investigate solar array degradation. Over eight firings of the ESEX arcjet (and 33 min. 26 sec operating time), the following preliminary results are reported. The microbalances show no measurable deposition from the arcjet, in agreement with predictions. The radiometer near the thruster, viewing the arcjet plume and body, experiences a change in the thermal properties of its coating from the firings. Radiometers with no view of the arcjet, or a view of only the plume, show no change. During firings, the solar cell segments, near the thruster, show decreasing open-circuit voltage; probably attributable to an additional electrical load provided by the plume plasma. The solar cells also exhibit a 3% decrease in non-firing, solar-illuminated over the eight arcjet firings, attributable to decreased solar transmission of the cover glass. However, no effects associated with the arcjet are observed on the spacecraft solar arrays. These data are in good agreement with model predictions, where available. In general, contamination effects are observed only on sensors near the thruster exhaust nozzle, a location unlikely to be used in an operational high-power electric propulsion system. No contamination effects are observed in the backplane of the thruster.

DTIC

Artificial Satellites; Arc Jet Engines; Electric Propulsion; Microbalances; Contamination

20030020360 Arizona Univ., Dept. of Aerospace and Mechanical Engineering, Tucson, AZ USA

Autonomous Space Processor for Orbital Debris

Ramohalli, Kumar, Arizona Univ., USA; Mitchell, Dominique, Arizona Univ., USA; Piagentini, Nick, Arizona Univ., USA; Rowney, David, Arizona Univ., USA; Alatawah, Zayed, Arizona Univ., USA; Chan, John, Arizona Univ., USA; Yousef, Anwar, Arizona Univ., USA; Cojinis, Philip, Arizona Univ., USA; Kulagin, Konstantin, Arizona Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 147-155; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

This year the ASPOD project provided hands-on-hardware experience for a total of twelve students that also included independent study students. In continuing to seek economical solutions to mitigate the orbital debris problem, the robot construction was improved. The advances included: a new modern six degrees of freedom arm, a high-tech. low weight, high strength composite frame for the Fresnel lens and mirror array, and a solar tracking test bed. The test bed consists of a strong support frame that is capable of holding both arms and the entire mirror assembly. The table/platform possesses two degrees of freedom, a rotational joint, and a second tilting about an axis. These two actuators allow the table to position the lenses in order to maximize the sunlight reception. The process is controlled by hard-wired logic circuit with four phototransistors positioned on the mirror frame. This logic system directs the two mirrors and will track the sun, allowing uninterrupted cutting during solar availability.

Author

Autonomy; Space Debris; Robots; Removal

20030020361 California Univ., Dept. of Mechanical, Aerospace and Nuclear Engineering, Los Angeles, CA USA

Planetary and Asteroid Missions: Getting There

Meyer, Rudolf X., California Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 156-166; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this hardware project, the students developed ideas for attaching objects to the surface of small moons or asteroids. A device was designed, and built in the university machine shop, that uses a projectile shot into concrete, thereby attaching a model spacecraft to the landing site.

Author

Spacecraft Landing; Natural Satellites; Asteroids; Projectiles; Attachment

20030020371 Maryland Univ., Dept. of Aerospace Engineering, College Park, MD USA

MOOSE: Manned On-Orbit Servicing Equipment

Akin, David L., Maryland Univ., USA; Rice, Tharen, Maryland Univ., USA; Budinoff, Jason, Maryland Univ., USA; Lane, J. Corde, Maryland Univ., USA; Leontsinis, Nicole, Maryland Univ., USA; Singh, Ram C., Maryland Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 258-268; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The ability to service satellites has thus far been limited to Low Earth Orbit (LEO) platforms within reach of the Space Shuttle. Other orbits, such as Geosynchronous Orbits (GEO) containing high-value spacecraft have, thus far, not been reachable by a

servicing vehicle. The useful life of a satellite can be extended by replacing spent propellant and damaged Orbital Replacement Units (ORUs), forestalling the need for eventual replacement. This growing need for satellite on-orbit servicing can be met by the Manned On-Orbit Servicing Equipment (MOOSE). Missions requiring orbit transfer capability, precision manipulation and maneuvering and man-in-the-loop control can be accomplished using MOOSE. MOOSE is a flexible, reusable, single operator, aerobraking spacecraft designed to refuel, repair, and service orbiting spacecraft. MOOSE will be deployed from Space Station Freedom, (SSF), where it will be stored, resupplied, and refurbished.

Author

Orbital Servicing; Spacecraft Maintenance; Reusable Spacecraft; Spacecraft Design; Manned Spacecraft

20030020385 Washington Univ., Dept. of Aeronautics and Astronautics, Seattle, WA USA

Project Hyreus: Mars Sample Return Mission Utilizing in Situ Propellant Production

Bruckner, A. P., Washington Univ., USA; Thill, Brian, Washington Univ., USA; Abrego, Anita, Washington Univ., USA; Koch, Amber, Washington Univ., USA; Kruse, Ross, Washington Univ., USA; Nicholson, Heather, Washington Univ., USA; Nill, Laurie, Washington Univ., USA; Schubert, Heidi, Washington Univ., USA; Schug, Eric, Washington Univ., USA; Smith, Brian, Washington Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 421-437; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Project Hyreus is an unmanned Mars sample return mission that utilizes propellants manufactured in situ from the Martian atmosphere for the return voyage. A key goal of the mission is to demonstrate the considerable benefits of using indigenous resources and to test the viability of this approach as a precursor to manned Mars missions. The techniques, materials, and equipment used in Project Hyreus represent those that are currently available or that could be developed and readied in time for the proposed launch date in 2003. Project Hyreus includes such features as a Mars-orbiting satellite equipped with ground-penetrating radar, a large rover capable of sample gathering and detailed surface investigations, and a planetary science array to perform on-site research before samples are returned to Earth. Project Hyreus calls for the Mars Landing Vehicle to land in the Mangala Valles region of Mars, where it will remain for approximately 1.5 years. Methane and oxygen propellant for the Earth return voyage will be produced using carbon dioxide from the Martian atmosphere and a small supply of hydrogen brought from Earth. This process is key to returning a large Martian sample to Earth with a single Earth launch.

Author

Mars Sample Return Missions; In Situ Resource Utilization; Propellants; Manned Mars Missions; Mars Atmosphere

13

ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

20030020377 Naval Postgraduate School, Monterey, CA USA

Near-Earth Asteroid Rendezvous

Agrawal, Brij, Naval Postgraduate School, USA; Euler, Ed, Naval Postgraduate School, USA; Price, Dave, Naval Postgraduate School, USA; Figuerres, John, Naval Postgraduate School, USA; Hand, Greg, Naval Postgraduate School, USA; Johnson, Rick, Naval Postgraduate School, USA; Lantto, Eric, Naval Postgraduate School, USA; Loesch, Rena, Naval Postgraduate School, USA; Riggs, John, Naval Postgraduate School, USA; Wilsey, Mark, Naval Postgraduate School, USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 318-325; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The AE4871 Spacecraft Design Course is the capstone design class for the M.S. in Astronautics at the Naval Postgraduate School. The Fall 92 class designed a spacecraft for the Near Earth Asteroid Rendezvous Mission (NEAR). The NEAR mission uses a robotic spacecraft to conduct up-close reconnaissance of a Near-Earth asteroid. Such a mission will provide information on Solar System formation and possible space resources. The spacecraft is intended to complete a NEAR mission as a relatively low-budget program while striving to gather as much information about the target asteroid as possible. A complete mission analysis and detailed spacecraft design were completed. Mission analysis included orbit comparison and selection, payload and telemetry requirements, spacecraft configuration, and launch vehicle selection. Spacecraft design included all major subsystems: structure, electrical power, attitude control, propulsion, payload integration, and thermal control. The resulting spacecraft

demonstrates the possibility to meet the NEAR Mission requirements using existing technology, 'off-the-shelf' components and a relatively low-cost launch vehicle.

Author

Near Earth Asteroid Rendezvous Mission; Spacecraft Design; Product Development; Structural Design; Systems Engineering; Mission Planning; Trajectory Analysis

14

GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also 09 Research and Support Facilities (Air).

20030019356 University of Central Florida, Orlando, FL USA

To Create Space on Earth: The Space Environment Simulation Laboratory and Project Apollo

Walters, Lori C., University of Central Florida, USA; February 2003; 62p; In English

Report No.(s): NASA/CR-2003-208933; NAS 1.26:208933; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Few undertakings in the history of humanity can compare to the great technological achievement known as Project Apollo. Among those who witnessed Armstrong's flickering television image were thousands of people who had directly contributed to this historic moment. Amongst those in this vast anonymous cadre were the personnel of the Space Environment Simulation Laboratory (SESL) at the Manned Spacecraft Center (MSC) in Houston, Texas. SESL houses two large thermal-vacuum chambers with solar simulation capabilities. At a time when NASA engineers had a limited understanding of the effects of extremes of space on hardware and crews, SESL was designed to literally create the conditions of space on Earth. With interior dimensions of 90 feet in height and a 55-foot diameter, Chamber A dwarfed the Apollo command/service module (CSM) it was constructed to test. The chamber's vacuum pumping capacity of 1×10^{-6} torr can simulate an altitude greater than 130 miles above the Earth. A "lunar plane" capable of rotating a 150,000-pound test vehicle 180 deg replicates the revolution of a craft in space. To reproduce the temperature extremes of space, interior chamber walls cool to -280F as two banks of carbon arc modules simulate the unfiltered solar light/heat of the Sun. With capabilities similar to that of Chamber A, early Chamber B tests included the Gemini modular maneuvering unit, Apollo EVA mobility unit and the lunar module. Since Gemini astronaut Charles Bassett first ventured into the chamber in 1966, Chamber B has assisted astronauts in testing hardware and preparing them for work in the harsh extremes of space.

Author

Carbon Arcs; Command Service Modules; Extravehicular Activity; Flicker; Lunar Module; Rotation; Solar Simulation; Space Environment Simulation; Vacuum Chambers

15

LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.

20030018858 Aerospace Corp., Lab. Operations, El Segundo, CA USA

Compact, Continuous-Beam, Cold-Atom Clock for Satellite Applications

Wang, H.; Buell, W. R.; Jun. 30, 2002; 17p; In English

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A409518; TR-2002(8555)-7; SMC-TR-03-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Highly stable atomic frequency standards are of increasing importance for a variety of space applications, ranging from communication to navigation and time transfer to tests of fundamental science. The requirements for an atomic clock vary significantly depending on the application, and for many space systems, compactness and robust design are at a premium, and stability dominates over absolute accuracy. We report on progress with our design for a compact laser-cooled Cs- beam atomic clock suitable for satellite applications such as GPS. The basic design features a continuous, cold atomic beam extracted from a magneto-optic trap (MOT). This cold atomic beam is then to be used in a laser-pumped Ramsey clock, with the clock signal derived from either a microwave C-field or, alternatively, by Raman resonance between the Ramsey fields. In order to reduce light shifts from the MOT light and improve signal-to-noise, the atomic beam will be optically deflected and transversely cooled upon

extraction from the MOT. We estimate that the shot-noise-limited stability achievable with this physics package can be 2 to 3 orders of magnitude better than current Cs-beam clocks used in satellite applications. We present our experimental progress towards a working frequency standard, including characterization of our six-beam magneto-optic cold atom trap and production and characterization of a cold atomic beam.

DTIC

Artificial Satellites; Atomic Clocks

20030018888 National Academy of Sciences - National Research Council, Eglin AFB, USA

Transport System for Delivery Tourists At Altitude 140 km

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; 2002; 10p; In English; 53rd International Astronautical Congress: The World Space Congress 2002, 10-19 Oct. 2002, Houston, TX, USA

Report No.(s): IAC-02-IAA.1.3.03; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The author offers a new method and installation for flight in space. This method uses the centrifugal force of a rotating circular cable that provides a means for the launch of a payload into outer space, to keep the fixed space stations at high altitudes (up to 200 km). The method may also be useful for landing to space bodies, for launching of the space ships (crafts), and for moving and accelerating other artificial apparatuses. The offered installation may be used as a propulsion system for space ships and/or probes. This system uses the material of any space body (i.e. stones) for acceleration and change of the space vehicle trajectory. The suggested system may be also used as a high capacity energy accumulator.

Author

Space Flight; Cables (Ropes); Rotation; Centrifugal Force

20030018889 National Academy of Sciences - National Research Council, Elgin AFB, USA

Inexpensive Cable Space Launcher of High Capability

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; 2002; 12p; In English; 53rd International Astronautical Congress: The World Space Congress, 10-19 Oct. 2002, Houston, TX, USA

Report No.(s): IAC-02-V.P.07; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

This paper proposes a new method and transportation system to fly into space, to the Moon, Mars, and other planets. This transportation system uses a mechanical energy transfer and requires only minimal energy so that it provides a 'Free Trip' into space. The method uses the rotary and kinetic energy of planets, asteroids, moons, satellites and other natural space bodies. computations for the following projects: 1. Non-Rocket Method for free launch of payload in Space and to other planets. The low cost project will accommodate one hundred thousand tourists annually. 2. Free Trips to the Mars for two thousand annually. 3. Free Trips to the Moon for ten thousand people annually. The projects use artificial materials like nanotubes and whiskers that have a ratio of tensile strength to density equal 4 million meters. In the future, nanotubes will be produced that can reach a specific stress up 100 millions meter and will significantly improve the parameters of suggested projects. The author is prepared to discuss the problems with serious organizations that want to research and develop these inventions.

Author

Cables (Ropes); Space Transportation; Energy Transfer; Rotation; Kinetic Energy; Spacecraft Launching

20030018907 National Academy of Sciences - National Research Council, Elgin AFB, USA

Non-Rocket Missile Rope Launcher

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; 2002; 7p; In English; 53rd International Astronautical Congress: The World Space Congress, 10-19 Oct. 2002, Houston, TX, USA

Report No.(s): IAC-02-S.P.14; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The method, installation, and estimation for delivering payload and missiles into outer space are presented. This method uses, in general, the engines and straight or closed-loop cables disposed on a planet surface. The installation consists of a space apparatus, power drive stations located along trajectory of the apparatus, the cables connected to the apparatus and to the power stations, a system for suspending the cable, and disconnected device. The drive stations accelerate the apparatus up to hypersonic speed. The estimations and computations show the possibility of making these projects a reality in a short period of time (see

attached project: launcher for missiles and loads). The launch will be very cheap \$1-\$2 per LB. We need only light strong cable, which can be made from artificial fibers, whiskers, nanotubes, which exist in industry and scientific laboratories.

Author

Hypersonic Speed; Payloads; Rocket Launchers; Synthetic Fibers

20030018908 National Academy of Sciences - National Research Council, Elgin AFB, USA

Employment of Asteroids for Movement Space Ship and Probes

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; 2002; 8p; In English; 53rd International Astronautical Congress: The World Space Congress, 10-19 Oct. 2002, Houston, TX, USA

Report No.(s): IAC-02-S.6.04; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

At present, rockets are used to change the trajectory of space ships and probes. This method is very expensive and requires a lot of fuel, which limits the feasibility of space stations, interplanetary space ships, and probes. Sometimes space probes use the gravity field of a planet. However, there are only 9 planets in our solar system and they are separated by great distances. There are tens of millions of asteroids in outer space. The author offers a revolutionary method for changing the trajectory of space probes. This method uses the kinetic or rotary energy of asteroids, meteorites or other space bodies (small planets, natural planet satellites, etc.) to increase (to decrease) ship (probe) speed up to 1000 m/sec (or more) and to get any new direction in outer space. The flight possibilities of space ships and probes are increased by a factor of millions.

Author

Asteroids; Gravitational Fields; Kinetic Energy; Natural Satellites; Planets; Ships; Trajectories

20030019299 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Review of Recent Progress During Laser-Powered Lightcraft Flights to Unlimited Altitudes

Mead, Franklin B.; Larson, C. W.; Sep. 26, 2000; 3p; In English

Report No.(s): AD-A409572; AFRL-PR-ED-AB-2000-183; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In 1996, the Air Force Research Laboratory's Propulsion Division at Edwards AFB initiated a project that had as its main objective to launch a laser-propelled Lightcraft into a suborbital trajectory within a period of five years in order to demonstrate the concept and its attractive features. The Lightcraft concept is a nanosatellite in which the laser propulsion engine and satellite hardware are intimately shared. The forebody aeroshell acts as an external compression surface (i.e. the airbreathing engine inlet). The afterbody has a dual function as a primary receptive optic (parabolic mirror) for the laser beam and as an external expansion surface (plug nozzle) during the laser rocket mode, which is used only outside the atmosphere. The primary thrust structure is the centrally located annular shroud. The shroud provides air through inlets and acts as a combustion chamber for plasma formation in the airbreathing mode. In the rocket mode, the air inlets are closed, and the afterbody and shroud combine to form the rocket thrust chamber and plug ("aerospike-type") nozzle. The full-scale vehicle has a focal diameter of 1 m and a dry mass of about 1 kg. Fully fueled, this vehicle would have an initial mass of about 2 kg (i.e., a mass fraction of 0.5), and would be launched into orbit with a megawatt-class infrared ground-based laser. It would be a single-stage-to-orbit (i.e., airbreathing (infinite Isp) to M=5 and 30 km; a laser thermal rocket with its own on-board propellant at higher altitudes and in space) using a combined-cycle pulsed detonation engine. Once in space, the Lightcraft will use its 1 m diameter optical system to provide, for example, Earth surveys with 8 to 13 cm resolution in the visible light frequencies from Low Earth Orbit.

DTIC

Laser Propulsion; Artificial Satellites; Nanotechnology

20030019922 Space Physics Research Inst., Sunnyvale, CA USA

Data Assimilation and Transport Modeling in Terrestrial and Planetary Atmospheres, 1 Apr. 1999 - 31 Jul. 2002

Houben, Howard C., Space Physics Research Inst., USA; [2002]; 8p; In English

Contract(s)/Grant(s): NCC2-1110; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Data assimilation is a blanket term used to describe a number of techniques for retrieving important physical parameters from observational data, subject to constraints imposed by prior knowledge (such as, in the case of meteorology, the primitive equations that govern atmospheric motion). Since these newly developed methods make efficient use of computational resources, they are of great importance in the interpretation of the voluminous datasets that are now produced by satellite missions. As proposed, these techniques have been applied to the study of the Martian and terrestrial atmospheres based on available satellite observations. In

addition, a sophisticated hydrodynamic model (non-hydrostatic, and therefore applicable to the study of the interiors of the giant planets) has also been developed and successfully applied to the study of tidally induced motions in Jupiter.

Derived from text

Data Acquisition; Planetary Atmospheres; Earth Atmosphere; Computer Techniques

20030020352 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

Design of an Airborne Launch Vehicle for an Air Launch Space Booster

Levy, David W., Michigan Univ., USA; Blow, John W., Michigan Univ., USA; Poth, Stefan M., Jr., Michigan Univ., USA; Chao, Chin H., Michigan Univ., USA; Cohen, Scott A., Michigan Univ., USA; Dumont, Brian J., Michigan Univ., USA; Gibin, Mauricius, Michigan Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 57-65; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A conceptual design is presented for a carrier vehicle for an air launched space booster. This airplane is capable of carrying a 500,000 pound satellite launch system to an altitude over 40,000 feet for launch. The airplane features a twin fuselage configuration for improved payload and landing gear integration, a high aspect ratio wing for maneuverability at altitude, and is powered by six General Electric GE-90 engines. The analysis methods used and the systems employed in the airplane are discussed. Launch costs are expected to be competitive with existing launch systems.

Author

Air Launching; Launch Vehicles; Booster Rocket Engines; Aircraft Configurations; Aircraft Design

16

SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also 03 Air Transportation and Safety and 15 Launch Vehicles and Launch Vehicles, and 18 Spacecraft Design, Testing and Performance. For space suits, see 54 Man/System Technology and Life Support.

20030018890 NASA Johnson Space Center, Houston, TX USA

STS-112 Mission Highlights Resource Tape Part 2 of 3

Jan. 22, 2003; In English; 59 min., 51 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2003009292; JSC-1942; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

An overview of the STS-112 Mission is presented. The fourth flight day begins with a view inside of the Destiny Laboratory of the International Space Station where Expedition Five Commander Valery Korzun is shown. The robotics workstation where Mission Specialist Sandra Mangus and Flight Engineer Peggy Whitson operate Canadarm 2 to lift the S(1) Truss segment out of the payload bay of the Space Shuttle Atlantis and maneuver it for installation onto the S(1) Truss is presented. Mission Specialist Piers Sellers is shown preparing for his six and one half hour spacewalk by performing breathing exercises. Animation of the installation of the S(1) Truss, and also the unbirthing of the S(1) truss is also presented. Mission Specialists David Wolf and Piers Sellers are shown getting suited for their spacewalks. During the spacewalk, David Wolf is removing the antenna assembly from its launched position and Piers Sellers is releasing launch restraints from the Radiator Beam Assembly. A beautiful view of the coast of Texas is captured during this spacewalk. Flight day five shows pilot Pam Melroy and Mission Specialist Dave Wolf working inside of the International Space Station's Quest Airlock. Flight day six is shown with Dave Wolf and Piers Sellers exiting their spacesuits inside of the Quest Airlock Module after a successful spacewalk. This presentation ends with views of the International Space Station's installed S(1) Truss, rotation of the radiator assembly and the radiator's coolant tubing.

CASI

Extravehicular Activity; Space Transportation System; Spacecraft Maintenance; Integrated Truss Structure S1; Robotics; NASA Space Programs

20030018893 National Academy of Sciences - National Research Council, Eglin AFB, USA

Non-Rocket Earth-Moon Transport System

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; 2002; 6p; In English; 34th COSPAR Scientific Assembly: The World Space Congress 2002, 10-19 Oct. 2002, Houston, TX, USA; Sponsored by Committee on Space Research, Unknown

Report No.(s): COSPAR-02-B0.3-F3.3-0032-02; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

This paper proposes a new method and transportation system to travel to the Moon. This transportation system uses a mechanical energy transfer and requires only minimal energy so that it provides a 'Free Trip' into space. The method uses the rotary and kinetic energy of the Moon. This paper presents the theory and results of computations for the project provided Free Trips (without rockets and spend a big energy) to the Moon for six thousand people annually. The project uses artificial materials like nanotubes and whiskers that have a ratio of tensile strength to density equal 4 million meters. In the future, nanotubes will be produced that can reach a specific stress up 100 millions meter and will significantly improve the parameters of suggested project. The author is prepared to discuss the problems with serious organizations that want to research and develop these innovations.

Author

Earth-Moon Trajectories; Energy Transfer; Kinetic Energy; Space Transportation; Moon

20030018894 Nelson Consulting, Moffett Field, CA USA

Formal Verification for a Next-Generation Space Shuttle

Nelson, Stacy D., Nelson Consulting, USA; Pecheur, Charles, Research Inst. for Advanced Computer Science, USA; Dec. 31, 2002; 15p; In English; 2nd Goddard Workshop on Formal Aspects of Agent-Based Systems, Unknown; Sponsored by NASA Goddard Space Flight Center, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses the verification and validation (V&2) of advanced software used for integrated vehicle health monitoring (IVHM), in the context of NASA's next-generation space shuttle. We survey the current VBCV practice and standards used in selected NASA projects, review applicable formal verification techniques, and discuss their integration into existing development practice and standards. We also describe two verification tools, JMPL2SMV and Livingstone PathFinder, that can be used to thoroughly verify diagnosis applications that use model-based reasoning, such as the Livingstone system.

Author

Program Verification (Computers); Next Generation Space Telescope Project; Space Shuttles; Software Engineering; Systems Health Monitoring

20030019201 NASA Johnson Space Center, Houston, TX USA

STS-112 Mission Highlights Resource, Part 3 of 3

Jan. 22, 2003; In English; 38 min., 40 sec. playing time, in color, with sound

Report No.(s): JSC-1942; NONP-NASA-VT-2003009346; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

The STS-112 Mission begins with a view of the center radiator on the S(1) Truss. A good view of the International Space Station's (ISS) Destiny Laboratory, Soyuz Crew Return Vehicle and Quest Airlock are shown from a video camera located at the end of the S(1) Truss Segment. The ISS Canadarm 2 is shown getting in position for spacewalk three. Highlights of flight day eight begin with Pilot Pam Melroy and Mission Specialist Fyodor Yurchikhin shown inside of the Quest Airlock closing the hatch as spacewalkers David Wolf and Piers Sellers move in the outer compartment of the Airlock to begin Extravehicular Activity 3 (EVA 3). During EVA 3, Dave Wolf and Piers Sellers are installing spool positioning devices on ammonia lines located on the ISS. Robot Arm Operators Peggy Whitson and Sandy Magnus are shown reviewing procedures for operating the robot arm. A view of Piers Seller climbing back into the Quest Airlock is presented. During flight day nine, robot arm operators Pam Melroy, Jeff Ashby and Peggy Whitson are in the process of removing spacesuits worn by David Wolf and Piers Sellers. A final farewell of the nine crewmembers shown inside of the Destiny Laboratory is presented during flight day ten. The undocking of Space Shuttle Atlantis from the International Space Station is shown on flight day eleven. This presentation ends on flight day 12 with a view of head up displays and the actual landing of the Space Shuttle Atlantis.

CASI

Space Transportation System; International Space Station; Robotics; Extravehicular Activity; Atlantis (Orbiter); Integrated Truss Structure S1

20030020372 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA

Project Perseus: A Crew Return Vehicle for Space Station Freedom

Weiss, Stanley I., Massachusetts Inst. of Tech., USA; McManus, Hugh L., Massachusetts Inst. of Tech., USA; Clarke, John-Paul, Massachusetts Inst. of Tech., USA; Suzuki, David E., Massachusetts Inst. of Tech., USA; Abernathy, Erik, Massachusetts Inst. of Tech., USA; Amir, Amir R., Massachusetts Inst. of Tech., USA; Aron, Edward, Massachusetts Inst. of Tech., USA; Bakkila, Michelle, Massachusetts Inst. of Tech., USA; Bernstein, Jakob, Massachusetts Inst. of Tech., USA; Brandt, John, Massachusetts Inst. of Tech., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 269-273; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

In the wake of the Space Shuttle Challenger accident in 1986, NASA reassessed the safety of manned space missions. As a result, the Johnson Space Center initiated a study for an escape vehicle for Space Station Freedom (SSF). The objective of this vehicle is to provide astronauts onboard the station a safe and simple method of evacuation in case of an emergency. While the Russian Soyuz capsule provides an early option, it has several limitations. Two Soyuz spacecraft can accommodate only four crewmembers, whereas current planning calls for four to eight by FY 2000. For the long term, there is a need for alternative concepts. The semester-long senior course, Space Systems Engineering, at the Massachusetts Institute of Technology undertook a design study for an alternative solution to the Soyuz capsule. Requirements were provided by the NASA Johnson Space Center. This vehicle, called PERSEUS for Personal Emergency and Utility Spacecraft, was designed as a lifting body with a cylindrical shape and a nose cone. The geometry provides a lift-to-drag ratio of approximately 1, allowing for a necessary cross-range capability to access seven possible landing sites, of which Eastern New Mexico is the primary one and Stuart Plain, Australia is secondary. PERSEUS sizing is governed by the ability to be launched in pairs by the Space Shuttle or singly by a Titan IV booster from the Kennedy Space Center. In addition to being able to safely evacuate four astronauts to earth, PERSEUS can provide a temporary 'safe haven' for station personnel, capture and transport back an EVA astronaut unable to return to the station, and reach a Space Shuttle in a lower orbit if it is disabled. Parachutes are released during reentry to reduce the velocity of PERSEUS and retro-rockets are fired shortly before touchdown to provide a soft landing in an upright position. All these mission scenarios can be accomplished within a period of 24 hours, fulfilling a requirement from NASA.

Author

Escape Capsules; Recovery Vehicles; Return to Earth Space Flight; Spacecraft Design; Structural Design; Design Analysis; Product Development

20030020382 Naval Academy, Dept. of Aerospace Engineering, Annapolis, MD USA

Remote Universal Naval Transponder

Severns, James, Naval Academy, USA; Schultz, Karl, Naval Academy, USA; Finney, Matthew, Naval Academy, USA; Tandy, David, Naval Academy, USA; Perkins, Lori, Naval Academy, USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 374-384; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The USA Naval Academy Space Systems Design Team has designed a digital transponder for use by U.S. Navy and commercial vessels for accountability and communication. The Remote Universal Naval Transponder, or "RUNT", was designed as a follow on to MACSAT and modeled loosely after PANSAT. The main benchmark when designing RUNT was cost. The overall goal was to produce a less expensive source of communication for naval vessels without sacrificing reliability. The RUNT will operate in a 881 km polar orbit. The spacecraft will be placed into this orbit, two at a time, by the SCOUT launch vehicle, which is capable of placing 130 kg into a 900 km orbit. The total lift off weight of both RUNTs, and all accompanying structure totals 84.4 kg. Total earth coverage could be accomplished with 32 satellites. However, with only eight satellites, a satellite would pass over any point on earth, at least every forty minutes. By using a gravity gradient boom, and a directional antenna, transmissions can be accomplished with less than 1 Watt eirp from the RUNT.

Author

Directional Antennas; Navy; Scout Launch Vehicle; USA; Design Analysis

20030020389 NASA, Washington, DC USA

The Preliminary Design of a Universal Martian Lander

Norman, Timothy L., West Virginia Univ., USA; Gaskin, David, NASA, USA; Adkins, Sean, West Virginia Univ., USA; MacDonnell, David, West Virginia Univ., USA; Ross, Enoch, West Virginia Univ., USA; Hashimoto, Kouichi, West Virginia Univ., USA; Miller, Loran, West Virginia Univ., USA; Sarick, John, West Virginia Univ., USA; Hicks, Jonathan, West Virginia Univ., USA; Parlock, Andrew, West Virginia Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 445-456; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

As part of the NASA/USRA program, nineteen West Virginia University students conducted a preliminary design of a manned Universal Martian Lander (UML). The WVU design considers descent to Mars from polar orbit, a six month surface stay, and ascent for rendezvous. The design begins with an unmanned UML landing at Elysium Mons followed by the manned UML landing nearby. During the six month surface stay, the eight modules are assembled to form a Martian base where scientific experiments are performed. The mission also incorporates hydroponic plant growth into a Controlled Ecological Life Support System (CELSS) for water recycling, food production, and to counteract psycho-logical effects of living on Mars. In situ fuel production for the Martian Ascent and Rendezvous Vehicle (MARV) is produced From gases in the Martian atmosphere.

Following surface operations, the eight member crew uses the MARV to return to the Martian Transfer Vehicle (MTV) for the journey home to Earth.

Author

Maneuverable Reentry Bodies; Hydroponics; Life Support Systems; In Situ Resource Utilization; Mars Landing

17

SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information, see also 04 Aircraft Communications and Navigation and 32 Communications and Radar.

20030020487 Embry-Riddle Aeronautical Univ., Coll. of Aviation, Prescott, AZ USA

Blind Flying on the Beam Aeronautical Communication, Navigation and Surveillance: Its Origins and the Politics of Technology, Part 1, Form and Function

Johnson, Randy, Embry-Riddle Aeronautical Univ., USA; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 37-68; In English; Copyright; Avail: Issuing Activity

In this first part of a three - part series, the technological and political progress from the earliest attempts at wireless communication to research on fog signaling, blind flying and early Post Office attempts at surveillance are examined. During this period, government agencies such as the War Department, Navy, Post Office and the National Bureau of Standards pursued various projects while testing technologies and methodologies for aerial electronic communication and navigation. Their research relied on administrative funding that could be very substantial or non-existent, depending on the national political climate. The Second part of the series considers the effect of Federal regulatory and administrative policy on the development of aeronautical communication and navigation in the USA (U.S.). The third part analyzes the effect of the continued Federal oversight during the Great Depression and the progress of aeronautical telecommunications research and the deployment of such technologies in support of aviation.

Author

Air Navigation; Aircraft Communication; Surveillance; Wireless Communication

18

SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see 54 Man/System Technology and Life Support. For related information, see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation and Safety.

20030018887 National Academy of Sciences - National Research Council, Eglin AFB, USA

Optimal Inflatable Space Towers with 3 - 100 km Height

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; JBIS; 2003; Volume 56, pp. 87-97; In English; World Space Congress 2002, 10-19 Oct. 2002, Houston, TX, USA; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

Theory and computations are provided for building inflatable space towers up to one hundred kilometers in height. These towers can be used for tourism, scientific observation of space, observation of the Earth's surface, weather and upper atmosphere, and for radio, television, and communication transmissions. These towers can also be used to launch space ships and Earth satellites. These projects are not expensive and do not require rockets. They require thin strong films composed from artificial fibers and fabricated by current industry. The towers can be built using present technology. The towers can be used (for tourism, communication, etc.) during the construction process and provide self-financing for further construction. The tower design does not require work at high altitudes; all construction can be done at the Earth's surface. The transport system for a tower consists of a small engine (used only for friction compensation) located at the Earth's surface. The tower is separated into sections and has special protection mechanisms in case of damage. Problems involving security, control, repair, and stability of the proposed towers are addressed in other publications. The author is prepared to discuss these and other problems with serious organizations desiring to research and develop these projects.

Author

Large Space Structures; Inflatable Space Structures; Towers; Design Optimization

20030018979 Colorado Univ., Boulder, CO USA

Three Corner Satellite Final Report, Jan. 1999-Sep. 2002

Hansen, Elaine; Beckwith, Dave; Egaas, Brian; Levin-Stankevich, Steve; Michels, Jennifer; Sep. 2002; 38p; In English; Original contains color images

Contract(s)/Grant(s): F49620-99-1-0208

Report No.(s): AD-A410043; UCB-CSGC-02-005; AFRL-SR-AR-TR-03-0011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of the overall Three Corner Satellite (3CS) project within the University Satellite Program, the development and testing of the science Imaging System and the End-to-End Data System (EEDS) were undertaken at the University of Colorado in conjunction with team members from Arizona and New Mexico. This report describes the overall satellite project and the details of the development of the Imaging System and the EEDS. The Three Corner Satellite (3CS) constellation is a cluster of three nanosatellites that are part of the U.S. Air Force University Nanosat program. The 3CS project was begun in January 1999 and the cluster of satellites is presently awaiting launch in 2003 from the Space Shuttle. The 3CS project is a joint effort of the faculty, staff and students at the three participating universities: Arizona State University (ASU), New Mexico State University (NMSU), and the University of Colorado at Boulder (CU).

DTIC

Artificial Satellites; Nanotechnology

20030019068 Tethers Unltd., Inc., Lynnwood, WA USA

Retrieve Tether Survival Probability

Forward, Robert L.; Mar. 08, 2002; 12p; In English

Contract(s)/Grant(s): F04611-01-C-0036

Report No.(s): AD-A410113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The survival probability with time of the Rendezvous, Examine, and Tethered Return for Immolative Evaporation Experiment (RETRIEVE) tether due to cuts of the tether by meteorites and orbital debris, is calculated to be 99.934% for the planned experiment duration of six months or less. This is equivalent to odds of 1 out of 1500 of the tether being severed during the six-month duration of the experiment. Nearly all of this relatively low risk is due to the unlikely event of a strike by a large piece of orbital debris greater than 1 meter in size cutting all the lines of the tether at once. The probability of the tether surviving multiple cuts by meteoroid and orbital debris impactors smaller than 5 cm in diameter is 99.9993% at six months, so severing of the tether by that mode has odds of less than 1 in 150,000. The tether survival probability Mh time will remain above 99% until after 5 years of exposure to cuts. After three decades of cuts, it will have fallen to 90%.

DTIC

Tethering; Probability Theory; Space Debris; Exposure

20030019308 Air Force Research Lab., Space Vehicles Directorate, Kirkland AFB, NM USA

A Systems Engineering Study of Gossamer Optical Satellites Final Report, 1 Oct. 2001-1 Feb. 2002

Robertson, Lawrence M.; Jan. 2002; 28p; In English

Contract(s)/Grant(s): Proj-8809

Report No.(s): AD-A409966; AFRL-VS-TR-2002-1007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a systems engineering modeling effort for very large, Gossamer, space optical systems. The focus of this effort was to determine the effect proposed Gossamer technology has on top-level performance parameters and total systems weight and power. For each technology chosen, system performance was evaluated using "first principals" approaches and then de-convolved into its specific hardware items. These specific hardware items and their performance, once identified, were flowed up into a single payload weight estimate. The payload weight was then combined with mission and spacecraft performance variables to create a single satellite system weight estimate. Finally, sensitivity of payload performance parameters within the payload weight estimate was performed in an attempt to understand the importance of the assumed technology performance.

DTIC

Systems Engineering; Payloads; Spacecraft Performance

20030019327 Tethers Unltd., Inc., Lynnwood, WA USA

The Proposed RETRIEVE Microsatellite Tether Deorbit Experiment

Hoyt, Robert; Forward, Robert; Slostad, Jeffrey; Minor, Bryan; Jan. 22, 2002; 12p; In English

Contract(s)/Grant(s): FO4611-01-C-0036; Proj-3005

Report No.(s): AD-A409988; AFRL-PR-ED-TP-2002-011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have designed and built prototype hardware for very small electrodynamic tether device for deorbiting a microsatellite at the end of its mission. This experiment is intended to fly as a secondary payload on a microsatellite mission. It is designed to present no risk to the spacecraft's primary payloads, remaining completely dormant until the spacecraft has completed its mission. At the end of the spacecraft's mission, the tether device will deploy a 2 km long interconnected-multiline conducting tether upwards from the micro satellite, and will use passive electrodynamic drag to lower the orbit of the microsatellite. To minimize the mass of the device, we developed a new tether deployment mechanism in which the tether deployer ejects itself away from the spacecraft and becomes the tether endmass ballast. Laboratory testing of this deployment mechanism indicates that it can successfully deploy a multiline tether at tensions low enough for successful deployment. We evaluated several plasma contactor technologies for this experiment, and selected a thermionic device based upon a COTS dispenser cathode for its minimal mass and technology maturity. With this tether hardware, a "barebones" experiment to deorbit a 100 kg microsatellite can be implemented with a total mass of less than 25 kg., which is less than the propellant required to fully deorbit such a microspacecraft using thrusters. A more capable experiment, with active control of tether dynamics and diagnostics on tether performance and dynamics can be implemented with a total mass of 3.5 kg.

DTIC

Artificial Satellites; Tethering

20030020362 University of Central Florida, Dept. of Mechanical and Aerospace Engineering, Orlando, FL USA

Design and Testing of a One-Third Scale Soyuz TM Descent Module Spartan Conversion Project Super Loki Instrumentation

Anderson, Loren A., University of Central Florida, USA; Armitage, Pamela Kay, University of Central Florida, USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 167-176; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The 1992-1993 senior Aerospace Engineering Design class continued work on the post landing configurations for the Assured Crew Return Vehicle. The Assured Crew Return Vehicle will be permanently docked to the space station fulfilling NASA's commitment of Assured Crew Return Capability in the event of an accident or illness aboard the space station. The objective of the project was to give the Assured Crew Return Vehicle Project Office data to feed into their feasibility studies. Three design teams were given the task of developing models with dynamically and geometrically scaled characteristics. Groups one and two combined efforts to design a one-third scale model of the Russian Soyuz TM Descent Module, and an on-board flotation system. This model was designed to determine the flotation characteristics and test the effects of a rigid flotation and orientation system. Group three designed a portable water wave test facility to be located on campus. Because of additional funding from Thiokol Corporation, testing of the Soyuz model and flotation systems took place at the Offshore Technology Research Center. Universities Space Research Association has been studying the use of small expendable launch vehicles for missions which cost less than 200 million dollars. The Crusader2B, which consists of the original Spartan first and second stage with an additional Spartan second stage and the Minuteman III upper stage is being considered for this task. University of Central Florida project accomplishments include an analysis of launch techniques, a modeling technique to determine flight characteristics, and input into the redesign of an existing mobile rail launch platform.

Author

Spacecraft Design; Assured Crew Return Vehicle; Scale Models; Soyuz Spacecraft; Loki Rocket Vehicle

20030020364 Duke Univ., Dept. of Mechanical Engineering and Materials Science, Durham, NC USA

Radiation Shielding for Interplanetary Spacecraft

Cocks, Franklin H., Duke Univ., USA; Watkins, Seth, Duke Univ., USA; Adkins, Alex, Duke Univ., USA; Bond, Edward, Duke Univ., USA; Errico, J. P., Duke Univ., USA; Garverich, Jason, Duke Univ., USA; Goldsmith, Bill, Duke Univ., USA; Gregory, John, Duke Univ., USA; Harrison, Tom, Jr., Duke Univ., USA; Haziq, Mustafa, Duke Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 189-199; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The concept of using a superconducting coil for magnetic shielding against solar flare radiation during manned interplanetary missions has long been contemplated and was considered in detail in the years preceding the Apollo missions. Only lower temperature superconductors were then known, and the field coils needed to produce the protective field were limited in size to the ship dimensions. These coils were ineffective unless they carried enormous total circulating currents, and their potential use in the Apollo program was abandoned. With high temperature superconductors, it has now become realistic to consider deploying the field coils beyond the spacecraft hull and the current requirement is dramatically lowered together with the total system mass and energy requirements. Importantly, concomitant experiments are made possible with such a magnetic field generating system, the interaction between the field of the earth and the field produced by the superconducting coil to obtain a thrust capable of

increasing the mean orbital radius and the magsail. With current high temperature superconductor materials, especially wires that have been produced within the last year, a test of all these concepts now appears possible through the use of a payload small enough to fly piggyback aboard another mission.

Author

Field Coils; High Temperature Superconductors; Interplanetary Spacecraft; Magnetic Shielding; Radiation Shielding

20030020369 Iowa State Univ. of Science and Technology, Dept. of Aerospace Engineering and Engineering Mechanics, Ames, IA USA

Iowa Satellite Project

Seversike, Leverage K., Iowa State Univ. of Science and Technology, USA; Kuper, Todd, Iowa State Univ. of Science and Technology, USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 232-245; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

With a few exceptions, satellite systems to date have been large and expensive. Over the past decade, there has been a growing interest in small, inexpensive satellites built and operated by universities to provide students with a 'hands on' engineering experience. It was decided that the university (Iowa State University of Science and Technology) would design, build and operate a satellite called ISAT-1. The primary mission of ISAT-1 is to provide a broad educational experience to Iowa citizens of all age groups and educational backgrounds. The requirements of the project are that ISAT-1 must be a small, inexpensive satellite that can be launched by mid-1996, have an operational lifetime of five years, and can be designed, constructed, and operated by university students. This satellite will have a mass of 50 kg and will be shaped as a hexagonal cylinder 34.0 cm wide and 61.3 cm tall. ISAT-1 will be launched into a circular, low Earth orbit as a secondary payload aboard a Delta II rocket in late 1995. The satellite will be stabilized using an extendible gravity-gradient boom with tip-mass and magnetic torquers. The body-mounted solar panels and rechargeable batteries will provide approximately 25 watts of continuous power. A variety of onboard payloads are designed to accomplish the educational goal including a CCD (charge coupled device) camera with a small telescope, particle detector, Earth Radio Frequency Experiment, and a robotic arm with a miniature CCD camera to examine the exterior of the satellite. Also, a network of weather stations positioned across Iowa will send weather and soil conditions to ISAT-1 for relay to the ground station. The entire project is expected to cost \$2 million. The report gives an overview of the design effort of ISAT-1 and a detailed description of the bus, payload, and ground systems.

Author

Education; Students; Universities; Scientific Satellites; Iowa

20030020374 Michigan Univ., Dept of Aerospace, Electrical, Mechanical and Nuclear Engineering, Ann Arbor, MI USA

Tethered Atmospheric/Ionospheric Research Satellite (AIRSAT)

Gilchrist, Brian E., Michigan Univ., USA; Santangelo, Andrew, Michigan Univ., USA; Niles, Penny, Michigan Univ., USA; Doud, Paul, Michigan Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 286-296; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The AIRSAT research group has designed a proof-of-concept tethered research satellite to be launched into orbit as a secondary payload aboard a Delta II rocket. Following the precedent set by the initial tethered satellite flight demonstration missions, Tethered Satellite System-1 (TSS-1) and the Small Expendable Deployment System-1 (SEDS-1), AIRSAT is proposed to be the first to deploy downward into the Earth's upper atmosphere and lower ionosphere with the intention of conducting proof-of-concept measurements of a scientific and technological nature. The external and internal sensor arrays will collect information concerning electron density and temperature, ion concentration and relative ion temperature, sub-satellite surface pressure, acceleration of sub-satellite, tether tension, altitude stability, and orbital decay. The design is innovative in concept and emphasized not only low cost but also a rapid transition from design completion to flight.

Author

Tethered Satellites; Satellite Design; Product Development; Structural Design; Systems Engineering; Computer Aided Design

SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.

20030018886 National Academy of Sciences - National Research Council, Eglin AFB, USA

Asteroids as Propulsion Systems of Space Ships

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; JBIS; 2003; Volume 56, pp. 98-107; In English; World Space Congress 2002, 10-19 Oct. 2002, Houston, TX, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

Currently, rockets are used to change the trajectory of space ships and probes. This method is very expensive and requires a lot of fuel, which limits the feasibility of space stations, interplanetary space ships, and probes. Sometimes space probes use the gravity field of a planet. However, there are only nine planets in the Solar System, all separated by great distances. There are tons of millions of asteroids in outer space. This paper offers a revolutionary method for changing the trajectory of space probes. The method uses the kinetic or rotary energy of asteroids, comet nuclei, meteorites or other space bodies (small planets, natural planetary satellites, space debris, etc.) to increase (to decrease) ship (probe) speed up to 1000 m/sec (or more) and to achieve any new direction in outer space. The flight possibilities of space ships and probes are increased by a factor of millions.

Author

Propulsion System Performance; Kinetic Energy; Gravitational Fields; Trajectory Optimization

20030018971 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA

Modeling Dense Sprays in Liquid Rocket Engines *Final Report, 1 Jan. 1999-31 Oct. 2003*

Heister, Stephen D.; Jan. 07, 2003; 170p; In English

Contract(s)/Grant(s): F49620-99-1-0092

Report No.(s): AD-A410028; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Models have been developed to address instabilities inside coaxial injectors and for basic description of primary atomization processes. The coaxial injector simulations have provided a database to quantify the amplitude and frequency of hydrodynamic instabilities within the submerged region of the injector for a variety of design conditions. Results compare favorably with experimental data showing that plume "flickering" frequencies are correctly predicted by the model. A new nonlinear primary atomization simulation has been developed in a boundary element framework. Here, the influence of the boundary layer at the orifice exit (and hence the orifice geometry) is properly accounted for such that changes in orifice design are shown to affect the subsequent spray. Droplet size distributions have been predicted from first principles with no calibration constants; data agree very well with limited experimental observations.

DTIC

Models; Liquid Propellant Rocket Engines; Spray Characteristics; Propellant Sprays

20030019067 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Progress on Pulsed Detonation Rocket Propulsion at AFRL: Constant-Volume Limit Studies and LOX Spray Detonations

Coy, E. B.; Talley, D. G.; Jul. 05, 2000; 5p; In English

Contract(s)/Grant(s): AFRL-PR-ED-AB-2000-146; Proj-3058

Report No.(s): AD-A410112; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Progress and plans for research at AFRL on pulsed-detonation rocket engines are described. Analytical studies of the constant-volume limit of pulsed-propulsion have been completed and have shown that the specific impulse penalty of using a fixed area ratio nozzle is less than 3%. Numerical studies of pulsed combustors have elucidated the importance of characteristic times for heat release, chamber blowdown and injector pulsing period. Experimental studies are under way to demonstrate the feasibility of the concept and provide anchoring data for the model. Plans for LOX spray detonation studies are described.

DTIC

Liquid Oxygen; Pulse Detonation Engines; Sprayers; Mathematical Models

20030019213 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

SBAS: The Structural/Ballistic Analysis System

Ruderman, Gregory; May 25, 1999; 19p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409839; AFRL-PR-ED-TP-1999-101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Viewgraph slides from presentation of structural and ballistic analyses of rockets conducted by the Air Force Research Lab.
DTIC
Structural Analysis; Rocket Engines; Interior Ballistics

20030019226 Energy Research Consultants, Inc., Laguna Hills, CA USA

Injection of Cryogenic Jets into Subcritical and Supercritical Environments: Raman Measurements

Chehroudi, Bruce; Badakshan, A.; Cohn, R.; Talley, Doug; Mar. 15, 2000; 16p; In English; Presented at the Intl Symposium on Liquid Space Propulsion (4th) held in Lampoldshausen, Germany on 13-15 Mar. 2000. Contains viewgraphs only
Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409823; AFRL-PR-ED-TP-2000-039; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
No abstract available.

CASI

Liquid Propellant Rocket Engines; Supercritical Flow; Fuel Injection; Cryogenic Rocket Propellants; Subcritical Flow

20030019227 Energy Research Consultants, Inc., Laguna Hills, CA USA

Injection of Cryogenic Fluids into Subcritical and Supercritical Environments

Chehroudi, Bruce; Talley, Doug; Woodward, Roger; Feb. 29, 2000; 33p; In English; Presented at the University Seminar, Eidgenossische Technische Hochschule (ETH) held in Zurich, Switzerland on 17 Mar. 2000. Contains viewgraphs only
Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409822; AFRL-PR-ED-TP-2000-038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
No abstract available.

CASI

Combustion Chambers; Liquid Propellant Rocket Engines; Supercritical Flow; Fuel Injection; Fluid Flow; Cryogenic Rocket Propellants; Gas Jets; Subcritical Flow

20030019283 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Powersail High Power Propulsion System Design Study

Gulczynski, Frank S., III; Schilling, John H.; Hall, Christopher D.; Woodward, Jonathan R.; Jun. 21, 2001; 13p; In English; Prepared in collaboration with Virginia Polytechnic Institute and State University, Blacksburg, VA
Contract(s)/Grant(s): AF Proj. 6340

Report No.(s): AD-A409913; AFRL-PR-ED-TP-2001-147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to support the development of high power, thin film photovoltaic solar arrays by the Air Force Research Laboratory Space Vehicles Directorate, the Propulsion Directorate's Spacecraft Propulsion Branch carried out an in-house propulsion trade study and contracted for a propulsion design study with Virginia Tech University. The in-house study assumed a 100 kW array and performed the most in-depth analysis of the forces perturbing the array and of propulsion options to counteract these forces. Due to the 10 year duration of the mission, the recommendation was to reduce propellant mass by utilizing FEEP thrusters with their extremely high (8000 sec) specific impulse. However, due to the low level of maturity of FEEPs at the required power level, the trade study recommended a combination of the Busek BHT-200 Hall thruster and the AFRL micro-PPT for a near-term mission. The Virginia Tech University design study looked at a 50 kW array and provided a more comprehensive look at the entire spacecraft system.

DTIC

Spacecraft Equipment; Spacecraft Propulsion

20030019291 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Another Look at the Practical and Theoretical Limits of an Expander Cycle, LOX/H₂ Engine

Krach, A. E.; Sutton, A. M.; Jun. 16, 1999; 10p; In English

Contract(s)/Grant(s): F04611-97-C-0029; AF Proj. 4373

Report No.(s): AD-A409900; AFRL-PR-ED-TP-FY99-0156; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Advances in materials and increases in turbopump efficiencies necessitate another look at the theoretical and practical limits for growth in chamber pressure and thrust in a liquid rocket expander cycle engine. The basic equations for turbopump power and heat flux rate out of the cooling jacket are examined to determine the theoretical limits for chamber pressure using an expander

cycle. Turbopump efficiencies and operating speed limits for a LOX/H₂ expander engine are explored to determine practical limits as applied to the chamber pressure.

DTIC

Rocket Engines; Heat Exchangers

20030019295 Thiokol Propulsion, Brigham City, UT USA

Solar Thermal Propulsion IHPRPT Phase I Demonstration Program

Lester, Dean M.; Farmer, Gregory D.; Holmes, Michael R.; Wong, Wayne; Jan. 02, 2002; 3p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409896; AFRL-PR-ED-AB-2002-001; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Solar thermal propulsion is an innovative concept that will double the efficiency of currently used LH₂ - L₀₂ chemical upper stages. Solar thermal propulsion uses the sun's energy to heat a low molecular weight working fluid such as hydrogen to very high temperatures (3,000 K). The stored thermal energy is then converted to kinetic energy as the working fluid exits a diverging nozzle. This document will report on the completed Phase I Integrated High Payoff Rocket Propulsion Technology (IHPRPT) Solar Thermal Propulsion Demonstration, The Air Force Research Lab (AFRL) has sponsored the team of Thiokol Propulsion and SRS Technologies to demonstrate the technological readiness and performance of an inflatable solar thermal propulsion system. The program culminates in a full-up integrated proof-of-concept ground test of a direct gain solar thermal propulsion system. These tests will demonstrate that the technology is ready for development of flight hardware for Solar Orbital Transfer Vehicles.

DTIC

Solar Thermal Propulsion; Military Technology; Research and Development

20030019315 Air Force Research Lab., Edwards AFB, CA USA

Overview of Pulse Detonation Engines

Talley, Doug; Dec. 16, 1999; 13p; In English

Contract(s)/Grant(s): Proj-3058

Report No.(s): AD-A409996; AFRL-PR-ED-TP-1999-0227; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

These viewgraphs provide an overview of pulse detonation engines.

DTIC

Pulse Detonation Engines; Pulses; Detonation

20030019355 NASA Glenn Research Center, Cleveland, OH USA

High Voltage TAL Erosion Characterization

Jacobson, David T., NASA Glenn Research Center, USA; February 2003; 15p; In English; 38th Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 755-04-12

Report No.(s): NASA/TM-2003-211879; NAS 1.15:211879; E-13561; AIAA Paper 2002-4257; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Extended operation of a D-80 anode layer thruster at high voltage was investigated. The thruster was operated for 1200 hours at 700 Volts and 4 Amperes. Laser profilometry was employed to quantify the erosion of the thruster's graphite guard rings and electrodes at 0, 300, 600, 900, and 1200 hours. Thruster performance and electrical characteristics were monitored over the duration of the investigation. The guard rings exhibited asymmetric erosion that was greatest in the region of the cathode. Erosion of the guard rings exposed the magnet poles between 600 to 900 hours of operation.

Author

Electric Propulsion; Electrostatics; Thrust; Erosion; Electrodes; Anodes; Barrier Layers

20030019686 Orbital Technologies Corp., Madison, WI USA

ORBITEC Advanced Cryogenic Solid Hybrid Rocket Engine and Propellant Developments: A 1998 Status Report

Rice, Eric E.; Bangsund, Edward; Chiaverini, Martin J.; Gramer, Daniel J.; May 22, 1998; 22p; In English; Pres: 1998 HEDM Conference, 20-22 May 1998, Monterey, CA. Presentation slides, Viewgraphs only

Contract(s)/Grant(s): F04611-97-C-0020; AF Proj. 1011

Report No.(s): AD-A409805; AFRL-PR-ED-TP-1998-105; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The presentation slides for ORBITEC Advanced Cryogenic Solid Hybrid Rocket Engine and Propellant Developments: A 1998 Status Report are presented.

DTIC

Chutes; Cryogenic Rocket Propellants; Solid Rocket Propellants; Hybrid Rocket Engines

20030019858 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

A Comparison of Sputtering Models for Plasma-Surface Interactions

VanGilder, D. B.; Kirtley, D. E.; Fife, J. M.; Gibbons, M. R.; Jun. 18, 2000; 3p; In English; Presented at the Int'l Electric Propulsion Conference (28th) held in Toulouse, France in March 2003

Contract(s)/Grant(s): AF Proj. 4847

Report No.(s): AD-A410121; AFRL-PR-ED-AB-2002-147; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The interaction of electric propulsion plumes with spacecraft surfaces is studied in order to predict possible spacecraft contamination. For example, ions in the plume may cause surface sputtering and this sputtered material may be deposited on other surfaces. Several models exist for the sputtering of surface material by ion bombardment based on various experimental data. These models depend on the ion species and materials from the data. In order to assess the uncertainty in sputtering predictions, this paper will present a comparison of models for sputtering of spacecraft materials due to operation of Hall-effect thrusters using xenon as a propellant. How this sputtering affects the redeposition will also be examined. The sputter yield versus angle for 300eV ions hitting aluminum and silver is shown in the figure below for two models. The one labeled "R" is from Roussel et al., "Numerical Simulation of Induced Environment, Sputtering and Contamination of Satellite due to Electric Propulsion," Proc. Second European Spacecraft Propulsion Conf. 1997. The other (labeled "Y") is from Yamamura et al., "Angular Dependence of Sputtering Yields on Monatomic Solids", Institute of Plasma Physics, Nagoya University, June 1983. A 3-D plasma interaction modeling system named COLISEUM has been developed and will be used as a tool to test these models as well as others.

DTIC

Sputtering; Electric Propulsion; Three Dimensional Models; Plasmas (Physics); Surface Reactions

20030019883 Pratt and Whitney Aircraft, West Palm Beach, FL USA

Development Status of a 50k LOX/Hydrogen Upper Stage Demonstrator

Long, R.; Grabowski, R.; Minick, A.; Peery, S.; Branam, R.; Jun. 24, 1999; 12p; In English; at AIAA/ASME/SAE/ASEE Joint Propulsion Conf. and Exhibit (35th). Held in Los Angeles, CA, 20-24 Jun 1999. Paper no. AIAA-99-2475

Contract(s)/Grant(s): F04611-97-C-0029; Proj-4373

Report No.(s): AD-A409845; AFRL-PR-ED-TP-1999-253; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses design and systems integration status of a 50,000 pound (222.4 kN) thrust Oxygen/Hydrogen Upper Stage Engine Demonstrator (USD) being created by Pratt & Whitney Liquid Space Propulsion under contract for the USA Air Force Research Laboratory (AFRL) to support the Integrated High Payoff Rocket Propulsion Technology (IHRPT) program. The objective of this program is to integrate advanced technology components into an expander cycle engine configuration and demonstrate a 1% increase in specific impulse, a 30% increase in engine thrust-to-weight, a 25% reduction in failures per 1000 uses, a 15% reduction in required support costs, and a 15% reduction in hardware costs relative to current state-of-the-art levels. Scheduled to be the first of the IHRPT program engine demonstrators, it is scheduled to be test fired in late 2000 and demonstrate a chamber pressure (Pc) capability of 1375 psia (9.48 MPa). This integrated 50k LOX/LH2 engine demonstrator will be used to evaluate individual component technologies as well as the system level mechanical, structural and thermodynamic interactions.

DTIC

Liquid Propellant Rocket Engines; Liquid Rocket Propellants

20030019884 Pratt and Whitney Aircraft, West Palm Beach, FL USA

Design and Development of a 50K LOX/Hydrogen Upper Stage Demonstrator

Peery, S.; Minick, A.; Jul. 1998; 13p; In English; at AIAA/ASME/SAE/ASEE Joint Propulsion Conf. and Exhibit (34th). Held in Cleveland, OH, 13-15 Jul 1998. Paper no. AIAA-98-3676

Contract(s)/Grant(s): F04611-97-C-0029; Proj-4373

Report No.(s): AD-A409846; AFRL-PR-ED-TP-1998-133; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses design and systems integration of a 50,000 pound (222.4 kN) thrust Oxygen/Hydrogen Upper Stage Engine Demonstrator (USD) being developed by Pratt & Whitney Liquid Space Propulsion under contract for the USA Air Force Research Laboratory (AFRL) to support the Integrated High Payoff Rocket Propulsion Technology (IHRPT) program. The objective of this program is to integrate advanced technology components into an expander cycle engine configuration and demonstrate a 1% increase in specific impulse, a 30% increase in engine thrust-to-weight, a 25% reduction in failures per 1000

uses, a 15% reduction in required support costs, and a 15% reduction in hardware costs relative to current state-of-the-art levels (RL10A-3-3A). Scheduled to be the first of the IHRPT program engine demonstrators, it is scheduled to be test fired in late 2000 and demonstrate a chamber pressure capability of 1375 psia. This integrated 50k LOX/LH2 engine demonstrator will be used to evaluate individual component technologies as well as the system level mechanical, structural and thermodynamic interactions.
DTIC

Liquid Propellant Rocket Engines; Liquid Rocket Propellants

20030019885 Pratt and Whitney Aircraft, West Palm Beach, FL USA

Development Status of a 50k LOX/Hydrogen Upper Stage Demonstrator

Grabowski, R.; Friant, J.; Long, R.; Lowinski, L.; Schmidt, E.; Jul. 2000; 11p; In English; at AIAA/SAME/SAE/ASEE Joint Propulsion Conf. and Exhibit (36th). Held in Huntsville, AL, 17-19 Jul 2000. Paper no. AIAA-2000-3784

Contract(s)/Grant(s): F04611-97-C-0029; Proj-4373

Report No.(s): AD-A409847; AFRL-PR-ED-TP-2000-149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses design and systems integration status a 50,000 pound (222,4 kN) thrust Oxygen/Hydrogen Upper Stage Engine Demonstrator (USD) being created by Pratt & Whitney Liquid Space Propulsion under contract for the United States Air Force Research Laboratory (AFRL) to support the Integrated High Payoff Rocket Propulsion Technology (IHRPT) program. The objective of this program is to integrate advanced technology components into an expander cycle engine configuration and demonstrate a 1% increase in specific impulse, a 30% increase in engine thrust-to-weight, a 25% reduction in failures per 1000 uses, a 15% reduction in required support costs, and a 15% reduction in hardware costs relative to current state-of-the-art levels. Scheduled to be the first of the IHRPT program engine demonstrators, test firing is planned in late 2001 to demonstrate a chamber pressure (Pc) capability of 1375 psia (9.48 Mpa). This integrated 50k LOX/LH2 engine demonstrator will be used to evaluate individual component technologies as well as the system level mechanical, structural and thermodynamic interactions.

DTIC

Liquid Propellant Rocket Engines; Liquid Rocket Propellants

20030019886 Pratt and Whitney Aircraft, West Palm Beach, FL USA

Design and Test of a Radial Inflow Turbine for an Advance Liquid Hydrogen Turbopump

Rodriguez, J. L.; Jul. 2000; 8p; In English; at AIAA/ASME/SAE/ASEE Joint Propulsion Conf. and Exhibit (36th). Held in Huntsville, AL, 17-19 Jul 2000. Paper no. AIAA-2000-0158

Contract(s)/Grant(s): F04611-97-C-0029; Proj-4373

Report No.(s): AD-A409848; AFRL-PR-ED-TP-2000-126; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Pratt & Whitney has developed a high performance Radial Inflow Turbine (RIT) to power the Advanced Liquid Hydrogen Turbopump (ALH) for the Upper Stage Demonstrator engine. The design is based on Pratt & Whitney developed RIT methodology that reduces axial length and tip diameter compared to state-of-the-art RIT's, while maintaining or exceeding existing performance levels. The full power speed is very high delivering ruined power to the pump. Included are the design characteristics and preliminary test results at low speed.

DTIC

Liquid Propellant Rocket Engines; Turbines

20030019887 Pratt and Whitney Aircraft, West Palm Beach, FL USA

Testing of an Advanced Liquid Hydrogen Turbopump

Chapman, L.; Crease, G.; Friant, J.; Grabowski, R.; Schmidt, E.; Jul. 2000; 12p; In English; at AIAA/ASME/SAE/ASEE Joint Propulsion Conf. and Exhibit (36th). Held in Huntsville, AL, 17-19 Jul 2000. Paper no. AIAA-2000-3679

Contract(s)/Grant(s): F04611-97-C-0029; Proj-4373

Report No.(s): AD-A409850; AFRL-PR-ED-TP-2000-150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses the testing of an Advanced Liquid Hydrogen Turbopump for a 50,000 pound (222.4 kN) thrust Upper Stage Expander Cycle Engine being developed by Pratt & Whitney Liquid Space Propulsion under contract to the USA Air Force Research Laboratory (AFRL) to support the Integrated High Payoff Rocket Propulsion Technology (IHRPT) program. The Advanced Liquid Hydrogen (ALH) Turbopump is designed to provide improved system thrust to weight decreased hardware/support costs, and increased reliability. These benefits will be demonstrated through test of this high speed, high efficiency, two stage hydrogen turbopump.

DTIC

Liquid Propellant Rocket Engines; Turbine Pumps; Tests

20030020359 Alaska Univ., Dept. of Electrical Engineering, Fairbanks, AK USA

Wireless Space Power Experiment (WISPER)

Hawkins, Joe, Alaska Univ., USA; Chouinard, Brian, Alaska Univ., USA; McSpadden, James, Alaska Univ., USA; Khouli, Sami, Alaska Univ., USA; Ruse, Eric, Alaska Univ., USA; Yearous, Christi, Alaska Univ., USA; Zietlow, Tom, Alaska Univ., USA; Parrott, Mark, Alaska Univ., USA; Alexander, Jeff, Alaska Univ., USA; Meitner, Randy, Alaska Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 135-146; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The 1993 Advanced Design Project at the University of Alaska Fairbanks was to design a spacecraft as a technology demonstration of wireless power transmission (WPT) from earth to space. With cost effectiveness as a design constraint, a microsatellite in low Earth orbit (LEO) was chosen for the mission. Existing and near-term technologies were analyzed and selected for the project. Two methods of power beaming are examined during two separate phases of spacecraft life. The first phase will demonstrate the technology and examine the theory of microwave power transmission at 35 GHz. Special aspects of Phase I will include a highly accurate attitude control system and a 14-m inflatable parabolic antenna. Phase II will investigate the utilization of high intensity laser power using modified photovoltaic arrays. Special instrumentation on the spacecraft will measure the conversion efficiency from the received microwave or laser power to direct current power.

Author

Microwave Power Beaming; Microsatellites; Low Earth Orbits

20030020373 Michigan Univ., Dept. of Aerospace, Ann Arbor, MI USA

Project Gryphon: Air Launched Space Booster

Eisley, Joe, Michigan Univ., USA; Akers, James, Michigan Univ., USA; Fisher, Mike, Michigan Univ., USA; Campbell, Krista, Michigan Univ., USA; Nagaj, Adam, Michigan Univ., USA; Hilbert, Elizabeth, Michigan Univ., USA; Ristow, Alan, Michigan Univ., USA; Shimshock, Ron, Michigan Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 274-285; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Gryphon Design Team has developed a next generation 500,000 lb air launched space booster. The Gryphon is launched from a 1.2 million lb aircraft, the Eclipse, at 44,000 ft. The primary purpose is the delivery of 7,900 lb to Geosynchronous Transfer Orbit (GTO) and 17,000 lb to Low Earth Orbit (LEO). With these payload capabilities, the Gryphon is able to beat out competitor launch vehicles cost per pound by 50% which allows investors a 15% return on their investment. The design has also allowed for the ability to supply Space Station Freedom, based on the Space Shuttles capabilities. Since the Gryphon was designed to compete with existing vehicles, cost has been minimized in all areas. Therefore, only 'off the shelf' technology has used in the design process.

Author

Launch Vehicles; Rocket Engine Design; Structural Design; Payloads; Cost Effectiveness; Product Development; Systems Engineering

20030020393 Wisconsin Univ., Dept. of Engineering Mechanics and Astronautics, Madison, WI USA

Jupiter Exploration using Fusion Rocket Integration (JEFRI)

Thomson, Ronald E., Wisconsin Univ., USA; Santarius, John F., Wisconsin Univ., USA; Kellicut, Anthony, Wisconsin Univ., USA; Zach, Theodore, Wisconsin Univ., USA; Drews, Christopher C., Wisconsin Univ., USA; Davis, Bryan C., Wisconsin Univ., USA; Finnell, Ned, Wisconsin Univ., USA; Hernandez, Michael J., Wisconsin Univ., USA; Pierpont, D. Andrew, Wisconsin Univ., USA; Strauss, William D., Wisconsin Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 457-470; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This project encompasses the design of a spacecraft for a three year round trip mission to collect data on the environmental and geological conditions of the Jovian moons. The design emphasizes the propulsion aspects and environmental control of the fusion engine, structure and shielding, dynamics, and habitat design. The spacecraft is configured about its spin axis which passes through the major axis of a cylindrically shaped engine and the center of a torus which houses the living modules and science platforms. Artificial gravity is created by rotation of the torus, which houses the astronauts in shielded and ergonomically-designed living modules. The type of fusion engine used is the Field Reversed Configuration. The engine is high-velocity-low thrust, and can utilize three different propulsion options: direct, mass-augmented, and NERVA-mode exhaust. The hydrogen propellant is stored as a liquid and frozen before injection. Deuterium and Helium-3, the fuel, is injected into the engine at its midpoint from external storage tanks. The engine is enclosed in a bioshield and rejects waste heat via a liquid drop

radiator that uses sheets of liquid aluminum, which is piped in a continuous loop from an external emitter to a collector for heat rejection.

Author

Control Systems Design; Nuclear Engine For Rocket Vehicles; Propellants; Spacecraft Design

23

CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.

20030018911 NASA Glenn Research Center, Cleveland, OH USA

Water Atomization of Barium Fluoride: Calcium Fluoride for Enhanced Flow Characteristics of PS304 Feedstock Powder Blend

Stanford, Malcolm K., NASA Glenn Research Center, USA; DellaCorte, Christopher, NASA Glenn Research Center, USA; February 2003; 22p; In English

Contract(s)/Grant(s): RTOP 708-18-04

Report No.(s): NASA/TM-2003-212125; NAS 1.15:212125; E-13777; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

PS304 is a plasma spray deposited solid lubricant coating with feedstock composed of NiCr, Cr₂O₃, Ag, and BaF₂-CaF₂ powders. The effects of rounded BaF₂-CaF₂ particles on the gravity-fed flow characteristics of PS304 feedstock have been investigated. The BaF₂-CaF₂ powder was fabricated by water atomization using four sets of process parameters. Each of these powders was then characterized by microscopy and classified by screening to obtain 45 to 106 micron particles and added incrementally from 0 to 10 wt% to the other constituents of the PS304 feedstock, namely nichrome, chromia, and silver powders. The relationship between feedstock flow rate, measured with the Hall flowmeter, and concentration of fluorides was found to be linear in each case. The slopes of the lines were between those of the linear relationships previously reported using angular and spherical fluorides and were closer to the relationship predicted using the rule of mixtures. The results offer a fluoride fabrication technique potentially more cost-effective than gas atomization processes or traditional comminution processes.

Author

Coating; Lubrication; Solid Lubricants; Powder (Particles); Barium Fluorides; Calcium Fluorides; Flow Characteristics; Water

20030019249 University of Southern California, Loker Hydrocarbon Research Inst., Los Angeles, CA USA

Triphenylmethyl difluoramine: A Stable Reagent for the Synthesis of gem-Bis(difluoramines)

Prakash, G. K.; Etkorn, Markus; Olah, George A.; Christe, Karl O.; Schneider, Stefan; Apr. 29, 2002; 4p; In English

Contract(s)/Grant(s): F04611-99-C-0025; AF Proj. 1011

Report No.(s): AD-A409564; AFRL-PR-ED-TP-2002-088; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The conversion of ketones into geminal bis(difluoramines) can be achieved under mild two phase reaction conditions by employing triphenylmethyl difluoramine as an in situ source of difluoramine.

DTIC

Synthesis (Chemistry); Nitramine Propellants; Triphenyls

24

COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20030018972 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Effects on Processing by Drop-In Modifiers in Nano-Composite Polymers

Ruth, Patrick; Viers, Brent; Blanski, Rusty; Lee, Andre; Feb. 21, 2002; 8p; In English

Report No.(s): AD-A410033; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

One of the greatest barriers in transitioning new or altered polymers to commercial application is the cost of new equipment for processing or the cost of developing parameters for the new material. One solution is developing 'drop-in' modifiers that alter the properties of presently used materials without altering the processing parameters or requiring exotic equipment. Over the last

decade the Air Force Research Laboratory has studied how the Polyhedral Oligomeric Silsesquioxanes (POSS) can be incorporated as blendables in industrial polymers like polypropylene to improve properties without sacrificing the ease of processing. This talk will detail the processing method (drying, blending, extruding and molding) of Octamethyl POSSI polypropylene nanocomposites. The degree of compatibility was established with visual methods.

DTIC

Polymers; Nanocomposites

20030018986 Air Force Research Lab., Edwards AFB, CA USA

Investigating the Strain Rate Effect on the Critical Inherent Initial Crack Size in a Particulate Composite Material

Liu, C. T.; Yang, J. N.; May 22, 2002; 15p; In English; Pres: 4th International Conf. on Statistical Mechanics, 9-13 Jun 2002, Corfu, Greece. Viewgraphs only

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A409613; AFRL-PR-ED-VG-2002-125; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The presentation slides for the investigating the Strain Rate Effect on the Critical Inherent Initial Crack Size in a Particulate Composite Material are presented.

DTIC

Composite Materials; Cracks

20030019051 Air Force Research Lab., Edwards AFB, CA USA

Metal Matrix Composites for Liquid Rocket Engines

Shelley, J. S.; LeClaire, R.; Nichols, J.; Jan. 25, 2001; 16p; In English

Report No.(s): AD-A410056; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article presents an overview of current research and material requirements for Metal Matrix Composite (MMC) technologies being developed for application to Liquid Rocket Engines (LRE). Developments in LRE technology for the US Air Force are being tracked and planned through the Integrated High Payoff Rocket Propulsion Technologies Program (IHRPT). Current efforts and research requirements for three types of MMC systems are discussed: Aluminum, Copper and Nickel matrix material systems. Potential applications include turbopump housings, rotating machinery and high stiffness flanges and duct work, DTIC

Liquid Propellant Rocket Engines; Metal Matrix Composites; Technology Utilization; Mechanical Properties; General Overviews

20030019053 Air Force Research Lab., Edwards AFB, CA USA

Investigating the Effects of Confining Pressure on Cumulative Damage and the Constitutive Behavior of a Particulate Composite Material

Nov. 01, 2002; 3p; In English

Report No.(s): AD-A410067; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

No abstract.

DTIC

Composite Materials; Cumulative Damage; Particulates; Pressure Effects; Mechanical Properties; Polymers

20030019211 Air Force Research Lab., Edwards AFB, CA USA

Investigating the Effects of Specimen Thickness and Pressure on the Crack Growth Behavior of a Particulate Composite Material

Liu, C. T.; Jan. 22, 2002; 14p; In English

Report No.(s): AD-A409844; AFRL-PR-ED-TP-2002-010; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this study, the effects of specimen thickness and confined pressure on the crack growth behavior in a particulate composite material, containing hard particles embedded in a rubber matrix, were investigated. The experimental data were analyzed and the results are discussed. An important engineering problem in structural design is evaluating structural integrity and reliability. It is well known that structural strength may be degraded during its design life due to mechanical or chemical aging, or a combination of these two aging mechanisms. Depending on the structural design, material type, service loading, and environmental condition, the pause and degree of strength degradation due to the different aging mechanisms differs. One of the common causes of strength degradation is the result of crack development in the structure. When cracks occur, the effects of crack sizes and the rate of growth on the fracture resistance of the material need to be investigated. In recent years, a considerable amount of work has been done studying crack growth behavior in particulate composite materials under different loading conditions at ambient pressure. This

work was based on linear fracture mechanics. The principles of classical fracture mechanics are well established for single-phase materials. However, experimental evidence indicates that linear fracture mechanics theories have been applied to particulate composite materials with varying degrees of success. In this study, pre-cracked specimens were used to study crack growth behavior in a particulate composite material, containing hard particles embedded in a rubbery matrix, under a constant strain rate condition at ambient and 8697 KPa confined pressure. The effects of specimen thickness and pressure on crack growth behavior was investigated and the results are discussed.

DTIC

Composite Materials; Crack Propagation; Particulates; Structural Reliability

20030019466 State Univ. of New York, Dept. of Materials Science and Engineering, Stony Brook, NY USA

Instrumentation to Facilitate High Protection Materials Synthesis and Analysis with an Existing Ti-Sapphire Femtosecond Laser Final Report, 1 Mar. 2001-31 May 2002

Clayton, Clive R.; Oct. 31, 2002; 7p; In English

Contract(s)/Grant(s): F49620-01-1-0223; Proj-3484

Report No.(s): AD-A409725; AFRL-SR-AR-TR-02-0432; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have designed and built a high precision computer controlled materials synthesis and analysis vacuum apparatus which will enable state-of-the-art control for both micro-machining and inspection as well as thin film synthesis when interfaced to our University's Ti-sapphire femtosecond laser. The majority of the machining of this apparatus had to be performed at a company who has had difficulties with meeting schedules due to probable downsizing issues. This has left our project seriously behind schedule and thus only now could the final report be written and issued. The apparatus consists of a high precision goniometer on which the laser target is held on to a motorized x-y stage. The target is able to rotate precisely to one of two quartz windows through which two ultra-high accuracy triangulating laser sensors are used to measure surface details to sub-micron precision regardless of the optical condition of the surface (diffuse or specular). The ability to precisely raster the target during ablation has dual use. In the case of synthesizing thin films, the rastering prevents cone formation in the target and thus improves film quality. When ablation is used for removal of layer from a sample such as paint or conversion coating, in preparation of further surface analysis, the rastering facilitates making a suitable window through the layer. Additionally, duplex-layered electrodes may be formed by combining synthesis and micro-machining so as to expose both layers during electrochemical analysis. The apparatus has been designed by us to meet the need for such a system at reasonable cost and because no such system to our knowledge was available on the market.

DTIC

Composite Materials; Analytical Chemistry; Electrochemistry; Sapphire; Numerical Control; Synthesis (Chemistry)

20030019863 Aerospace Corp., Lab. Operations, El Segundo, CA USA

Burst Testing of Filament-Wound Graphite-Epoxy Composite Cylindrical Tubes

Chang, D. J.; Katzman, H. A.; Nokes, J. P.; Adams, P. M.; Amimoto, S. T.; Nov. 01, 2002; 80p; In English; Original contains color images

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A410130; TR-2001(1413)-3; SMC-TR-03-05; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An experimental and analytical program was performed to elucidate the failure process of filament-wound graphite-epoxy tubes, especially the effects of wrinkled fibers and of proof testing on tube burst strength. Four types of tubes were tested: those free of flaws, those with a minor or severe helical wrinkle, and those with a hoop wrinkle. Tests included pressurization to burst, and single or multiple proof tests followed by burst. Data collection included burst pressure, acoustic emission events and energies, axial and hoop strains, and location of failure initiation. Tension and torsion tests were performed to determine Young's and shear moduli. Two optical techniques, shadow Moire and speckle interferometry, were adapted to investigate deformation modes of the tubes. Three types of analysis were performed: composite laminate theory, Weibull analysis of tube strength data, and finite-element analysis of stress distributions near wrinkles. Hoop wrinkles caused an average reduction in burst pressure of 14%; severe helical wrinkles caused an average reduction of 8%. Minor helical wrinkles had no effect. Proof pressures up to ^95% of burst and number of proof testing cycles had no noticeable effect on the average ultimate burst pressures of the tubes.

DTIC

Composite Materials; Stress Analysis; Stress Distribution; Graphite-Epoxy Composites

20030019870 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Near-Tip Behavior in a Particulate Composite Material Under Constant Strain Rate Including Temperature and Thickness Effects

Liu, C. T.; Smith, C. W.; Jan. 30, 2001; 8p; In English

Contract(s)/Grant(s): AF Proj. 2302

Report No.(s): AD-A410144; AFRL-PR-ED-TP-2001-032; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A series of tensile tests were conducted at a constant cross head speed (2.54 mm/min) and three temperatures (-53.9 C, 22.2 C, and 73.9 C) on edge cracked sheet specimens of two thicknesses (2.54 mm and 12.7 mm). The specimens were made from polybutadiene rubber embedded with hard particles. The effects of temperature and specimen thickness on local behavior and strain fields near the crack tip were investigated and the results are discussed.

DTIC

Composite Materials; Tensile Properties; Strain Rate; Temperature Effects; Thickness

20030019889 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Investigating the Strain Rate Effect on the Equivalent Initial Crack Size in a Particulate Composite Material

Liu, C. T.; Yang, J. N.; Mar. 06, 2002; 11p; In English; Prepared in collaboration with Univ. of California, Irvine, CA. Pres. at Intl. Conf. on Computational Stochastic Mechanics (4th). Held in Corfu, Greece, 9-12 Jun 2002

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A409852; AFRL-PR-ED-TP-2002-047; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this study, the effect of strain rate on the equivalent initial crack size in a particulate composite material is investigated. The results of analyses indicate that the equivalent initial crack length is insensitive to the strain rate and it follows the second asymptotic distribution of maximum values.

DTIC

Cracks; Strain Rate

25

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also 34 Fluid Dynamics and Thermodynamics, For astrochemistry see category 90 Astrophysics.

20030018918 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Singlet Delta Oxygen Production from a Gas-Solid Reaction

Alfano, Angelo; Christe, Karl; May 09, 2002; 3p; In English; Presented at AFOSR Molecular Dynamics Conference in Boston, MA, 20 May 2002

Contract(s)/Grant(s): F04611-99-C-0025; Proj-1011

Report No.(s): AD-A409617; AFRL-PR-ED-AB-2002-108; No Copyright; Avail: Defense Technical Information Center (DTIC)

Spontaneous reactions between alkali metal or alkaline earth peroxides and hydrogen (deuterium) halide gases demonstrate the efficient production of singlet delta oxygen in a non-liquid medium. These reactions occur under ambient conditions without the need for any external energy source. The production of singlet delta oxygen was verified by direct emission spectroscopy at 1.27 microns with a calibrated optical multichannel analyzer. These reactions overcome the severe quenching problems encountered in liquid-phase reactions and the dangers/inconvenience associated with the use of basic hydrogen peroxide for the chemical oxygen iodine laser (COIL).

DTIC

Oxygen; Alkali Metals; Oxygen Production; Hydrogen Peroxide; Gas-Solid Interactions

20030018927 NASA Ames Research Center, Moffett Field, CA USA

First Principle Predictions of Isotopic Shifts in H₂O

Schwenke, David W., NASA Ames Research Center, USA; Dec. 20, 2002; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We compute isotope independent first and second order corrections to the Born-Oppenheimer approximation for water and use them to predict isotopic shifts. For the diagonal correction, we use icMRCI wavefunctions and derivatives with respect to mass dependent, internal coordinates to generate the mass independent correction functions. For the non-adiabatic correction, we use

scaled SCF/CIS wave functions and a generalization of the Handy method to obtain mass independent correction functions. We find that including the non-adiabatic correction gives significantly improved results compared to just including the diagonal correction when the Born-Oppenheimer potential energy surface is optimized for H₂O-16. The agreement with experimental results for deuterium and tritium containing isotopes is nearly as good as our best empirical correction, however, the present correction is expected to be more reliable for higher, uncharacterized levels.

Author

Isotopes; Wave Functions; Born-Oppenheimer Approximation; Correction; Potential Energy

20030018940 Air Force Research Lab., Edwards AFB, CA USA

Chemistry and Spectroscopy in Solid Parahydrogen

Fajardo, Mario E.; Apr. 2001; 39p; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A409586; AFRL-PR-ED-VG-2001-078; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Discussed in this report are cryosolid propellants team, HEDM cryosolid Propellants concept (atoms in solid hydrogen), rapid vapor deposition of transparent parahydrogen (pH₂) solids, B and A1 doped pH₂ solids, high resolution IR spectroscopy of molecular dopants in solid pH₂ and a summary.

DTIC

Chemistry; Infrared Spectroscopy; Solid Cryogen; Para Hydrogen; Hydrogen Atoms

20030018980 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Model Polyhedral Oligomeric Silsesquioxane Thin Films for Coating Applications

Viers, Brent; Phillips, Shawn; Haddad, Timothy; Esker, Alan; Polidan, Joe; Feb. 21, 2002; 11p; In English

Report No.(s): AD-A410044; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The possibility of forming Polyhedral Oligomeric Silsesquioxanes (POSS) based coatings is considered. Surfactant POSS molecules (containing hydrophilic silanol 'head' groups and hydrophobic organic coronas) are spread on water in a Langmuir Blodgett apparatus and the surface pressure-area relationships are determined and correlated to the structure of the POSS surfactant. Langmuir-Blodgett transfer of surfactant POSS onto silicon substrates is considered as a model 'dip coat' application; however, POSS monolayers do not appear to be sufficiently stable to undergo Langmuir Blodgett transfer. The thin film stability is discussed.

DTIC

Thin Films; Substrates; Polyhedrons; Oligomers

20030018983 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Kinetics of CH Radicals with O₂: Evidence for CO-Chemiluminescence in the Gas Phase Reaction

Vaghjani, Ghanshyam L.; Mar. 19, 2002; 4p; In English; Abstract only. Pres: XXV Informal Conference on Photochemistry, Univ. of Miami, FL, 2-7 Jun 2002

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A410049; AFRL-PR-ED-AB-2002-062; No Copyright; Avail: Defense Technical Information Center (DTIC)

The methylidyne (CH) radical is known to be an important reaction intermediate during the oxidation of hydrocarbon fuels. Its reactivity with combustion species such as O₂, O-atoms, CO₂, N₂, N₂O, NO, NO₂, NH₃ and numerous other hydrogenous, carbonaceous and sulfurous species is well reviewed and compiled in the literature. However, the nature of product branching, energy disposal and its theoretical treatment has been examined in only a few of these reactions; (CH + NO) and (CH + N₂) reactions by far being the most studied systems. Particularly lacking in the literature is information on the production of electronically excited state species. The Air Force Research Laboratory is interested in the methylidyne and the methylene (CH₂) radical reactions with O₂ and O-atoms since they are thought to play an important role in the production of ultraviolet/visible chemiluminescence when rocket plumes interact with the earth's ambient atmosphere.

DTIC

Chemiluminescence; Methylidyne; Excitation

20030018989 University of Southern California, Loker Hydrocarbon Research Inst., Los Angeles, CA USA

Improved Synthesis of CsN₃

Gerken, Michael; Schneider, Stefan; Schroer, Thorsten; Christe, Karl O.; Dec. 17, 2001; 7p; In English; In German

Contract(s)/Grant(s): F04611-99-C-0025; Proj-1011

Report No.(s): AD-A409616; AFRL-PR-ED-TP-2001-240; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Cesium azide can conveniently be prepared from anhydrous CsF and (CH₃)₃SiN₃ in SO₂ solvent in high purity and yield. In this reaction, the initially generated SO₂F(-) anion is converted in SO₂ solvent to solvated azide, (SO₂)_(sub n)N₃(-), which is labile and releases SO₂ under dynamic vacuum yielding pure CsN₃.

DTIC

Cesium Compounds; Sulfur Dioxides; Azides (Inorganic)

20030019043 Jackson (Henry M.) Foundation, Rockville, MD USA

Carcinogenicity and Immunotoxicity of Embedded Depleted Uranium and Heavy-Metal Tungsten Alloy in Rodents Annual Report, 17 Sep. 2001-16 Sep 2002

Miller, Alexandra C.; Kalinich, John F.; McClain, David E.; Oct. 2002; 17p; In English

Contract(s)/Grant(s): DAMD17-01-1-0821

Report No.(s): AD-A409697; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study investigates the carcinogenic and immunotoxic potential of embedded fragments of depleted uranium (DU) and a heavy-metal tungsten alloy (HMTA) to determine if carcinogenicity and immunotoxicity are correlated with tissue-metal content. We hypothesize that long-term chronic exposure to embedded DU and HMTA initiates changes in normal immune function that will eventually result in a carcinogenic response characterized by both tumor formation at the fragment implantation site (solid-state or foreign-body carcinogenesis) and at distant tissue sites ('true' carcinogenesis). To test this hypothesis, male Fischer 344 rats are surgically implanted with pellets of DU or HMTA. Responses in these rats are compared with those from rats implanted with a known carcinogen, nickel, or an inert metal, tantalum. At selected times after implantation, we assess tissue metal content, mutagenicity, and genotoxicity as well as perform tests to assess cell-mediated, humoral, and innate immunity. This report summarizes accomplishments of the project after the first year of work. Year one milestones are met: assays and other systems have been established and standardized, implant pellets and other materials contracted for and obtained, and over 300 rats have undergone pellet implantation surgery.

DTIC

Uranium; Tungsten Alloys; Embedding; Surgery; Carcinogens; Immune Systems; Toxicity; Genes

20030019046 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Investigations of Chemiluminescence in the CH₂ + O Gas Phase Reaction

Vaghjani, Ghanshyam L.; Mar. 16, 2001; 3p; In English; Pres: 37th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, Salt Lake City, UT, 8-11 July 2001. Abstract only

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A410050; AFRL-PR-ED-AB-2001-055; No Copyright; Avail: Defense Technical Information Center (DTIC)

The interactions of carbonaceous combustion species in rocket plumes with the atmosphere are thought to play an important role in the production of ultraviolet, visible, and infrared radiation signatures at high altitudes. A detailed understanding of the pertinent chemical reactions that produce the electronically excited species, and of the competing quenching reactions that remove the internal energy in radiation-less processes is needed to accurately calculate plume spectral signatures and absolute radiances (in the short wavelength region), and their temporal/spatial evolution in the high atmosphere. To facilitate these efforts, we are currently carrying out laboratory investigations to elucidate the reaction mechanism(s) in the oxidation of CH, CH₂, C₂H, and C₂O with O-atoms and O₂.

DTIC

Oxygen; Spectral Signatures; Chemiluminescence; Excitation

20030019195 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Experimental Study and Modeling of the Reaction H + O₂ + M yields HO₂ + M (M = Ar, N₂, H₂O) at Elevated Pressures and Temperatures Between 1050-1250 K

Bates, Ronald W.; Golden, David M.; Hanson, Ronald K.; Bowman, Craig T.; Jan. 25, 2001; 21p; In English; Prepared in collaboration with High Temperature Gasdynamics Laboratory, Department of Mechanical Engineering, Stanford University, CA Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409565; AFRL-PR-ED-TP-2001-024; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The H + O₂ + M yields HO₂ + M reaction was investigated at temperatures between 1050-1250 K and pressures from 7 to 152 bar behind reflected shock waves in gas mixtures of H₂, O₂, NO, and bath gases of Ar, N₂, and H₂O. Narrow linewidth laser absorption of NO₂ at 472.7 nm was used to measure quasi-steady NO₂ concentration plateaus in experiments designed to be sensitive only to the H + O₂ + M yields HO₂ + M and the relatively well-known H + NO₂ yields NO + OH and H + O₂ yields OH + O reaction rates. The pressure dependence of the reaction was studied by measuring the fall-off of the reaction for M = Ar over

a 10-152 bar pressure range. A simple modified Hindered-Gorin model of the transition state is used in an RRKM analysis of the results to facilitate comparisons of this work with measurements from other researchers at lower pressures. The RRKM calculations can also be described, using the simple functional form suggested by Troe, with the following: $k(\infty)/\text{cm}^3 \text{molecule}^{-1} \text{s}^{-1} = 4.7 \times 10^{11} (T/300)^{0.02}$; $k_0(\text{Ar})/\text{cm}^6 \text{molecule}^{-2} \text{s}^{-1} = 2.0 \times 10^{-32} (T/300)^{-1.2}$; $k_0(\text{N}_2)/\text{cm}^6 \text{molecule}^{-2} \text{s}^{-1} = 4.4 \times 10^{-32} (T/300)^{-1.3}$; $k_0(\text{H}_2\text{O})/\text{cm}^6 \text{molecule}^{-2} \text{s}^{-1} = 3.4 \times 10^{-31} (T/300)^{-1.0}$; $F_c = 0.7$ for Ar and N₂ and 0.8 for H₂O. Measured values of the reaction rate for M = Ar in the highest pressure experiments fall below both simple RRKM analysis and the more sophisticated treatment of Troe using an ab initio potential energy surface. Collision efficiencies of N₂ and H₂O relative to Ar at 1200K are 3.3 and 20 respectively.

DTIC

Reaction Kinetics; Hydrogen; Oxygen; Hydroxyl Radicals

20030019199 California Univ., Dept. of Chemistry, Santa Barbara, CA USA

Catalysis by Nanostructures: Methane, Ethylene Oxide, and Propylene Oxide *Final Report, 1 Jun. 2001-31 May 2002*

Metiu, Horia; Dec. 2002; 5p; In English

Contract(s)/Grant(s): F49620-01-1-0379; AF Proj. 3484

Report No.(s): AD-A409509; AFRL-SR-AR-TR-02-0445; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have received funds to purchase a variable-temperature, UHV, STM-AFM system with an UHV analytical chamber. The instrument has been purchased and installed and is now working. Fig. 1 shows the microscope and the UHV analytical chamber. The instrument consists of a chamber with a STM and an AFM microscope. The sample can be cooled in the range 30 K to 1000 K. Pictures can be taken at constant temperature. The sample is mounted on a manipulator that can move it in a UHV chamber where we have: sources for metal vapor deposition (to form clusters on the surface), thermal desorption, ion gun (for sample cleaning by sputtering), Auger spectrometer (to monitor surface composition and cleanliness), gas dosers (to adsorb gases on the surface), and thermal desorption equipment. All these and a variety of peripherals (computers, pumps, gauges, etc) have been purchased with funds from the grant.

DTIC

Catalysis; Vacuum Chambers

20030019207 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Stereoselective Synthesis of Functionalized cis-Hydrindanes from 2-exo-Carbomethoxytricyclo5.2.1.0(2,6)deca-3,8-diene-5-ones

Suri, Suresh C.; Rodgers, Stephen L.; Prakash, G. K.; Apr. 19, 2000; 3p; In English; Prepared in collaboration with Department of Chemistry and Loker Hydrocarbon Research Institute, University of Southern California, Los Angeles, CA. Pres: Pacificchem 2000, Honolulu, HI, 14-19 Dec 2000. Abstract only

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409877; AFRL-PR-ED-AB-2000-074; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Compounds having bicyclo4.3.0nonane (cis-hydrindane) carbon skeleton or embedded as a core unit in their structure are widely distributed in nature. Several synthetic methodologies for cis-hydrindane have been developed while aiming at the synthesis of specific target molecule. The bicyclo4.3.0nonane skeleton is enclosed within tricyclo5.2.1.0(2,6)decane carbon framework. The extraction of a cis-hydrindane carbon skeleton from tricyclo5.2.1.0(2,6)decane (2) carbon framework is very attractive since stereofacial bias inherent in 2 should allow elaboration of the cis-hydrindane 1 with high degree of stereoselectivity. The detailed account for the stereoselective synthesis of functionalized cis-hydrindanes from 2-exo-carbomethoxytricyclo5.2.1.0(2,6)deca-3,8-diene-5-one and its methyl derivatives shall be presented.

DTIC

Carbon Compounds; Synthesis (Chemistry)

20030019232 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Matrix Isolation of Boron and Carbon Vapor. Control of Cluster Formation During Preparation and Annealing

Larson, C. W.; Harper, J.; Presilla-Marquez, J. D.; Mar. 15, 2000; 10p; In English

Report No.(s): AD-A409816; AFRL-PR-ED-TP-2000-048; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The formation and recombination of small boron/carbon clusters were studied by quantitative Fourier transform infrared (FTIR) spectroscopy. Samples were prepared by evaporation of powder mixtures from a resistively heated oven (3000 K) and isolated at 10 K in solid argon C3 and BC2 disappeared entirely over the course of several annealings. Yields of all the larger

clusters (BiC_{nj} , n greater than 4 $J = 0, 1, 2$) increased during annealing. Clusters within greater than 4 are linear, with the boron atoms of the $J = 1$ and 2 clusters capping the ends of carbon chains; $\text{B}(2) \text{C}(n-2)$ cluster are inert.

DTIC

Annealing; Clusters; Boron

20030019319 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

CO-Chemiluminescence in the CH + O Gas Phase Reaction

Vaghjiani, Ghanshyam L.; Mar. 19, 2002; 4p; In English; Pres: 17th International Symposium on Gas Kinetics, Univ. of Essen, Germany, 24-29 Aug 2002. Abstract only

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A409991; AFRL-PR-ED-AB-2002-061; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The methylidyne (CH) radical is known to be an important reaction intermediate during the oxidation of hydrocarbon fuels. Its reactivity with combustion species such as O_2 , O-atoms, CO_2 , N_2 , N_2O , NO, NO_2 , NH_3 and numerous other hydrogenous, carbonaceous and sulfurous species is well reviewed and compiled in the literature. However, the nature of product branching, energy disposal and its theoretical treatment has been examined in only a few of these reactions; (CH + NO) and (CH + N_2) reactions by far being the most studied systems. Particularly lacking in the literature is information on the production of electronically excited state species. The Air Force Research Laboratory is interested in the methylidyne and the methylene (CH_2) radical reactions with O_2 and O-atoms since they are thought to play an important role in the production of ultraviolet/visible chemiluminescence when rocket plumes interact with the earth's ambient atmosphere.

DTIC

Oxygen; Chemiluminescence; Hydrocarbon Fuels; Nitrogen Oxides

20030019326 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Reaction of CH_2 with O-Atoms: A Source for CO-Chemiluminescence

Vaghjiani, Ghanshyam L.; Apr. 13, 2001; 3p; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A409989; AFRL-PR-ED-TP-2001-085; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The interactions of carbonaceous combustion species in rocket plumes with the atmosphere are thought to play an important role in the production of ultraviolet, visible, and infrared radiation signatures at high altitudes. A detailed understanding of the pertinent chemical reactions that produce the electronically excited species, and of the competing quenching reactions that remove the internal energy in radiation-less processes is needed to accurately calculate plume spectral signatures and absolute radiances (in the short wavelength region), and their temporal/spatial evolution in the high atmosphere. To facilitate these efforts, we are currently carrying out laboratory investigations to elucidate the reaction mechanism(s) in the oxidation of CH, CH_2 , C_2H , and C_2O with O-atoms and O_2 .

DTIC

Oxygen; Carbon Monoxide; Chemiluminescence; Methylene

20030019348 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

The Synthesis and Characterization of Methylene Bisoxamine $\text{CH}_2(-\text{O}-\text{NH}_2)_2$ Salts

Tollison, Kerri; Drake, Greg; Hawkins, Tom; Brand, Adam; McKay, Milton; Feb. 14, 2001; 27p; In English; Prepared in cooperation with SRI International, Inc, Menlo Park, CA, and Cordant Technologies/Thiokol Propulsion, Brigham City, UT

Contract(s)/Grant(s): F04611-99-C-0010; Proj-2303

Report No.(s): AD-A409718; AFRL-PR-ED-TP-2001-038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A large family of energetic salts were made using methylene bisoxamine, $\text{CH}_2(-\text{O}-\text{NH}_2)_2$, a dibasic, geminal oxamine of methane. Single salts including the nitrate, perchlorate, dinitramide, and nitroformate, and doubly protonated methylene bisoxamine salts, nitrate, perchlorate and bisdinitramide, were all synthesized in good to high yields, from simple acid-base reactions with the corresponding aci-forms of energetic anions. All of the salts were characterized by vibrational (IR, Raman), multinuclear nmr (^1H , ^{13}C), and DSC studies. The single crystal X-ray diffraction study was carried out on the double perchlorate salt. Initial safety studies (impact and friction), were carried out on most of the new materials, as well as the thermal stability of these salts at 75 deg C.

DTIC

Salts; Methylene

20030019461 University of Southern California, Loker Hydrocarbon Research Inst., Los Angeles, CA USA

Synthesis and Characterization of the First Examples of Perfluoroalkyl Substituted Trialkyl-Oxonium Salts, (CH₃)₂OCHF₃(+)Sb₂F₁₁(-) and (CH₃)₂OCHF(CF₃)₂(+) Sb₂F₁₁(-)

Hegge, Joachim; Hoge, Berthold; Sheehy, Jeffrey A.; Christe, Karl O.; Minkwitz, Rolf; Mar. 16, 2001; 22p; In English; Prepared in cooperation with Anorganische Chemie, Fachbereich Chemie der Universitat Dortmund, Dortmund, Germany and Institut fur Anorganische and Analytische Chemie der Freien Universitat Berlin, Berlin, Germany

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A409720; AFRL-PR-ED-TP-2001-056; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the superacidic HF/SbF₅ system, methyl-trifluoromethylether forms at -78 deg C the new tertiary oxonium salt, (CH₃)₂OCHF₃(+)Sb₂F₁₁(-), that was characterized by Raman and multinuclear NMR spectroscopy and its crystal structure. The same oxonium salt was also obtained by methylation of CH₃OCHF₃ with CH₃F and SbF₅ in HF solution at -30 to -10 deg C. Replacement of one methyl group in the trimethyloxonium cation by the bulkier and more electronegative trifluoromethyl group increases the remaining O-CH₃ bond lengths by 3.7(1) pm and the sum of the C-O-C bond angles by about 4.5 deg. Methylation of CH₃OCHF(CF₃)₂ with CH₃F and SbF₅ in HF solution at -30 deg C in HF solution produces (CH₃)₂OCHF(CF₃)₂(+)Sb₂F₁₁(-). The observed structures and vibrational and NMR spectra are confirmed by theoretical studies at the B3LYP/6-31 1++G(2d, 2p) and the MP2/6-31 1++G(2d,p) levels.

DTIC

Salts; Antimony Compounds; Alkyl Compounds; Fluorine Organic Compounds

20030019462 University of Southern California, Loker Hydrocarbon Research Inst., Los Angeles, CA USA

Polynitrogen Chemistry, Synthesis, Characterization, and Crystal Structure of Surprisingly Stable Fluoroantimonate Salts of N₅(+)

Vij, Ashwani; Wilson, William W.; Vij, Vandana; Tham, Fook S.; Christe, Karl O.; Mar. 01, 2001; 48p; In English; Prepared in cooperation with Department of Chemistry, University of Southern California, Los Angeles, CA and Department of Chemistry, University of California, Riverside, CA

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A409721; AFRL-PR-ED-TP-2001-042; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The new N₅(+) salt, N₅(+)SbF₆(-), was prepared from N₂F₄(+)SbF₆(-) and HN₃ in anhydrous HF solution. The white solid is surprisingly stable, decomposing only at 70 deg C, and is relatively insensitive to impact. Its vibrational spectrum exhibits all nine fundamentals with frequencies that are in excellent agreement with the theoretical calculations for a five-atomic V-shaped ion of C_{2v} symmetry. The N₅(+)Sb₂F₁₁(-) salt was also prepared and its crystal structure was determined. The geometry previously predicted for free gaseous N₅(+) from theoretical calculations was confirmed within experimental error. The Sb₂F₁₁(-) anions exhibit an unusual geometry with eclipsed SbF₄ groups due to inter-ionic bridging with the N₅(+) cations. The N₅(+) cation is a powerful one-electron oxidizer. Its electron affinity falls between 11.0 and 12.08 eV because it readily oxidizes NO to NO(+) and NO₂ to NO₂ but fails to oxidize Xe or O₂.

DTIC

Salts; Antimony Compounds; Electron Affinity; Stability

20030019488 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

The Synthesis and Characterization of New Energetic Salts

Drake, Greg; Tollison, Kerri; Hawkins, Tom; Brand, Adam; McKay, Milton; Oct. 30, 2000; 5p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409798; AFRL-PR-ED-AB-2000-215; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

Presently, hydrazine is the state of the art in many attitude control devices on many currently used satellite systems. The physical properties of hydrazine, namely its density and high vapor pressure, have led several research groups to search for new superior materials. In the late 1980s and through most of the 1990s significant amounts of work were placed on two low melting salts, hydroxylammonium nitrate (HAN), and hydroxylammonium dinitramide (HADN). These two salts have from 60-70% density increase over that of hydrazine and when formulated with various fuels, make for energetic propellant materials. Unfortunately, hydroxylammonium nitrate and dinitramide salts have many safety, compatibility, storage, and ignition problems. At the Air Force Research Laboratory, we have been pursuing the synthesis and characterization of new energetic salts, as new monopropellant ingredients. Herein, we will discuss our synthetic work with a new large array of energetic salts based on high nitrogen, 1, 2, 4-triazoles, and on the very energetic 1, 2-bis(oxyamino)ethane. This discussion will include the synthesis, characterization, initial small scale safety testing (impact and friction), and some initial thermal stability studies of all these salts. It was realized that there are several, easily synthesized, nitrogen heterocycles that could be paired with anions including the

nitrate, perchlorate, and dinitramide anions to form highly energetic salts. The four heterocycle systems are 1,2,4-triazole; 4-amino-1,2,4-triazole; 3,4,5-triamino-1,2,4-triazole; and 1,2,3-triazole (Figure 1). All of these heterocycles are either commercially available or are easily synthesized in high yield from inexpensive starting materials, and all have high heats of formation.

DTIC

Hydrazines; Synthesis (Chemistry); Salts; Ammonium Compounds; Azoles; Satellite Attitude Control; Rocket Propellants

20030019685 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Matrix Isolation of Boron and Carbon Vapor: Control of Cluster Formation during Preparation and Annealing

Presilla-Marquez, J. D.; Harper, J.; Larson, C. W.; Mar. 15, 2000; 18p; In English; Presented the Intl IUPAC Conf. on High Temperature Materials Chemistry (10th) held in Juelich, Germany on 10-14 Apr. 2000

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409803; AFRL-PR-ED-TP-2000-049; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No abstract available.

Author

Annealing; Boron Carbides; Kinetics; Molecular Clusters

20030019694 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Quantitative Analysis of the Condensation of B_jC_n -j Clusters ($n = 2-12$, $J = 0,1,2$) in Solid Argon

Harper, J.; Sheehy, J. A.; Mills, J. D.; Larson, C. W.; May 22, 1998; 15p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409815; AFRL-PR-ED-TP-1998-095; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No abstract available.

Author

Quantitative Analysis; Solidified Gases

20030019872 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Investigations of Chemiluminescence in the $CH_2 + O$ Gas Phase Reaction

Vaghjiani, Ghanshyam L.; Jul. 2001; 16p; In English

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A410150; AFRL-PR-ED-TP-2001-153; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The reaction of ketene (C_2H_2O) in a known excess of O-atoms was studied in a discharge flow-tube apparatus. Characteristic CO-chemiluminescence was observed in the range 130-900 nm. The rate coefficient for this reaction was determined to be $(6.82 \pm 1.02) \times 10^{-13}$ cm³/molec. s at 295 K by recording the relative strength of the steady-state 216-nm Cameron emission as a function of the reaction length in the flow-tube. The band structure of the emission spectrum recorded suggests that the subsequent very rapid reaction of O-atoms with the product C₂O and possibly with CH₂ that are formed in the initial $C_2H_2O + O$ oxidation lead to the observed radiation. 351-nm pulsed laser photolysis of the unreacted ketene in the detection volume of the apparatus resulted in transient enhancements of the CO-chemiluminescence. The time behavior of these emissions and their dependence on the laser fluence employed was consistent with the photolytic production of CH₂ and also C₂O, respectively, due to 1-photon and 2-photon absorption of the 351-nm laser radiation by the ketene. Strong OH(A) emission was also seen in these experiments when excess O₂ was present. The reaction of CH with O₂ is responsible for this emission. The principal source for CH in our system is thought to be the $CH_2 + O$ reaction.

DTIC

Reaction Kinetics; Oxygen; Chemiluminescence; Ketenes

20030020391 Worcester Polytechnic Inst., Dept. of Mechanical Engineering, MA USA

Evaluation of the Microgravity Ignition Experiment Prepared for the GASCAN II Project

Duckworth, James, Worcester Polytechnic Inst., USA; Motevalli, Vahid, Worcester Polytechnic Inst., USA; Smith, Richard, Worcester Polytechnic Inst., USA; Johnson, Timothy, Worcester Polytechnic Inst., USA; Parker, Richard E., Worcester Polytechnic Inst., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 490-495; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

As flight durations increase, the risk of occurrence of fires also increases. It is important to better understand the physics of a fire in a microgravity environment so that the fire can be detected and suppressed as quickly as possible. The Microgravity

Ignition Experiment is designed to answer fundamental questions regarding time to ignition. The purpose of this project was to perform ground-based testing of the prototype version of the Microgravity Ignition experiment chamber and finalize the electrical and mechanical design of the experiment. A preflight procedure has been developed for preparation of the experiment for launch, assembly, and final check. Finally, the combustion chambers have been constructed and will be assembled. Any modifications of the procedure or instrumentation based on results of the prototype testing will be implemented. The current experiment consists of exposing a sample of alpha-cellulose paper to a radiant flux and measuring the changes in ambient temperature and pressure in the chamber and the rise in fuel temperature. The ground based experiments in 1-g have resulted in ignition occurring within approximately thirteen seconds. In microgravity, it is anticipated that the two competing mechanisms of increasing surface temperatures and reduced oxygen near the fuel surface, both caused by reduced convective flows, will significantly change the time to ignition.

Author

Microgravity; Fires; Temperature Measurement; Surface Temperature; Ignition; Experiment Design

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METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20030019203 Academy of Sciences, Inst. for Metals Superplasticity Problems, Ufa Russia

Processing of Submicron-Grained Billets of Ti-6Al-4V Titanium Alloy by Multiple Forging *Final Report, 1 Sep. 2001-31 Aug. 2002*

Salishchev, Gennady; Sep. 23, 2002; 54p; In English

Report No.(s): AD-A409894; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report results from a contract tasking the Institute for Metals Superplasticity Problems as follows: The project will study sub-microcrystalline structure formation in a Ti-6Al-4V titanium alloy during large plastic deformation by multiple isothermal forging; and to produce large (diameter up to 200mm) billets with homogeneous microstructure and a grain size of no more than 0.5 microns. The results of the project will establish the connection between microstructural changes resulting in the formation of a sub-microcrystalline structure and resulting mechanical behavior in a Ti-6Al-4V alloy during large plastic deformation at temperatures about half the melting temperature and reveal whether dynamic recrystallization is the pertinent metallurgical process. The influence of temperature and rate of deformation as well as the initial microstructure (grain size, phase volume fraction, thickness of plates of α and β -phases) on the kinetics of structure formation, its uniformity, and mechanical properties will be shown. The influence of initial microstructure on cavitation and workability will also be determined. Based on the experimental studies, computer modeling of multi-step isothermal forging in a special die set unit will also be conducted. Optimum routes of multiple isothermal forging in the special die set will be determined.

DTIC

Microstructure; Forging; Titanium Alloys

20030019248 Ohio State Univ., Columbus, OH USA

Atomic-Scale Modeling of the Structure and Dynamics of Dislocations in Complex Alloys at High Temperatures *Interim Report*

Daw, Murray S., Clemson Univ., USA; Mills, Michael J., Ohio State Univ., USA; February 2003; 12p; In English

Contract(s)/Grant(s): NAG3-2675; RTOP 708-87-23

Report No.(s): NASA/CR-2003-212122; NAS 1.26:212122; E-13774; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on the progress made during the first year of the project. Most of the progress at this point has been on the theoretical and computational side. Here are the highlights: (1) A new code, tailored for high-end desktop computing, now combines modern Accelerated Dynamics (AD) with the well-tested Embedded Atom Method (EAM); (2) The new Accelerated Dynamics allows the study of relatively slow, thermally-activated processes, such as diffusion, which are much too slow for traditional Molecular Dynamics; (3) We have benchmarked the new AD code on a rather simple and well-known process: vacancy diffusion in copper; and (4) We have begun application of the AD code to the diffusion of vacancies in ordered intermetallics.

Author

Atomic Structure; Models; Kinetic Energy; Monte Carlo Method; Acceleration (Physics); Embedded Atom Method

20030019263 Positron Systems, Inc., Boise , ID USA

Corrosion-Induced Fatigue Measurements on 2024 and 7075 Aluminum Using Photon-Induced Positron Annihilation (PIPA) Final Report, 1 Apr.-1 Nov. 2002

Akers, D. W.; Dec. 2002; 43p; In English; Original contains color images

Contract(s)/Grant(s): F33615-02-M-3203; Proj-3005

Report No.(s): AD-A409601; AFRL-VA-WP-TR-2003-3003; No Copyright; Avail: Defense Technical Information Center (DTIC)

Corrosion-related fatigue damage in aerospace platforms is a significant problem for military aircraft, which, in many cases, are over 20 years old and have projected lifetimes up to 40 years. Specific problems include multilayer corrosion damage in aircraft lap slices that result in cracking at fastener holes and rapid crack growth. A new nondestructive examination technique, photon-induced positron annihilation (PIPA), has demonstrated the capability to detect and quantify various types of atomic lattice structure damage, including fatigue, creep, and other mechanisms. The purpose of this project is to evaluate the PIPA technology to assess the effects of relatively low levels of corrosion on early fatigue damage, and to provide an approach for incorporating data of this type into developing confidence levels for CBM reliability models. Specimens of 2024-T3 and 7075-T6 aluminum were subjected to salt spray corrosion for periods up to 96 hours and then subjected to fatigue testing to determine the effects of the corrosion on the fatigue response for these types of aluminum, which have different corrosion characteristics. PIPA results from this study indicate that corrosion-related fatigue damage is detectable at relatively low fatigue levels (is less than 10% of failure) and that damage to the inside surface of the aluminum specimens is also detectable.

DTIC

Corrosion; Aluminum Alloys; Fatigue (Materials); Fatigue Tests

20030019268 Wisconsin Univ., Madison, WI USA

Phase Stability in Ultra-High Temperature Refractory Metal Alloys and Coatings Final Report, 1 Apr. 2001-31 Mar. 2002

Perepezko, John H.; Dec. 12, 2002; 19p; In English

Contract(s)/Grant(s): F49620-01-1-0296

Report No.(s): AD-A409935; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The experimental determination of phase stability in very high temperature refractory metal (RM) base alloys such as those in the Mo-Si-B system and the evaluation of thermal barrier and oxidation resistant coatings for these systems requires very high temperature annealing furnaces with long term capability to 2400 degrees C under vacuum and inert atmosphere conditions. Moreover, in order to establish quantitative phase stability data for key phase reactions and to evaluate fully the kinetics of coating reactions, the acquisition of a very high temperature DTA/TGA system represents a critical experimental capability. With an effective phase stability model, data from measurements at a few temperatures may be extrapolated over a wide range of temperature and the influence of additional alloying components may be assessed effectively in order to enable the computational design of optimal alloy and coating constitution for high temperature performance. The combination of a very high temperature annealing facility and a high temperature DTA/TGA system represents a powerful and very effective enhancement of the experimental capabilities that are necessary in order to complete the current studies and provides an essential base for continued evaluation of very high temperature materials systems for structural applications. Both components of the high temperature analysis facility have been purchased under the grant. The facilities are being installed and tested and will be utilized also in educational developments for class projects and for the training of undergraduate and graduate students in the evaluation of ultrahigh temperature phase stability and coating reactions in structural materials.

DTIC

High Temperature; Metal Coatings; Refractory Metal Alloys; Phase Stability (Materials); Thermogravimetry

20030019756 NASA Glenn Research Center, Cleveland, OH USA

Specimen Designs for Testing Advanced Aeropropulsion Materials Under In-Plane Biaxial Loading

Ellis, John R., NASA Glenn Research Center, USA; Abul-Aziz, Ali, Cleveland State Univ., USA; January 2003; 69p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 708-31-19

Report No.(s): NASA/TM-2003-212090; E-13362; NAS 1.15:212090; Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A design study was undertaken to develop specimen designs for testing advanced aeropropulsion materials under in-plane biaxial loading. The focus of initial work was on developing a specimen design suitable for deformation and strength tests to be conducted under monotonic loading. The type of loading initially assumed in this study was the special case of equibiaxial, tensile loading. A specimen design was successfully developed after a lengthy design and optimization process with overall dimensions

of 12 by 12 by 0.625 in., and a gage area of 3.875 by 3.875 by 0.080 in. Subsequently, the scope of the work was extended to include the development of a second design tailored for tests involving cyclic loading. A specimen design suitably tailored to meet these requirements was successfully developed with overall dimensions of 12 by 12 by 0.500 in. and a gage area of 2.375 by 2.375 by 0.050 in. Finally, an investigation was made to determine whether the specimen designs developed in this study for equibiaxial, tensile loading could be used without modification to investigate general forms of biaxial loading. For best results, it was concluded that specimen designs need to be optimized and tailored to meet the specific loading requirements of individual research programs.

Author

Aerodynamic Loads; Structural Design Criteria; Loads (Forces); Stress Cycles; Fatigue (Materials); Stress Analysis; Aircraft Models; Materials Selection

20030019763 Naval Air Warfare Center, Weapons Div., China Lake, CA USA

Characterization of Nanometer- to Micron-Sized Aluminum Powders by Thermogravimetric Analysis

Johnson, Curtis E.; Fallis, Stephen; Groshens, Thomas J.; Higa, Kelvin T.; Ismail, Ismail M.; Jul. 24, 2000; 29p; In English
Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409796; AFRL-PR-ED-TP-2000-155; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The reactivity of aluminum powders was studied by thermogravimetric analysis in air, oxygen, and nitrogen. Weight gains from complete oxidation of the aluminum were used to calculate particle sizes in the range of 30 nm to 500 nm. These particle sizes correlated well with particle sizes derived from surface area measurement. Particle size was also examined by scanning electron microscopy and atomic force microscopy, and compared to crystallite size determined by x-ray diffraction. Weight gains from complete oxidation were also used to determine the amount of active metal and aluminum oxide present in the submicron powders. Nitridation of aluminum powders was studied for extended times at 600 deg C. A 2 micrometer powder was nearly completely nitrided in 1 h, indicating that the nitride product has little inhibiting effect on the reaction.

DTIC

Aluminum Oxides; Powdered Aluminum; Thermogravimetry; Nanostructure (Characteristics); Nanoparticles; Fineness; Nitriding; Scanning Tunneling Microscopy

27

NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

20030018973 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Hybrid Inorganic/Organic Reactive Polymers for Severe Environment Protection

Phillips, Shawn H.; Gonzalez, Rene I.; Blanski, Rusty L.; Viers, Brent D.; Hoflund, Gar B.; Feb. 21, 2002; 11p; In English
Report No.(s): AD-A410034; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Leading-edge, fundamental research in polymer technology is often directed towards those applications requiring dramatic improvements in temperature or oxidation resistance. While non-reactive polymers systems are often desired, many benefits can be realized by utilizing inorganic, reactive molecules within the polymer matrix. In such systems, a sacrificial layer of the hybrid polymer is destroyed until passivation occurs. Over the last decade the Air Force Research Laboratory has studied how the incorporation of Polyhedral Oligomeric Silsesquioxanes (POSS), which are nanostructured chemicals, can be used for protective coatings in oxygen rich environments. This talk will detail the strategy employed for using sacrificial nanocomposites along with applied research in the areas of solid rocket motor insulation and space-survivable materials.

DTIC

Polymers; Polyhedrons; Oligomers; Nanocomposites; Oxygen Atoms

20030018976 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

High Temperature Lubricants Based on Polyhedral Oligomeric Silsesquioxanes (POSS)

Blanski, Rusy; Leland, Justin; Viers, Brent; Phillips, Shawn H.; Feb. 21, 2002; 7p; In English
Report No.(s): AD-A410038; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Lubricants that operate at high temperature can be useful for high performance jet turbines. The challenges that have to be overcome for high performance turbines are two fold. The first challenge is increasing the operating temperature of the system while the second challenge is maintaining low temperature pumpability. We have been investigating the use of POSS compounds

for lubrication applications because of its proven high temperature stability and its access to a diverse array of silsesquioxane geometries that may be amenable to low temperature pumpability. Consequently, a wide array of POSS alkyls were synthesized and tested for temperature stability and viscosity profiles. The synthesis of these POSS alkyls as well as the relevant temperature and viscosity data will be discussed.

DTIC

Synthesis (Chemistry); Lubricants; Polyhedrons; Oligomers

20030019047 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

High Temperature Lubricants Based on Polyhedral Oligomeric Silsesquioxanes (POSS)

Blanski, Rusty; Leland, Justin; Viers, Brent; Phillips, Shawn; Dec. 17, 2001; 3p; In English; Pres: SAMPE Industry Conference, 12-15 May 2002. Prepared in collaboration with Engineering Research and Consulting Inc., Edwards AFB, CA 92523. Abstract only

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A410051; AFRL-PR-ED-AB-2001-242; No Copyright; Avail: Defense Technical Information Center (DTIC)

Lubricants that operate at high temperature can be useful for high performance jet turbines. The challenges that have to be overcome for high performance turbines are two fold. The first challenge is increasing the operating temperature of the system while the second challenge is maintaining low temperature pumpability. We have been investigating the use of POSS compounds for lubrication applications because of its proven high temperature stability and its access to a diverse array of silsesquioxane geometries that may be amenable to low temperature pumpability. Consequently a wide array of POSS alkyls were synthesized and tested for temperature stability and viscosity profiles. The synthesis of these POSS alkyls as well as the relevant temperature and viscosity data will be discussed.

DTIC

High Temperature Lubricants; Polyhedrons; Oligomers

20030019048 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Organic Polymers Modified with Inorganic Polyhedra

Haddad, Timothy S.; Viers, Brent D.; May 08, 2002; 29p; In English

Report No.(s): AD-A410052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nanostructured composites of thermoplastics and inorganic clusters have been developed by incorporating polyhedral oligomeric silsesquioxane (POSS) macromers into organic polymers. These hybrid inorganic/organic thermoplastics based on styrenes, acrylics, imides, norbornenes or siloxanes, are reinforced by covalently linking monodisperse inorganic POSS clusters to the polymer backbone. A typical POSS-macromer, R7P(SisO12), is a well-defined octomeric polyhedron containing a single "P" functionality for polymerization and seven "R11" groups to solubilize and compatibilize the inorganic filler with the organic matrix. A nanoreinforcement effect from the POSS groups is strongly influenced by the seven "R" groups (cyclopentyl, cyclohexyl, isobutyl or phenyl). Covalently attached POSS groups result in significant change to the observed characteristic relaxation time of the polymer; rheological measurements on molten polymer indicate that interactions between the POSS groups generate a reversible network material with rubbery properties. TEM images show that the inorganic POSS moieties associate to form a nanoscale network within the polymer matrix.

DTIC

Organic Materials; Inorganic Materials; Polymer Matrix Composites

20030019064 Academy of Sciences of the Ukraine, Kiev Inst. of Materials Science Problems, Ukraine

Science for Materials in the Frontier of Centuries: Advantages and Challenges, Volume 2

Nov. 2002; 441p; In English

Contract(s)/Grant(s): F61775-02-WF042

Report No.(s): AD-A410104; EOARD-CSP-02-5042; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

The Final Proceedings for Science for Materials in the Frontier of Centuries: Advantages and Challenges, 4 Nov 02-8 Nov 02. I. Fundamental problems of materials science including phase transformations, reaction kinetics, deformation of materials, materials modeling, and surface phenomena. II. Prospective materials for functional and structural purposes as composites, ceramics, amorphous and nanocrystalline materials, quasi-crystals, fullerenes, nano-tubes, intermetallics, eutectic materials, hard alloys and cermets. III. Materials processing routes including materials synthesis in the bulk and dispersed states, self-propagating

high- temperature synthesis, powder formation, sintering, joining, and coating. IV. Characterization of materials properties using non-destructive methods, microscopy, spectroscopy, acoustics, and x-ray.

DTIC

Composite Materials; Nanocrystals; Intermetallics; Ceramics; Amorphous Materials

20030019204 Technion Research and Development Foundation Ltd., Haifa Israel

Phase-Equilibria and Nanostructure Formation in Charged Rigid-Rod Polymers and Carbon Nanotubes *Final Report, 18 Sep. 2000-18 Nov. 2001*

Cohen, Yachin; Nov. 10, 2002; 44p; In English; Original contains color images

Contract(s)/Grant(s): F61775-00-WE066

Report No.(s): AD-A409880; EOARD-SPC-00-4066; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report results from a contract tasking Technion Research & Development Foundation as follows: The contractor will investigate 1) the mechanism of structure formation in rigid-rod and nanotube polyelectrolyte solutions using intrinsically charged rigid rods, in aqueous solutions containing acid anions and other solutes, as model systems 2) solubilization procedures for carbon nanotubes, in particular aqueous dispersion of acid-oxidized systems. 3) phase equilibria and kinetics of the solidification transition in solutions of carbon nanotubes 4) if the 10nm limit on the microfibrillar width is a fundamental limitation to rigid-rod or carbon nanotube technology or whether it can be surpassed.

DTIC

Carbon Nanotubes; Nanostructure (Characteristics)

20030019280 Air Force Research Lab., Edwards AFB, CA USA

Molecularly Reinforced Polymers

Phillips, Shawn H.; Haddad, Timothy S.; Blanski, Rusty L.; Lee, Andre Y.; Vaia, Richard A.; Jun. 11, 2001; 12p; In English; Presented at Int'l Symposium on Nanocomposites held in Chicago, IL on 25-27 Jun. 2001. Prepared in cooperation with Michigan State Univ., East Lansing, MI

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A409917; AFRL-PR-ED-TP-2001-135; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

New nanotechnology initiatives have catapulted nano-materials science to the forefront of research and development in industrial, academic and government labs. While it will be many years before any foreseeable payoffs are realized for new efforts, existing programs have already shown that significant improvements are possible by controlling/understanding the molecular level interactions of polymer systems. For over a decade the Air Force Research Laboratory has invested in both fundamental and applied research of such nanocomposite materials (POSS nanotechnology and clay nanocomposites) and how molecular reinforcement occurs through the addition of inorganic particles, whether blended, grafted, or copolymerized. This talk will broadly cover both nanocomposite materials and commercialization efforts, as well as a focused discussion on recent breakthroughs in POSS nanotechnology for controlling polymer property enhancements.

DTIC

Nanocomposites; Nanotechnology; Polymers

20030019325 Montpellier-2 Univ., France

Synthesis and Investigation of Non-Linear Optical Properties of Organometallic Polymers *Final Report, 10 Sep. 2001-10 Sep 2002*

Douglas, William; Nov. 22, 2002; 26p; In English; Original contains color images

Contract(s)/Grant(s): F61775-01-WE058

Report No.(s): AD-A409990; EOARD-SPC-01-4058; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Universite de Montpellier II as follows: The contractor will investigate the nonlinear optical properties of a variety of organometallic polymer-based materials. Organic materials offer the potential for greatly increased non-linear interactions with intense laser light, enabling the construction of a wide variety of electro-optic components for laser systems.

DTIC

Optical Materials; Organometallic Compounds; Optical Properties

20030019752 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Salt-Fog Accelerated Testing of Glass Fiber Reinforced Polymer Composites Final Report

Caceres, Arsenio; Jamond, Robert M.; Hoffard, Theresa A.; Malvar, L. J.; Dec. 01, 2002; 53p; In English; Original contains color images

Contract(s)/Grant(s): N0001401WX20217

Report No.(s): AD-A409960; NFESC-TR-2215-SHR; No Copyright; Avail: Defense Technical Information Center (DTIC)

The objective of this project was to determine the durability under accelerated salt-fog exposure of six commercially available composites. These composites included glass-reinforced vinylesters, polyesters, phenolics, and an epoxy. Durability was measured mainly in terms of the loss of elastic modulus and flexural strength after exposure. In order to accelerate aging, the specimens were subjected to temperatures of 95F (35C), 120F (49C), and 160F (71C) for one, two and three months each while exposed to a salt-fog spray. A previous project had determined that among the common marine exposures, salt-fog was a major cause for degradation of composites used in the retrofit of the Navy's waterfront infrastructure. Flexural tests were performed, along with dynamic mechanic analyses and scanning electron microscopy. Once the aging effects were determined, a time-temperature superposition analysis was performed in order to extrapolate the results and estimate the degradation over longer time periods. Analysis predictions indicate losses of 35% or more in flexural strength over a 5-year period. To enable predictions beyond 5 years, additional and longer lasting testing would be necessary. Suggestions were made on how to introduce these findings in the design of composite material structures.

DTIC

Glass Fibers; Salt Spray Tests; Glass Fiber Reinforced Plastics; Accelerated Life Tests

20030019847 Northwestern Univ., Chemistry Dept., Evanston, IL USA

Development of Highly-Conductive Polyelectrolytes for Lithium Batteries Final Report, 1 Jun. 2001 - 30 Nov. 2002

Shriver, D. F., Northwestern Univ., USA; Ratner, M. A., Northwestern Univ., USA; Vaynman, S., Northwestern Univ., USA; Annan, K. O., Northwestern Univ., USA; Snyder, J. F., Northwestern Univ., USA; Mar. 04, 2003; 31p; In English

Contract(s)/Grant(s): NAG3-2628; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Future NASA and Air Force missions require reliable and safe sources of energy with high specific energy and energy density that can provide thousands of charge-discharge cycles at more than 40% depth-of-discharge and that can operate at low temperatures. All solid-state batteries have substantial advantages with respect to stability, energy density, storage life and cyclability. Among all solid-state batteries, those with flexible polymer electrolytes offer substantial advantages in cell dimensionality and commensurability, low temperature operation and thin film design. The above considerations suggest that lithium-polymer electrolyte systems are promising for high energy density batteries and should be the systems of choice for NASA and US Air Force applications. Polyelectrolytes (single ion conductors) are among most promising avenues for achieving a major breakthrough in the applicability of polymer-based electrolyte systems. Their major advantages include unit transference number for the cation, reduced cell polarization, minimal salt precipitation, and favorable electrolyte stability at interfaces. Our research is focused on synthesis, modeling and cell testing of single ion carriers, polyelectrolytes. During the first year of this project we attempted the synthesis of two polyelectrolytes. The synthesis of the first one, the poly(ethyleneoxide methoxy acrylate-co-lithium 1,1,2-trifluorobutanesulfonate acrylate), was attempted few times and it was unsuccessful. We followed the synthetic route described by Cowie and Spence. The yield was extremely low and the final product could not be separated from the impurities. The synthesis of this polyelectrolyte is not described in this report. The second polyelectrolyte, comb polysiloxane polyelectrolyte containing oligoether and perfluoroether sidechains, was synthesized in sufficient quantity to study the range of properties such as thermal stability, Li-ion conductivity and stability toward lithium metal. Also, the batteries containing this polyelectrolyte were assembled and tested. The results are detailed below. The synthesis of another polyelectrolyte similar to polysiloxane polyelectrolyte has been started, however, the synthesis was not completed due to termination of the project.

Derived from text

Polysiloxanes; Electrolytes; Lithium Batteries; Thermal Stability; Electrical Resistivity

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PROPELLANTS AND FUELS

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

20030018968 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

The Effects of LOX Post Biasing on SSME Injector Wall Compatibility

Strakey, P. A.; Talley, D. G.; Tseng, L. K.; Miner, K. L.; Jul. 19, 1999; 13p; In English; Prepared in cooperation with The Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA

Contract(s)/Grant(s): AF Proj. 3058

Report No.(s): AD-A410025; AFRL-PR-ED-TP-FY99-0169A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental investigation has been carried out to examine the effects of LOX post biasing of a shear coaxial injector on the behavior of the spray near a chamber wall. The experimental work was performed with inert propellant simulants in a high-pressure chamber. Injector flow rates and chamber pressure were designed to match the Space Shuttle Main Engine (SSME) injector gas-to-liquid density and velocity ratio at the point of propellant injection. Measurements of liquid mass flux, gas phase velocity and droplet size were made using mechanical patternation and phase Doppler interferometry techniques. The measurements revealed that the liquid mass flux distribution shifts away from the wall with increasing LOX post bias away from the wall. The shift in the liquid flux distribution was much greater than that caused by the angling of the LOX post alone. Gas velocity near the wall simultaneously increased with increasing LOX post bias away from the wall. The increase in wall side gas velocity was due to the higher fraction of gas injected on the wall side of the injector as a result of the eccentricity at the injector exit. The net result was a decrease in mixture ratio near the wall. Estimates of heat transfer and engine performance relative to the unbiased case are presented.

DTIC

Interferometry; Space Shuttles; Injectors; Rocket Engines; Doppler Effect; Liquid Oxygen

20030018969 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

The Effects of LOX Post Biasing on SSME Injector Wall Compatibility

Strakey, P. A.; Talley, D. G.; Tseng, L. K.; Miner, K. I.; Mar. 01, 2000; 26p; In English; Presented at Int'l Symposium on Liquid Space Propulsion (4th) held in Lampoldshausen, Germany on 13-15 Mar. 2000. Prepared in cooperation with The Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA

Contract(s)/Grant(s): AF Proj. 3058

Report No.(s): AD-A410026; AFRL-PR-ED-TP-2000-040; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental investigation has been carried out to examine the effects of LOX post biasing of a shear coaxial injector on the behavior of the spray near a chamber wall. The experimental work was performed with inert propellant simulants in a high-pressure chamber. Injector flow rates and chamber pressure were designed to match the Space Shuttle Main Engine (SSME) injector gas-to-liquid density and velocity ratio at the point of propellant injection. Measurements of liquid mass flux, gas phase velocity and droplet size were made using mechanical patternation and phase Doppler interferometry techniques. The measurements revealed that the liquid mass flux distribution shifts away from the wall with increasing LOX post bias away from the wall. The shift in the liquid flux distribution was much greater than that caused by the angling of the LOX post alone. Gas velocity near the wall simultaneously increased with increasing LOX post bias away from the wall. The increase in wall side gas velocity was due to the higher fraction of gas injected on the wall side of the injector as a result of the eccentricity at the injector exit. The net result is a decrease in mixture ratio near the wall. Estimates of heat transfer and engine performance relative to the unbiased case are presented.

DTIC

Injectors; Simulation; Chambers; Liquid Oxygen; Space Shuttle Main Engine

20030019055 Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA

Protocol of Test Methods for Evaluating High Heat Sink Fuel Thermal Stability Additives for Aviation Jet Fuel JP-8+100 Final Report, 1 Jun. 2001-1 Apr. 2002

Morris, Robert W., Jr.; Minus, Donald; Zabarnick, Steven; Balster, Lori; Binns, Kenneth E.; Apr. 2002; 29p; In English; Original contains color images; Prepared in collaboration with University of Dayton Research Institute, OH and Pratt and Whitney Aircraft, Fuels and Lubricants Group, East Hartford, CT

Contract(s)/Grant(s): Proj-3048

Report No.(s): AD-A410074; AFRL-PR-WP-TR-2002-2037; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the high heat sink fuels thermal stability additive evaluation protocol of test methods as they apply to the evaluation of additives for JP-8+100. Individual test methods are described and a standardized methodology for test operation is presented. Acceptance criteria for both baseline fuels and candidate additives are also given.

DTIC

Heat Sinks; Protocol (Computers); Thermal Stability; JP-8 Jet Fuel; Additives; Fuel Tests

20030019212 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Subcritical Crack Growth in a Composite Solid Propellant

Baron, D. T.; Liu, C. T.; Miller, T. C.; May 07, 1998; 31p; In English; Original contains color images

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409841; AFRL-PR-ED-TP-1998-101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No abstract available.

CASI

Crack Propagation; Composite Propellants

20030019214 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

The Behavior of Cryogenic Shear Layers Under Supercritical Conditions

Chehroudi, B.; Cohn, R.; Talley, D.; Mar. 2001; 8p; In English; Symposium on Turbulence and Shear Flow Phenomena (2nd). Held in Stockholm, Sweden, 27 Jun 2001

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409838; AFRL-PR-ED-TP-2001-045; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recent experience gained at AFRL with the injection of cryogenic fluids into high back-pressures is summarized. In the experimental investigations described, a jet of a cryogenic fluid, typically liquid N₂, is injected into a chamber whose ambient pressure is varied to values exceeding the critical pressure of the injectant. The structure of the jet and the shear layer between the jet and the ambient has been examined. Results from visualization, jet growth rate, fractal analysis, and Raman scattering measurements indicate that the behavior of the injected fluid changes from spray-like behavior to gas jet-like behavior as pressure increased.

DTIC

Pressure; Cryogenic Rocket Propellants

20030019215 Engineering Research and Consulting, Inc., Edwards AFB, CA USA

Visual Characteristics and Initial Growth Rates of Round Cryogenic Jets at Subcritical and Supercritical Pressures

Chehroudi, B.; Talley, D.; Coy, E.; Mar. 2001; 22p; In English; Submitted to Physics of Fluids journal

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409837; AFRL-PR-ED-TP-2001-050; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The visual characteristics and initial growth rates of round cryogenic jets injected into subcritical and supercritical pressures were studied. We found that the jet exhibits liquid-like and gas-like characteristics at subcritical and supercritical pressures, respectively. Explanations are offered. The jet spreading angle at supercritical pressures has been demonstrated to agree quantitatively with the theoretical spreading angle of incompressible but variable density turbulent gas jets, the first time more than a qualitative visual similarity with gas jets has ever been demonstrated. In addition, the present measurements of spreading rates have been plotted along with other measurements for subsonic incompressible constant density and variable density jets, liquid sprays, supersonic jets, and other mixing layers in a plot spanning four orders of magnitude in gas-to-liquid density ratio. This is the first time these results have been consolidated in a single plot over such a large range of density ratio.

DTIC

Thermodynamics; Cryogenic Rocket Propellants

20030019216 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Experimental and Numerical Studies of Transcritical LOX Droplets

Talley, D. G.; Woodward, R. D.; Kaltz, T. L.; Long, L. N.; Micci, M. M.; Jul. 1998; 8p; In English; Prepared in collaboration with the Pennsylvania State Univ., University Park, PA

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409836; AFRL-PR-ED-TP-1998-100; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A 137 atm pressure vessel has been developed for the study of transcritical liquid oxygen and liquid nitrogen droplets and jets. At the same time, numerical modeling of the same phenomena is being pursued using scaled and unscaled molecular dynamics. Experimental and numerical results both show the disappearance of surface tension as the droplet passes through its critical point and the effect of various environment mixtures on the critical point.

DTIC

Evaporation; Liquid Oxygen

20030019217 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Basic Research in Liquid Rocket Combustion at the Air Force Research Laboratory

Talley, Doug; May 1999; 44p; In English

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409835; AFRL-PR-ED-TP-1999-099; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Viewgraph slides for presentation on Air Force research on liquid rocket combustion given at an international workshop on research status and perspectives in liquid rocket combustion chamber flow dynamics.

DTIC

Combustion; Liquid Propellant Rocket Engines; Liquid Rocket Propellants

20030019222 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Advanced Propellants

Hawkins, Tom; Dec. 05, 2000; 11p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409830; AFRL-PR-ED-TP-2000-231; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The presentation slides for the briefing for Advanced Propellants are presented.

DTIC

Monopropellants; Solid Rocket Propellants

20030019234 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Progress in Advanced Propellant Research

Harper, Jessica; Jun. 05, 2000; 17p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409789; AFRL-PR-ED-TP-2000-123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

These viewgraphs discuss progress in advanced propellant research, including topics such as technology development path, cryogenic solid HEDM (High Energy Density Matter) propellants, all nitrogen compound, monopropellant development, high performance, reduced toxicity, advanced monopropellants, liquid hydrocarbon fuels, energetic and hydrocarbon fuels.

DTIC

Propellants; Hydrocarbons; Cryogenics

20030019236 Alabama Univ., Tuscaloosa, AL USA

Dual Fuel Solar Thermal Propulsion for LEO to GEO Transfer: Ideal Rocket Analysis

Stewart, Jesse F.; Martin, James A.; Jul. 1995; 13p; In English

Report No.(s): AD-A409786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Analysis of a dual fuel solar thermal propulsion concept was performed based on a system designed at NASA's Marshall Space Flight Center. The MSFC system uses a single fuel, hydrogen, to transfer 1,000 pounds of payload from LEO to GEO. Ammonia and hydrogen are used by the dual fuel system and both propellants were considered for use in the early stages of the mission. However, it was found that a system burning ammonia first was more suitable for the given mission. A fixed gross weight and the ideal rocket equation were used to calculate component weights. The analysis included some propellant losses. Payload weight was initially decreased by the addition of ammonia but it was increased by downsizing the power system to provide 2 potind of thrust with ammonia instead of with hydrogen. The analysis indicated that 1,000 pounds of payload could be placed into geosynchronous orbit with ammonia fraction of about 14 percent of the gross weight. The tank volume was decreased by 20 percent and the propellant lost to boiloff was decreased by 24 percent. Also, thrust to weight variation with change in ammonia weight fraction was examined. Further analysis is required to fully weigh the benefits of a dual fuel solar thermal system.

DTIC

Rocket Propellants; Solar Thermal Propulsion

20030019853 Air Force Research Lab., Space and Missile Propulsion Div, Eglin AFB, FL USA

Characterization of Reduced Toxicity, High Performance Monopropellants at the US Air Force Research Laboratory

Hawkins, T. W.; Brand, A. J.; McKay, M. B.; Drake, G. W.; Ismail, I. M.; Nov. 05, 2001; 3p; In English

Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A409863; AFRL-PR-ED-AB-2001-219; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Current programs are aiming to develop reduced toxicity monopropellant formulations to replace spacecraft hydrazine monopropellant. The Air Force Research Laboratory's approach to replacing hydrazine is the synthesis and development of energetic compounds with substantially less vapor toxicity and superior performance (specific impulse and density). Characterization and testing of these new high energy density materials is an essential part of the screening process for viable novel energetic ingredients. Hazardous characteristics, undesirable physical properties or unacceptable combustion behavior of propellants must also be identified and/or modified to further development by a potential user. During the last year work has focused on the production and characterization of a few of these reduced toxicity monopropellant formulations. Limited safety and sensitivity, thermal stability, rheological and toxicity studies have been conducted. Thruster testing of selected propellants has also been performed with results indicating that a greater than 50% improvement in energy-density over hydrazine is achievable.

DTIC

Toxicity; Monopropellants

20030019854 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Evaluation of Monopropellants for Reusable Launch Vehicles

Jones, Paul F.; Hawkins, Tom W.; Brand, Adam J.; McKay, Milton B.; Rodgers, Stephen L.; Nov. 05, 2001; 3p; In English

Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A409864; AFRL-PR-ED-AB-2001-221; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Previously, the Air Force has been investigating high performance salt-based, liquid monopropellants for low thrust spacecraft applications. The focus of this effort has been on finding a reduced toxicity monopropellant with a predicted density performance impulse greater than 50% over hydrazine. During this same period of time, NASA has been investigating reusable launch vehicle (KLV) concepts and has considered using monopropellants in this application. Anticipating a possible RLV payoff, NASA and the Air Force are working on a trade study to gauge the potential applicability of the salt-based monopropellants in booster applications. This study will include a performance comparison of salt-based monopropellants; a list of minimum safety, hazard, and physical property requirements based on operational and logistical support environments for an RLV.

DTIC

Reusable Launch Vehicles; Monopropellants

20030020363 Cincinnati Univ., Space Engineering Center, OH USA

Design of a Lunar Propellant Processing Facility

Anno, James, Cincinnati Univ., USA; Ciric, Amy, Cincinnati Univ., USA; Cooper, Larry, Cincinnati Univ., USA; Greenberg, Dave, Cincinnati Univ., USA; Helmicki, Arthur, Cincinnati Univ., USA; Henderson, H. Thurman, Cincinnati Univ., USA; Lin, Ray, Cincinnati Univ., USA; Nevin, Joseph, Cincinnati Univ., USA; Weisgerber, Frank, Cincinnati Univ., USA; Williams, Trevor, Cincinnati Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 177-188; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Mankind's exploration of space will eventually lead to the establishment of a permanent human presence on the Moon. Essential to the economic viability of such an undertaking will be prudent utilization of indigenous lunar resources. The design of a lunar propellant processing system is presented. The system elements include facilities for ore processing, ice transportation, water splitting, propellant storage, personnel and materials transportation, human habitation, power generation, and communications. The design scenario postulates that ice is present in the lunar polar regions, and that an initial lunar outpost has been established. Mining, ore processing, and water transportation operations are located in the polar regions. Water processing and propellant storage facilities are positioned near the equator. A general description of design operations is outlined below. Regolith containing the ice is mined from permanently- shaded polar craters. Water is separated from the ore using a microwave processing technique, and refrozen into projectiles for launch to the equatorial site via railgun. A mass-catching device retrieves the ice. This ice is processed using fractional distillation to remove impurities. and the purified liquid water is fed to an electrolytic cell that splits the water into vaporous hydrogen and oxygen. The hydrogen and oxygen are condensed and stored separately in a tank farm. Electric power for all operations is supplied by SP-100 nuclear reactors. Transportation of materials and personnel is accomplished primarily using chemical rockets. Modular living habitats are used which provide flexibility for the placement

and number of personnel. A communications system consisting of lunar surface terminals, a lunar relay satellite, and terrestrial surface stations provides capabilities for continuous Moon-Moon and Moon-Earth transmissions of voice, picture, and data.

Author

Extraterrestrial Resources; In Situ Resource Utilization; Lunar Bases; Moon; Propellants; Space Processing

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ENGINEERING (GENERAL)

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.

20030019860 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

The History of the Bates Motor at RPL

Beckman, Charles W.; Jul. 10, 1998; 25p; In English

Contract(s)/Grant(s): AF Proj. 3059

Report No.(s): AD-A410126; AFRL-PR-ED-TP-1998-113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

BATES is a highly accurate test motor system for ballistic prediction, assessment and comparison. BATES is an invaluable assessment tool. It provides precision measurements, simple and analyzable hardware; it is adaptable to tactical, strategic or space needs and it is a irreplaceable propellant and ballistic database.

DTIC

Motors; Ballistics; Automatic Test Equipment

20030020366 Florida State Univ., Coll. of Engineering, Tallahassee, FL USA

Umbilical Support, Lunar Surface Emergency Shelter and Robotic Arm for Lunar Surface Vehicle Projects

Hollis, Patrick, Florida State Univ., USA; Shields, William, Florida State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 212-221; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The purpose of this study was to develop a conceptual design of an Umbilical for Lunar Lander Support (LLS). The emphasis of the study is on the subsystems needed to fulfill each support requirement while considering environmental conditions such as thermal ranges, radiation effects, micrometeorites and lunar ejecta. These subsystems include transferring two liters of hydrogen boil-off from tanks on the lander to a storage facility to later be condensed and recycled, providing power to maintain on-board systems, and continuous transmission of video, voice and data signals. An external housing to protect each of the internal components by way of housing was designed and an interface mechanism which provides continuity between each subsystem.

Author

Lunar Surface Vehicles; Robot Arms; Umbilical Connectors; Lunar Shelters; Power Lines; Communication Cables; Housings

20030020428 NASA Glenn Research Center, Cleveland, OH USA

Coupled Multi-Disciplinary Optimization for Structural Reliability and Affordability

Abumeri, Galib H., QSS Group, Inc., USA; Chamis, Christos C., NASA Glenn Research Center, USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 5-1 - 5-10; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

A computational simulation method is presented for Non-Deterministic Multidisciplinary Optimization of engine composite materials and structures. A hypothetical engine duct made with ceramic matrix composites (CMC) is evaluated probabilistically in the presence of combined thermo-mechanical loading. The structure is tailored by quantifying the uncertainties in all relevant design variables such as fabrication, material, and loading parameters. The probabilistic sensitivities are used to select critical design variables for optimization. In this paper, two approaches for non-deterministic optimization are presented. The non-deterministic minimization of combined failure stress criterion is carried out by: (1) performing probabilistic evaluation first and then optimization and (2) performing optimization first and then probabilistic evaluation. The first approach shows that the optimization feasible region can be bounded by a set of prescribed probability limits and that the optimization follows the cumulative distribution function between those limits. The second approach shows that the optimization feasible region is bounded by 0.50 and 0.999 probabilities.

Author

Structural Reliability; Thermodynamics; Optimization; Failure; Combined Stress

COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation and Safety.

20030018899 National Association of State Chief Information Officers, Lexington, KY USA

Public-Sector Information Security: A Call to Action for Public-Sector CIOs

Heiman, Don; Oct. 01, 2002; 48p; In English; Original contains color images

Report No.(s): AD-A410220; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report expands upon the themes and issues raised at a forum on Security and Critical Infrastructure Protection sponsored by the National Association of State Chief Information Officers (NASCIO) with the support of the IBM Endowment, Forum participants included state chief information officers, government information technology managers, and other key state government staff, At the forum, held in November 2001, conference participants identified a series of actions designed to combat emerging cyber-threats to security and critical infrastructure, Subsequent to the forum, NASCIO asked Don Heiman, former chief information officer of the State of Kansas, to develop recommendations for improving public-sector information security. He developed % 0 recommendations in three areas: management, technology, and homeland security, Taken together, these recommendations reflect the concept that security is about more than just information technology. One key point is that IT governance is a critical responsibility for the heads of government entities and should include all key stakeholders, The report argues that in order to exercise effective enterprise and IT governance, agency heads and the agency's executive management team must have a clear understanding of what to expect from their enterprise's information and security programs. It is crucial that organizations evaluate the positive aspects and short- comings of their current security program, and then design improved programs to meet organizational needs, Organizations also must work to improve their capacity to effectively implement their security program. The % 0 recommendations set forth by Heiman are critical components to a successful response against cyber-security threats and attacks, We trust that this report will be helpful and useful to chief information officers at all levels of government as they develop and implement security measures to protect the nation's critical infrastructure,

DTIC

Data Processing Equipment; Security; Management Systems; Information Systems

20030018975 New Brunswick Univ., Fredericton, New Brunswick Canada

Hidden Markov Model Classification of Myoelectric Signals in Speech

Chan, A. D.; Englehart, K.; Hudgins, B.; Lovely, D. F.; Oct. 25, 2001; 5p; In English

Report No.(s): AD-A410037; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A hidden Markov model based classifier is proposed in this paper to perform automatic speech recognition using myoelectric signals from the muscles of vocal articulation. The classifier's resilience to temporal variance is compared to a linear discriminant analysis classifier that was used in a pervious study. Speech recognition was performed, using five channels of myoelectric signals, on isolated words from a 10-word vocabulary. Temporal variance was induced by temporally misaligning data from the test set, with respect to the training set. When compared to the LDA classifier, the hidden Markov model classifier demonstrated a markedly lower variation in classification error due to the temporal misalignment. Characteristics of the hidden Markov model MES classifier suggest that it would effectively complement a conventional acoustic speech recognizer, in a multi-modal speech recognition system.

DTIC

Speech Recognition; Myoelectricity

20030018978 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Low-Angle X-Band Radar Ground Clutter Spatial Amplitude Statistics

Billingsley, J. B.; Dec. 20, 2002; 213p; In English

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A410042; TR-958; ESC-TR-2000-066; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A large volume of X-band radar ground clutter measurement data was collected from many sites widely dispersed over the North American continent. This program of measurements involved a wide variety of terrain types, where at each site backscatter was recorded from all of the terrain within the field of view, through 360 degrees in azimuth and to ranges typically extending to 25 or 50km. As a result, in most of these measurements the angle of illumination of the earth's surface was usually very low, typically within a degree or so of grazing incidence, with much intermittent shadowing of low regions occurring within the field

of view. This report examines the nature of low-angle radar ground clutter as it has come to be understood through analysis of this extensive base of measurements. Depression angle, that is, the angle below the horizontal at which the backscattering terrain point is observed at the radar antenna, is shown to be the principal parametric influence on clutter amplitude statistics, even for the very low angles and small (typically fractional) variations in angle that occur in surface-sited radar. This principal role of depression angle is the result of its effect on shadowing in a sea of patchy visibility and discrete or localized scattering sources. Following this understanding, a general predictive model for X-band ground clutter spatial amplitude statistics is developed based on specific computation of depression angle but on only relatively general specification of terrain type. The report goes on to illustrate how increasing information about terrain type allows more precise prediction of clutter statistics.

DTIC

Backscattering; Clutter; Radar Antennas; Superhigh Frequencies

20030019224 Department of Defense, Office of the Assistant Inspector General for Audit, Arlington, VA USA

Acquisition of the Synthetic Aperture Radar/Moving Target Indicator

Jan. 31, 2003; 15p; In English

Report No.(s): AD-A409827; OAIG-AUD-D-2003-052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Those who are specifically involved in the management, support, and oversight of the Synthetic Aperture Radar/Moving Target Indicator (SAR/MTI) should read this report because it discusses why the SAR/MTI program was halted and pending program actions. The SAR/MTI is an Army acquisition category III program. SAR/MTI, when installed on the Tactical Unmanned Aerial Vehicle (TUAV), is to provide imaging of stationary targets and detection of moving targets, resulting in the tactical commander having increased situational awareness during periods of adverse weather and through battlefield obscuration. The Army estimates that total life-cycle costs would exceed \$100 million for acquiring, operating, and maintaining 86 SAR/MTI systems.

DTIC

Synthetic Aperture Radar; Indicating Instruments

20030019281 Brunel Univ., Uxbridge UK

Optimum Delivery of Telemedicine Over Low Bandwidth Satellite Links

Clarke, M.; Fragos, A.; Jones, R. W.; Lioupis, D.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409916; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Telemedicine is frequently used to support the delivery of medicine to remote regions, but it can often be the case that these areas are poorly served by communications. The AIDMAN project investigates the delivery of telemedicine in remote regions of Greece using satellite. However the high cost of such links can severely limit the bandwidth available to applications. In addition the satellite link is a clear channel and may be configured to emulate any protocol. This presents a problem of determining which protocol may best support the applications. We have modelled the three types of link protocol, circuit switched (ISDN), packet switched (TCP/IP) and cell switched (ATM) to determine how their characteristics affect the performance when bandwidth is severely restricted. We further investigate how performance may be optimized when the link is used to carry mixed traffic of real time video conference and image transfer. Our simulation shows that TCP/IP can support telemedicine applications reasonably well, so long as the number of simultaneous image transfers are restricted. Furthermore, IPv6, which supports prioritization of traffic, can overcome this restriction. Use of TCP/IP has further advantage, in that it permits integration of wider networks, is cheap, widely available and supports virtually all telemedicine applications. Real-time measurements using the virtual consultation workstations developed for the AIDMAN project on a low bandwidth link implemented on routers connected using ISDN to simulate a link with 128 kbps and on the CALENOS satellite network confirms the findings of the simulation.

DTIC

Data Links; Telemedicine; Satellite Communication

20030019310 Virginia Commonwealth Univ., School of Engineering, Richmond, VA USA

Isolated Speech Recognition Using Artificial Neural Networks

Polur, Prasad D.; Zhou, Ruobing; Yang, Jun; Adnani, Fedra; Hobson, Rosalyn S.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409964; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this project Artificial Neural Networks are used as research tool to accomplish Automated Speech Recognition of normal speech. A small size vocabulary containing the words YES and NO is chosen. Spectral features using cepstral analysis are extracted per frame and imported to a feedforward neural network which uses a backpropagation with momentum training algorithm. The network is trained to recognize and classify the incoming words into the respective categories. The output from the neural network is loaded into a pattern search function, which matches the input sequence with a set of target word patterns. The level of variability in input speech patterns limits the vocabulary and affects the reliability of the network. The results from the first stage of this work are satisfactory and thus the application of artificial neural networks in conjunction with cepstral analysis in isolated word recognition holds promise.

DTIC

Neural Nets; Speech Recognition; Pattern Recognition; Cepstral Analysis; Words (Language)

20030019330 Maryland Univ., Baltimore, MD USA

Preserving Spectral Contrast in Amplitude Compression for Hearing Aids

Tejero-Calado, Juan C.; Rutledge, Janet C.; Nelson, Peggy B.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409985; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Amplitude compression processing is used to reduce the amplitude level variations of speech to fit the reduced dynamic ranges of sensorineural impaired listeners. However this processing results in spectral smearing due in part to reduced peak-to-valley ratios. Presented here are two variations of a compression processing algorithm based on a sinusoidal speech model that preserves the important spectral peaks. Both models operate on a time-varying, frequency- dependent basis to adjust to the speech variations and the listener's hearing profile. Preliminary subject tests indicate benefit from preserving spectral contrast. Enhancing spectral contrast is possible with the algorithm presented here.

DTIC

Speech; Earphones; Frequencies; Hearing; Auditory Defects

20030019489 Space and Naval Warfare Systems Center, San Diego, CA USA

COMWIN Antenna Project: Final Report FY 1999 to 2002 Final Report, FY 1999-FY 2002

Adams, R. C.; Mueller, D. W. Von; Abramo, R. S.; Sep. 2002; 91p; In English; Original contains color images

Report No.(s): AD-A409799; SSC/SD-TR-1892; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The two goals of the COMbat Wear INtegration (COMWIN) project are to develop a soldier-carried antenna that can transmit or receive a signal at any frequency from 2 MHz to 2 GHz and that disguises the identity of the radio operator. The purpose of the first aim is to make the antenna compatible with the hand-held radio that will be manufactured in accordance with the Operational Requirements Document of the Joint Tactical Radio. The purpose of the second aim is to increase the difficulty of snipers to target the radio operators and disrupt command, communications, and control at the squad level. Both aims are achieved by integrating the antenna into the uniform of the soldier or marine. This document is comprehensive in that it provides a summary of all the important steps taken during the 3-year period of the effort. Details will be provided on the work done during Fiscal Year (FY) 2002.

DTIC

Telecommunication; Broadband; Antenna Design

20030019850 Naval Research Lab., Washington, DC USA

Synthetic Aperture Ladar (SAL): Fundamental Theory, Design Equations for a Satellite System, and Laboratory Demonstration

Lucke, Robert L.; Rickard, Lee J.; Bashkansky, Mark; Reintjes, John; Funk, Eric E.; Dec. 26, 2002; 31p; In English

Report No.(s): AD-A409859; NRL/FR/7218--02-10051; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The carrier-to-noise ratio (CNR) resulting from phase-sensitive heterodyne detection in a photon-limited synthetic aperture ladar (SAL) is developed, propagated through synthetic aperture signal processing, and combined with speckle to give the signal-to-noise ratio (SNR) of the resulting image. CNR and SNR are defined in such a way as to be familiar to the optical imaging community. Design equations are presented to allow quick assessment of the hardware parameters required for a notional system, most notably optical aperture sizes and the laser's power, chirp, and pulse rate capabilities. Some tutorial information on

phase-sensitive heterodyne detection and synthetic aperture image formation is provided. The first two-dimensional synthetic aperture imaging in the optical domain is demonstrated in a laboratory setting.

DTIC

Image Processing; Images; Synthetic Apertures

20030020307 NASA Glenn Research Center, Cleveland, OH USA

Weather Information Communications (WINCOMM) Overview and Status

Martzaklis, K., NASA Glenn Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 51-72; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

The second annual project review of Weather Information Communications (WINCOMM) is presented. The topics of discussion include: 1) In-Flight Weather Information; 2) System Elements; 3) Technology Investment Areas; 4) NAS Information Exchange; 5) FIS Datalink Architecture Analyses; 6) Hybrid FIS Datalink Architecture; 7) FIS Datalink Architecture Analyses; 8) Air Transport: Ground and Satellite-based Datalinks; 9) General Aviation: Ground and Satellite-based Datalinks; 10) Low Altitude AutoMET Reporting; 11) AutoMET: Airborne-based Datalinks; 12) Network Protocols Development; and 13) FAA/NASA Collaboration. A summary of WINCOMM is also included. This paper is in viewgraph form.

CASI

General Overviews; Weather Forecasting; Civil Aviation; Information Systems; Communication Networks; NASA Programs

20030020317 Lockheed Martin Global Telecommunications, Cleveland, OH USA

VHF Datalink (Mode 2) for Cockpit Weather for Air Transports

Tanger, Thomas E., Lockheed Martin Global Telecommunications, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 200-202; In English; Also announced as 20030020303; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on an assessment of the capabilities of the VHF Datalink Mode 2 (VDLM2) for disseminating information to a cockpit weather information system.

CASI

Data Links; Cockpit Weather Information Systems; Very High Frequencies

20030020321 Honeywell International, Inc., USA

General Aviation FIS Broadcast System

Joyce, Jim, Honeywell International, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 289-307; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the development of a Flight Information System (FIS) broadcast system. The presentation includes images of the system's ground stations and equipment, and diagrams which illustrate how they operate.

Author

Broadcasting; General Aviation Aircraft; Ground Stations; Information Systems

20030020325 NASA Glenn Research Center, Cleveland, OH USA

TAMDAR Datalink Development

Andro, Monty, NASA Glenn Research Center, USA; Wiersma, Stephen C., NASA Glenn Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 364-378; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the development of a downlink system for the TAMDAR (Tropospheric Airborne Meteorological Data Reporting) system of sensors mounted on individual airplanes. These sensors will be used by forecast models, weather briefers, air traffic controllers, and other aircraft. They will have the ability to monitor and report moisture, temperature, and wind characteristics below 20,000 feet altitude. The presentation discusses, with flowcharts, the various downlinking interconnections and network architectures.

CASI

Data Links; Downlinking; Forecasting; Meteorological Parameters; Weather; Flight Instruments

20030020335 NASA Langley Research Center, Hampton, VA USA

Turbulence Lidar Development Status

Clark, Ivan, NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 586-618; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph provides an overview of efforts conducted by Coherent Technologies, Inc. in conjunction with NASA Langley Research Center to develop a robust turbulence detection capability that spans full range of turbulence environments. Topics covered include: general principles of infrared doppler radar (lidar) turbulence measurement, performance simulation, complete detection capability provided by dual wavelength radar, algorithm development, technology development needs and turbulence detection problems. Versions of this turbulence lidar system were flight tested. Data analysis from these flight tests are presented. Future flight tests aboard DC-8 and B-757 are planned as well as continued algorithm development and performance simulation activities.

CASI

Turbulence; Optical Radar; Radar Detection; Data Processing; Algorithms; Applications Programs (Computers)

20030020336 NASA Langley Research Center, Hampton, VA USA

Flight Test Results for a Turbulence Detection Radar

Schaffner, Phil, NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 619-666; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of flight tests conducted on an aircraft turbulence detection radar system. Topics covered include: flight operations summary, radar data collection, baseline algorithm methodology, radar hazard tables and proposed alert criteria. Flight tests results are presented and summarized. Data analysis from these flight tests are also included.

Author

Aircraft Safety; Airborne Radar; Data Processing; Flight Tests; Optical Radar; Turbulence

20030020342 Federal Aviation Administration, USA

Flight Information Services Data Link (FISDL)

Moosakhanian, Alfred, Federal Aviation Administration, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 758-769; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of the FAA's Flight Information Services Datalink (FISDL). This service provides a VHF broadcast from a network of ground stations to in-cockpit displays of General Aviation aircraft presenting flight information products nation wide. The FAA has agreed to the use by commercial industry of FAA-owned VHF data frequencies for transmittal of datalinked flight information . The partner companies develop, test, deploy and operate the information delivery network. The result is that private pilots are able to receive valuable flight information informing of potentially hazardous conditions and activities. Topics covered include: FIS POLICY Implementation, Key Provisions: FAA Commitments and Key Provisions: Provider commitments.

Author

General Aviation Aircraft; Information Systems; Weather Forecasting; Flight Conditions; Government/Industry Relations; Very High Frequencies

20030020345 National Center for Atmospheric Research, Boulder, CO USA

National Business Aviation Association (NBAA)

Lindholm, Tenny, National Center for Atmospheric Research, USA; Lamond, Bob, National Business Aviation Association, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 791-794; In English; Also announced as 20030020303; No Copyright; Avail: CASI; A01, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of the National Business Aviation Association's position on cockpit weather information systems.

CASI

Cockpit Weather Information Systems; Aircraft Safety; Turbulence

ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment. and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.

20030018981 Massachusetts Inst. of Tech., Cambridge, MA USA

Data Fusion in Large Arrays of Microsensors

Willsky, Alan S.; Oct. 2001; 7p; In English; Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors, 2001, held in Applied Physics Lab., Johns Hopkins Univ.

Contract(s)/Grant(s): DAAD19-00-1-0466

Report No.(s): AD-A410046; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper provides a brief summary of the research being performed under the ODDR&E MURI on the topic of data fusion in large arrays of microsensors, a program that involves researchers from MIT, The University of Illinois, and Princeton University. The overall objective of this program is the investigation and development of innovative concepts and solutions to the challenges presented by the envisioned availability of very large numbers of heterogeneous sensors each of which is limited in sensing capability, power, computation, and communication.

DTIC

Arrays; Multisensor Fusion; Microinstrumentation

20030019070 University of Petroleum and Minerals, Dhahran Saudi Arabia

New Denoising Scheme for Magnetic Resonance Spectroscopy Signals

Ahmed, Osama A.; Oct. 28, 2001; 5p; In English

Report No.(s): AD-A410138; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A new scheme for denoising magnetic resonance spectroscopy signals is presented. The scheme is based on projecting noisy signals on different time-frequency domains, consecutively, and performing noise filtering operations in these domains according to the noise level. The evaluation of this scheme was performed using extensive simulation of magnetic resonance spectroscopy signals with different noise levels. It was observed that this scheme gives superior results that compensate for the excess computational requirements, especially for very low signal to noise ratio signals.

DTIC

Spectroscopy; Magnetic Resonance; Noise Reduction; Noise Intensity

20030019196 Montreal Univ., Notre Dame Hospital, Quebec Canada

Non-Invasive Measurement of Diaphragmatic Contraction Timing in Dogs

Torres, A.; Fiz, J. A.; Morera, J.; Grassino, A. E.; Jane, R.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409563; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The movement of thoracic cage (TM) measured with a piezoelectric contact sensor placed on the costal wall is presented in this work as a new non-invasive technique for diaphragmatic contraction period (CP) monitoring. Relationship between CP estimated with this technique is compared with estimations done with other respiratory signals commonly employed for physiological research studies: diaphragm length measured with sonomicrometry (DL), transdiaphragmatic pressure (DP) and respiratory airflow (FL). Specific algorithms were developed to determinate the CP in the four signals. Experiments were performed in three pentobarbital-anesthetized mongrel dogs. Two respiratory tests were studied: spontaneous ventilations (SV) and respiration with an inspiratory load (IL). CP estimated with DL signal was used as reference because this signal is the directly related with the diaphragmatic contraction. Different parameters were estimated for the study of the relationship between CP measured with DL signal and CP measured with TM, FL and DP signals. High relationships were obtained in the IL respiratory test. Lower values were obtained in SV protocol, but the parameters obtained from TM signal correlated better with the ones obtained from DL signal than those from FL and DP signals. Results confirm that it is possible to monitor the diaphragmatic contraction timing with a non-invasive piezoelectric contact sensor.

DTIC

Detectors; Piezoelectricity; Diaphragm (Anatomy); Dogs

20030019266 Barcelona Design, Inc., Sunnyvale, CA USA

Design of Pipeline Analog-to-Digital Converters Via Geometric Programming

Hershenson, Maria del Mar; Sep. 2002; 11p; In English; Availability: Pub. in Proceedings of the IEEE Int'l Conference on Computer Aided Design, 10 Nov 2002

Contract(s)/Grant(s): F33615-01-2-1979; Proj-ARPS

Report No.(s): AD-A409938; AFRL-SN-WP-TP-2002-105; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, a method for the design of analog-to-digital converters is presented. This method computes the sizes of the different components (transistors, capacitors, etc.) in a predefined ADC topology so that the design specifications are met in the desired process technology. The method is based on formulating the ADC design constraints such as specifications on power, signal-to-noise ratio (SNR), area, and sampling frequency in special convex form in terms of the component sizes of the ADC and intermediate design variables. More specifically, the problem of sizing the components of the ADC are cast as a geometric program. Therefore, all design constraints are formulated as posynomial inequality or monomial equality constraints. Very efficient numerical algorithms are then used to solve the resulting geometric program and to compute the component sizes of an ADC that meets the desired specifications. The synthesis method is fast, and determines the globally optimal design; in particular, the final solution is completely independent of the starting point (which can even be infeasible), and infeasible specifications are unambiguously detected. This paper introduces the concept of hierarchical problem formulation within a geometric programming framework. This modular formulation allows a high reuse of the ADC posynomial model.

DTIC

Analog to Digital Converters; Topology; Integrated Circuits; Mathematical Models; Mathematical Programming; Design Analysis

20030019342 California Univ., Berkeley, CA USA

Modular Monolithic Microelectromechanical (MEMS) System Technology (M3S) Final Report, May 1997-Apr. 2002

Boser, Bernhard; Yasaitis, John; Sep. 2002; 29p; In English; Original contains color images

Contract(s)/Grant(s): F30602-97-2-0266; AF Proj. E117

Report No.(s): AD-A409761; AFRL-IF-RS-TR-2002-254; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Surface micromachining with monolithic integrated electronic evaluation circuits is an attractive technology for low-cost, highly compact sensors. Unfortunately, past monolithic sensor/circuits processes suffer from technology complexity resulting from the combination of two complex fabrication processes. The complex interactions slow down progress and preclude a straightforward upgrade path when a better circuit process becomes available. The technology developed here overcomes the disadvantages. by fabricating the mechanical structures first and embedding them in a planarized wafer, it achieves a high degree of separation between the two processes. In fact, the mechanical structures are fabricated by Analog Devices, while a CMOS foundry adds electronic circuits. New circuit options are added by simply sending the wafers to a different foundry. A full complement of gyroscopes and accelerometers fabricated in the modular process demonstrates the practicality of the approach. Compared to conventional processes, the sensors benefit from unproved circuits performance and higher integration capability. A 5-V only gyroscope operating at ambient pressure underscores the flexibility of the approach to implement functions that normally require special technologies, such as high voltage transistors or vacuum packaging. The simpler approach greatly reduces cost and should be of value particularly in cost-sensitive applications such as smart ammunition or micro-air-vehicles.

DTIC

Electronic Equipment; Micromachining

20030019346 New Mexico Univ., Dept. of Electrical Engineering and Computer Science, Albuquerque, NM USA

Radiation Effects on Space-Based Optoelectronic Materials and Devices Final Report, 1 Nov. 1999-31 Oct. 2002

Manasreh, Omar; Aug. 15, 2002; 44p; In English

Contract(s)/Grant(s): F49620-00-1-0026

Report No.(s): AD-A409755; AFRL-SR-AR-TR-02-0443; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have investigated the irradiation effects on interband and intersubband transitions in III-V semiconductors quantum wells and superlattices. We also investigated irradiation induced defects in III-nitride thin films including C-H complexes in AlGaN. In particular, we investigated the Gamma-ray, electron, neutron, He(+)-ion, and proton irradiation effects on the intersubband transitions in multiple quantum wells. Thermal annealing recovery of the intersubband transition (or thermal recycling) in heavily irradiated samples has been investigated. The final report contains detail discussions of the results obtained during the last three

years. At the end of the report, we listed our professional activities including technical papers, books, symposia, invited talks, and students supported by the grant.

DTIC

Electro-Optics; Infrared Detectors; Radiation Effects

20030019857 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Solid State Research, 2002:3 Quarterly Report, 1 Feb.-30 Apr. 2002

Shaver, David C.; Jan. 29, 2003; 78p; In English

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A409920; 2002:3; ESC-TR-2002-077; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 May-31 July 2002. The topics covered are Quantum Electronics, Electro-optical Materials and Devices, Submicrometer Technology, Biosensor and Molecular Technologies, Advanced Imaging Technology, Analog Device Technology, and Advanced Silicon Technology. Funding is provided by several DoD organizations- including the Mr Force, Army, DARPA (Defense Advanced Research Projects Agency), MDA (Milestone Decision Authority), Navy, NSA (National Security Administration), and OSD (Office of the Secretary of Defense)-and also by the DOE (Department of Energy), NASA, and NIST (National Institute of Standards and Technology).

DTIC

Images; Solid State Physics; Quantum Electronics; Charge Coupled Devices

20030020376 Naval Postgraduate School, Space Systems Engineering, Monterey, CA USA

NATSAT: A Multi-Purpose Leo Bus

Agrawal, Brij, Naval Postgraduate School, USA; Clifton, B., Naval Postgraduate School, USA; Hecker, M., Naval Postgraduate School, USA; Laszakovits, J., Naval Postgraduate School, USA; Mathers, B., Naval Postgraduate School, USA; McCrorie, D., Naval Postgraduate School, USA; Newman, S., Naval Postgraduate School, USA; Urbon, B., Naval Postgraduate School, USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 310-317; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In response to requirements established by the Strategic Defense Initiative Office, the Naval Postgraduate School (NPS) has designed NATSAT, a general purpose satellite for use in low and medium Earth orbits. Inexpensive and light weight, NATSAT serves as a spacecraft bus onto which a variety of small experiments can be mounted and flown. Payload masses up to 23 kg can be bolted onto an external equipment platform and receive housekeeping services that include 40 W of power, 3 axis stabilization, TT&C links, ephemeris data, and a small amount of thermal control. Orbital inclinations from zero to sun synchronous are achievable with a minimum life of one year. With a combined bus and experiment mass of 113.5 kg, NATSAT is configured to be launched from Orbital Sciences Corporation's Pegasus vehicle.

Author

Satellite Design; Product Development; Structural Design; Systems Engineering; Spacecraft Propulsion; Design Analysis

20030020485 NASA Langley Research Center, Hampton, VA USA

InGaAsSb Detectors' Characterization for 2-Micron CO2 Lidar/DIAL Applications

Refaat, Tamer F., Science and Technology Corp., USA; Abedin, M. Nurul, NASA Langley Research Center, USA; Koch, Grady J., NASA Langley Research Center, USA; Singh, Upendra N., NASA Langley Research Center, USA; February 2003; 32p; In English

Contract(s)/Grant(s): RTOP 755-09-00-07

Report No.(s): NASA/TP-2003-212140; NAS 1.60:212140; L-18243; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Recent interest in monitoring atmospheric CO₂ focuses attention on infrared remote sensing using the 2-micron lidar/differential absorption lidar (DIAL) technique. Quantum detectors are critical components in this technique, and many research efforts concentrate on developing such devices for the 2-micron wavelength. Characterization results of InGaAsSb quantum detectors for the 2-micron wavelength range are presented, including experimental setup and procedure. Detectors are prototype devices manufactured by using separate absorption and multiplication (SAM) structures. Characterization experiments include V-I measurements, spectral response and its variation with bias voltage and temperature, noise measurements, noise-equivalent-power (NEP) and detectivity calculations, and signal-to-noise ratio (SNR) estimation. A slight increase in the output signal occurred with increased bias voltage and was associated with a noise level increase. Cooling down the detectors

reduces noise and shifts the cutoff wavelength to shorter values. Further improvement in the design and manufacturing process, by increasing the device gain and lowering its noise level, is necessary to meet the required CO2 lidar/DIAL specifications.

Author

Differential Absorption Lidar; Remote Sensing; Carbon Dioxide Concentration; Indium Gallium Arsenides; Antimony; Infrared Detectors

34

FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.

20030018860 NASA Ames Research Center, Moffett Field, CA USA

Implementation of Preconditioned Dual-Time Procedures in OVERFLOW

Pandya, Shishir A., NASA Ames Research Center, USA; Venkateswaran, Sankaran, Tennessee Univ., USA; Pulliam, Thomas H., NASA Ames Research Center, USA; [2003]; 12p; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC2-5493

Report No.(s): AIAA Paper 2003-0072; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Preconditioning methods have become the method of choice for the solution of flowfields involving the simultaneous presence of low Mach and transonic regions. It is well known that these methods are important for insuring accurate numerical discretization as well as convergence efficiency over various operating conditions such as low Mach number, low Reynolds number and high Strouhal numbers. For unsteady problems, the preconditioning is introduced within a dual-time framework wherein the physical time-derivatives are used to march the unsteady equations and the preconditioned time-derivatives are used for purposes of numerical discretization and iterative solution. In this paper, we describe the implementation of the preconditioned dual-time methodology in the OVERFLOW code. To demonstrate the performance of the method, we employ both simple and practical unsteady flowfields, including vortex propagation in a low Mach number flow, flowfield of an impulsively started plate (Stokes' first problem) and a cylindrical jet in a low Mach number crossflow with ground effect. All the results demonstrate that the preconditioning algorithm is responsible for improvements to both numerical accuracy and convergence efficiency and, thereby, enables low Mach number unsteady computations to be performed at a fraction of the cost of traditional time-marching methods.

Author

Flow Distribution; Unsteady Flow; Ground Effect (Aerodynamics); Iterative Solution; Cylindrical Bodies; Cross Flow; Accuracy

20030018861 NASA Ames Research Center, Moffett Field, CA USA

Automated CFD Parameter Studies on Distributed Parallel Computers

Rogers, Stuart E., NASA Ames Research Center, USA; Aftosmis, Michael J., NASA Ames Research Center, USA; Pandya, Shishir, NASA Ames Research Center, USA; Chaderjian, Neal, NASA Ames Research Center, USA; Tejnil, Edward, NASA Ames Research Center, USA; Ahmad, Jasim, NASA Ames Research Center, USA; [2003]; 7p; In English; NASA IPG Workshop, 5-6 Feb. 2003, Palo Alto, CA, USA; Sponsored by NASA Ames Research Center, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents viewgraphs of an automated process of running CFD parameter studies on distributed parallel computers. CASI

Computational Fluid Dynamics; Parallel Computers; Automatic Control; Distributed Processing; Prototypes

20030018885 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

Flow Predictions for Multi-Element Control Surfaces Final Report, 1 Jan. 2000-30 Sep. 2001

Lee, Yu-Tai; Ebert, Michael P.; Hosangadi, Ashvin; Dec. 2002; 28p; In English; Original contains color images

Contract(s)/Grant(s): Proj-93R1-01-HY

Report No.(s): AD-A409575; NSWCCD-50-TR-2002/061; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The TAC (Tab-Assisted Control) and FlexTAC (Flexible Tab-Assisted Control) airfoils based on NACA 0018 sections are conceptual multi-element airfoil designs for future marine vehicle control surfaces. In addition to a relative motion between the stabilizer and the flap, either a rigid (for TAC) or a flexible (for FlexTAC) tab is used to augment the functionality of the control

surfaces. The TAC airfoil has a front and a rear gap while FlexTAC airfoil has only the front gap. This report summarizes CFD validations on the TAC and FlexTAC airfoils using unstructured Reynolds Averaged Navier Stokes (RANS) solvers, i.e. UNCLE and CRUNCH codes. The force and moment predictions are compared with the 24- inch water-tunnel test data obtained for the TAC airfoil and the 36-inch water-tunnel data obtained for the FlexTAC airfoil. The CFD results suggest that the UNCLE and CRUNCH codes are able to predict the forces and moments with reasonable accuracy for flap angles under 20 degrees. The comparisons also indicate that the FlexTAC measured force data may have been over-corrected for the water-tunnel blockage. Comparisons between the measured TAC data and FlexTAC data imply that the gudgeons installed for the TAC experiments have a profound effect on the stabilizer and flap torque calculations, but have a minimum effect on the force calculations.

DTIC

Computational Fluid Dynamics; Flaps (Control Surfaces); Stabilizers; Flight Control

20030018961 Istituto Superiore di Sanita, Lab. of Biomedical Engineering, Rome, Italy

A Study of Discharge Coefficient in Bileaflet Valves

Grigioni, M.; Daniele, C.; D'Avenio, G.; Morbiducci, U.; Del Gaudio, C.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A410012; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The measurement of a cardiac valve's area is a common procedure, usually performed with noninvasive, Doppler-based techniques. Such measurements are not, however, without problems: a potential source of errors is the value of a valve's discharge coefficient. In-vitro pressure and flow measurements relative to the bileaflet valve of four brands were performed. A total of 12 valve samples was studied to cover the entire range of valve sizing. The data were used in the Gorlin formula for valve area measurements, and the dependence of the discharge coefficient on the internal diameter of the valve and the flow rate was accurately determined. The reported results can be used in a great number of follow-up clinical assessments to improve the accuracy of valvular orifice measurements.

DTIC

Heart Valves; Flow Velocity

20030019011 Naval Postgraduate School, Monterey, CA USA

A Characterization of Sway Forces Induced by Close Proximity Ship Towing

Rodriguez, Richard Y.; Mar. 2002; 86p; In English; Original contains color images

Report No.(s): AD-A409641; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The scope of this thesis is to characterize the connection forces in the horizontal plane of surface ships in close proximity towing in waves. Strip theory calculations are used in order to predict the hydrodynamic coefficients and wave exciting forces and moments in sway and yaw. The resistance-speed characteristics of the leading ship are used to provide the matching condition between the two ships. The two-parameter Bretschneider spectrum is used to model the sea environment. Results are presented in terms of speed polar and sea state polar plots. An extensive set of parametric studies is presented in regular waves as well as in a wide variety of sea states.

DTIC

Ocean Surface; Ships; Towing

20030019033 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

The Effect of Manifold Cross-Flow on the Discharge Coefficient Sharp-Edged Orifices

Strakey, P. A.; Talley, D. G.; Mar. 16, 1998; 34p; In English

Contract(s)/Grant(s): AF Proj. 3058

Report No.(s): AD-A409685; AFRL-PR-ED-TP-1998-067; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The objective of this study is to determine the effect of manifold cross-flow on the discharge coefficient and cavitation characteristics of sharp-edged orifices over a wide range of flow-rates, back-pressures and cross-flow velocities. The orifice geometries studied cover a range of orifice diameters, length to diameter ratios and orifice angles characteristic of impinging element liquid rocket injectors. Experimental results for an orifice angle of 90° with respect to the manifold are presented here. Along with the experimental effort, an analytical model is being developed. The model predicts the discharge coefficient for a sharp edged orifice over a wide range of flow regimes including cavitating and non-cavitating flow, and for a wide range of orifice geometries. The analytical model generally shows good agreement with the experimental data over the range of conditions studied

here. The model also closely follows the experimental data for cavitating flow except when the orifice length to diameter ratio is small, in which case the model over-predicts the discharge coefficient.

DTIC

Cross Flow; Manifolds; Orifices

20030019049 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Computation of Spray Dynamics by Direct Solution of Moment Transport Equations

Archambault, Mark R.; Edwards, Christopher F.; Sep. 27, 1999; 13p; In English; Presented at the Annual AIAA (38th) Mtng. on Atomization and Spray Systems, 10-13 Jan. 2000

Contract(s)/Grant(s): AF Proj. 3058

Report No.(s): AD-A410053; AFRL-PR-ED-TP-FY99-0183; AIAA-2000-0197; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In many spray applications, it is important to know the size and velocity distribution of the drops. Conventional particle tracking techniques can require prohibitively large computational times, especially in regions of low droplet number density or when detailed statistics are desired. In this paper, we develop a method to compute the statistics directly by solving a series of moment transport equations. A maximum entropy model is used to close higher-order moments appearing in the equations. Solution of these equations gives not only the transported moments of the spray, but also the maximum entropy probability distribution function from which further statistics can be obtained. The method has been tested on a quasi-one-dimensional spray problem to assess its viability. Submodels which account for the effects of the gas on the drops, including turbulence modification and correlation between the gas and drop velocities, are incorporated. Results for expected quantities are in good agreement with the solution from a particle tracking simulation.

DTIC

Particles; Spray Characteristics; Drops (Liquids)

20030019063 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Computation of Spray Dynamics by Direct Solution of Moment Transport Equations-Inclusion of Nonlinear Momentum Exchange

Archambault, M. R.; Edwards, C. F.; May 11, 2000; 10p; In English; Presented at the Intl Conference on Liquid Atomization and Spray Systems (8th) held in Pasadena, CA on 16-20 Jul. 2000. Prepared in cooperation with the Dept. of Mechanical Engineering, Stanford Univ. CA

Contract(s)/Grant(s): Proj-3058

Report No.(s): AD-A410102; AFRL-PR-ED-TP-2000-108; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Using conventional particle tracking techniques to predict the dynamics of spray flows can be prohibitively expensive, requiring large computation times and significant data storage. Moreover, because of the discontinuous nature of the spray drops, data from a simulation of the flow does not produce smooth statistics unless the results from many simulations have been averaged. Recently, a new model was developed that computes spray statistics directly, without simulating the flow. In this paper, the model is extended to include the effects of nonlinear momentum exchange between the phases. The approach was tested on a quasi-one-dimensional flow geometry. The results are compared with a Lagrangian simulation and demonstrate good agreement.

DTIC

Flow Geometry; Nonlinearity; Momentum Transfer; Sprayers

20030019069 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Spray Characteristics of Impinging Jet Injectors at High Back-Pressure

Strakey, P. A.; Talley, G. D.; May 03, 2000; 7p; In English; Presented at Eighth International Conference on Liquid Atomization and Spray Systems, 16-20 Jul. 2000, Pasadena, CA

Contract(s)/Grant(s): Proj-3058

Report No.(s): AD-A410114; AFRL-PR-ED-TP-2000-104; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Atomization characteristics of an impinging jet injector were studied over a range of injection velocities and back-pressures typical of liquid rocket injectors. Sheet breakup length was measured by strobe light imaging and was found to decrease with increasing injection velocity and chamber pressure. The experimentally measured breakup length was compared to linear stability theory and agreement was found to improve with increasing chamber gas density. At low chamber pressures, disturbances due to impact waves were believed to be the primary breakup mechanism. Measurements of droplet size distribution were made with a combination of laser diffraction and droplet imaging instruments. Droplet size was found to be a highly non-linear function of chamber pressure and axial distance from the impingement point. Sauter mean diameter was found to decrease with increasing

chamber pressure and axial distance. Secondary atomization was believed to be the breakup mechanism responsible for this dependence. The width of the droplet size distribution was also found to be a function of chamber pressure.

DTIC

Impingement; Injectors; Jet Impingement; Spray Characteristics; Liquid Rocket Propellants

20030019178 Istituto Superiore di Sanita, Lab. of Biomedical Engineering, Rome, Italy

Hydraulic Properties of the Hemopump HP31: A Study of the Downstream Pressure Distribution

Grigioni, M.; Carotti, A.; Daniele, C.; Morbiducci, U.; Gaudio, C. D.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A409716; X5-X5; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Hemopump was commercialized as an useful tool for the left ventricle assistance. Bioengineers and clinicians showed great interest to develop applications and to analyze its hydraulic behavior; in this work an application for axial pump in different conditions is presented. A study of the spatial pressure distribution generated by the impeller of the Hemopump is investigated in highly accurate steady-flow conditions. The experimental set up adopted for this study consists in a plexiglass test pipe (simulating an aortic conduit of 22-mm diameter) and allows the sampling of the pressure at the outlet of the pump in 16 points spaced 1/2 diameter each other. Keeping fixed the constant head at the inlet of the Hemopump and varying the constant head at its outlet, i. e. afterloads, in 11 step levels, it was possible to draw the characteristic flow curves versus delivered pressure for all the seven speed levels. A pressure range of about 35/130 mmHg and a flow range of about -0.7/3.7 l/min was experimented. The results show that the flow delivered by the Hemopump is fully developed after 5 pressure taps (about 55 mm), with no further varying along the test chamber. These data could be used to optimize the setting up of clinical experimental procedures.

DTIC

Pumps; Hydraulics; Pressure Distribution

20030019220 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Three-Dimensional Simulations of a Gas/Gas, Hydrogen/Oxygen Engine

Archambault, Mark; Perroomian, Oshin; Nov. 2002; 7p; In English; Prepared in collaboration with Metacomp Technologies, Westlake Village, CA. Pres. at AIAA Computational Fluid Dynamics Conf. (16th). Held in Orlando, FL, 23-26 Jun 2003

Contract(s)/Grant(s): AF Proj. 3058

Report No.(s): AD-A409832; AFRL-PR-ED-AB-2002-276; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The overall objective of this research is to establish a design methodology for gas/gas injectors. This paper, however, focuses on a computational methodology to efficiently, accurately, and robustly obtain high-fidelity solutions of combusting rocket engine flows to gain a knowledge and understanding of their features. To that end, simulations of a single-element, shear-coaxial, H₂/O₂ engine are being performed to characterize its flowfield and to validate the CFD++ flow solver for this class of problems. Previous work has focused on obtaining solutions on a grid three to four times finer than those reported by other researchers and resolving numerical issues that reduce the computational efficiency of this inherently unsteady flow. Comparisons of steady and averaged time-accurate solutions have also shown that a steady solution may not provide an accurate depiction of the combusting flow field over time.

DTIC

Computational Fluid Dynamics; Flow Distribution; Rocket Engines

20030019221 Energy Research Consultants, Inc., Laguna Hills, CA USA

Experiences on Cryogenic Injection under Supercritical Condition

Chehroudi, Bruce; Talley, Doug; Cohn, R.; May 22, 2000; 10p; In English; Presented at the Intl Conference on Liquid Atomization and Spray Systems (8th) held in Pasadena, CA on 17-20 Jul. 2000

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409831; AFRL-PR-ED-TP-2000-118; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Experience learned at the AFRL on injection of cryogenic jets into sub- and supercritical conditions using shadowgraphy and Raman scattering measurements are presented here. Metamorphic behavior of the jet boundary undergoing disruption has been shown to occur near the critical point of the injected fluid. At subcritical pressures, formations of droplets and ligaments are seen, resembling a second wind-induced liquid-jet breakup. The jet is incapable of reaching the classical full atomization regime due to existence of the critical point of the jet fluid within the operating range. At this point, the jet anatomy changes abruptly to imitate turbulent gas jet injection. The jet initial growth rate is plotted against the chamber-to-injectant density ratio, along with available

data on other liquid/gaseous jets and mixing layers, producing a unique and informative graph. For supercritical conditions, our measured growth rate agrees well with a theoretical equation proposed by Dimotakis 1 and closely follows the trend of Papamoschou and Roshko 2 for incompressible but variable-density gaseous turbulent mixing layers. Fractal analysis of the jet boundary also shows a similarity to gas jet behavior with comparable fractal dimension. This is the first time quantitative evidence has been provided to support qualitative visualizations suggesting that supercritical jets appear to behave like conventional gas jets.

DTIC

Supercritical Flow; Fuel Injection; Cryogenic Rocket Propellants

20030019223 Energy Research Consultants, Inc., Laguna Hills, CA USA

Raman Scattering Measurement in the Initial Region of Sub- and Supercritical Jets

Chehroudi, Bruce; Cohn, R.; Talley, Doug; Badakhshan, A.; Jul. 19, 2000; 12p; In English; Presented at the AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit (36th) held in Huntsville, AL on 17-19 Jul. 2000

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409828; AFRL-PR-ED-TP-2000-145; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A high-pressure chamber is used to investigate and further enhance our knowledge and physical understanding on effects of thermodynamical subcritical-to-supercritical transition of ambient condition on cryogenic liquid injection using two-dimensional scattering. Pure liquid N₂ is injected into N₂. The injector is a 508-micron diameter straight hole having a long length-to-diameter ratio of 100. The optical setup uses a pulsed Nd:YAG laser frequency-doubled to 532 nm. Difficulties arise with optical breakdown of the N₂ molecules in drops and ligaments by local focusing of the laser beam dominating the Raman signal particularly at sub- and near-critical regions. The severity of this problem is reduced by stretching the laser pulse width using a double-loop design with mirrors and beam splitters. Careful and painstaking alignment is needed to take advantage of this pulse-stretcher design. Two-dimensional images are taken near the injector and results interpreted in terms of density plots. At subcritical ambient conditions a small number of images are needed for averaging and strong Raman signal is obtained.

DTIC

Combustion Chambers; Liquid Propellant Rocket Engines; Supercritical Flow; Jet Flow; Cryogenic Rocket Propellants; Raman Spectra; Subcritical Flow

20030019225 Energy Research Consultants, Inc., Laguna Hills, CA USA

The Behavior of Cryogenic Shear Layers under Supercritical Conditions

Chehroudi, Bruce; Cohn, R.; Talley, Doug; Jun. 29, 2001; 5p; In English; Presented at the Intl Symposium on Turbulence and Shear Flow Phenomena (2nd) held in Stockholm, Sweden on 27 Jun. 2001

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409825; AFRL-PR-ED-TP-2000-173; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

As combustion chamber pressures increase in order to realize higher performance and efficiency in a wide range of propulsion applications, the injected fluid may experience ambient pressures which exceed the critical pressure of the injected propellants. For example, in the cryogenic liquid hydrogen/liquid oxygen Space Shuttle main engine, the thrust chamber pressure is more than 4 times larger than the critical pressure of oxygen. In these applications, the initial temperature of the injected oxygen can initially be below the critical temperature, and then undergo a transition to a supercritical temperature as the oxygen is mixed and burned in the combustion chamber.

DTIC

Liquid Propellant Rocket Engines; Supercritical Flow; Cryogenic Rocket Propellants; Shear Layers

20030019302 Rutgers - The State Univ., Dept. of Mechanical and Aerospace Engineering, Piscataway, NJ USA

Large Eddy Simulation of Three Dimensional High Speed Aerodynamic Flows Final Report, 1 Dec. 1998-31 Mar. 2002

Knight, Doyle D.; Jun. 30, 2002; 40p; In English

Contract(s)/Grant(s): F49620-99-1-0008

Report No.(s): AD-A409569; RU-TR-MAE-F-203B; AFRL-SR-AR-TR-02-0435; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An unstructured grid Large Eddy Simulation (LES) methodology has been developed for compressible high speed flows. The filtered compressible Navier-Stokes equations are solved on an unstructured grid of tetrahedra. The inviscid fluxes are obtained from an exact locally one-dimensional Riemann solver using Godunov's method. The viscous fluxes are obtained using a discrete analog of Gauss' Theorem. The reconstruction is performed using a Least Squares technique. The temporal integration is a Runge-Kutta method. The algorithm is overall second order accurate in space and time. Four flow fields have been computed:

supersonic flat plate boundary layer, supersonic compression corner, supersonic expansion-compression corner and subsonic square jet. The computed results show close agreement with experiment and Direct Numerical Simulation, and validate the unstructured grid LES methodology.

DTIC

Turbulence; Vortices; Computational Fluid Dynamics; Three Dimensional Flow; Large Eddy Simulation

20030019876 Smithsonian Astrophysical Observatory, Cambridge, MA USA

The Origin and Distribution of Heavy Elements in the CD Groups MKW 4 and AWM 4 Final Report, 1 Nov. 2000 - 31 Oct. 2002

Vrtilek, Jan, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English

Contract(s)/Grant(s): NAG5-10071; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

At this point, data for MKW4 have been received and those for AWM4 are still awaited. The MKW4 data have been fully analyzed and a complete manuscript is available and in final review by co-authors before submission for refereed publication. The following is a summary of our principal findings: We examined the distribution and properties of the hot gas which makes up the group halo. The inner halo shows some signs of structure, with circular or elliptical beta-models providing a poor fit to the surface brightness profile. This may be evidence of large-scale motion in the inner halo, but we do not find evidence of sharp fronts or edges in the emission. The temperature of the halo declines in the core, with deprojected spectral fits showing a central temperature of approximately 1.3keV compared to approximately 3keV at 250 arcsec. However, cooling flow models provide poor fits to the inner regions of the group and the estimated cooling time of the gas is long except within the central dominant galaxy, NGC4073. Abundance profiles show a sharp increase in the core of the group. We conclude that MKW4 is a fairly relaxed group, which has developed a strong central temperature gradient but not a large-scale cooling flow.

Author

Stellar Evolution; Mathematical Models; Heavy Elements; Chemical Reactions; High Temperature Gases; Stellar Structure; Astronomical Models

20030020404 Industria de Turbo Propulsores S.A., Madrid, Spain

Investigation on the Capability of a Non Linear CFD Code to Simulate Wave Propagation

delaCazada, Pedro, Industria de Turbo Propulsores S.A., Spain; Quintana, Pablo, Industria de Turbo Propulsores S.A., Spain; Burgos, Manuel Antonio, Industria de Turbo Propulsores S.A., Spain; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 4-1 - 4-15; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The potential wave propagation is described by defining the driving parameters of the propagation characteristics. Then a parametric study with a non linear code is performed in order to define the mesh refinement needed to obtain a sufficient accuracy in the predictions of inflow and outflow perturbation propagation. The results are compared with a linear version of the code as well as with a linear code for flat plate response showing the good behaviour of the non linear code. As additional test cases, the behaviour of the code for simulating the response of a cascade of flat plates to potential disturbances is investigated. Results from the different linear and non linear codes are also compared. Different cases are investigated including one with large resonances, which is shown to be the most difficult case to be predicted, in special the resonance peaks as well as the trailing edge region regarding the wave phase behaviour.

Author

Computational Fluid Dynamics; Nonlinearity; Wave Propagation

20030020448 Stanford Univ., Center for Turbulence Research, Stanford, CA USA

Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program

Bradshaw, Peter, Editor, Stanford Univ., USA; December 2002; 399p; In English, 29 Jul. - 23 Aug. 2002, Stanford, CA, USA; Also announced as 20030020449 through 20030020480

Contract(s)/Grant(s): NCC2-1151; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

The ninth Summer Program of the Center for Turbulence Research was held during the period July 29th - August 23rd, 2002. The increase in number of participants, noted in the Preface to the Proceedings of the 2000 Program, continues: this year there were 50 participants from ten countries, and 30 hosts from Stanford and NASA-Ames. This Proceedings volume contains 32 papers that span a wide range of topics and an enormous range of physical scales. The papers have been divided into seven groups:

Acoustics, RANS modeling, Combustion, Large-eddy simulation (LES), LES Numerics, Stratified Flows, and Fundamentals, In several cases, a paper could have fitted in more than one group so the classification is somewhat arbitrary.

Derived from text

Large Eddy Simulation; Turbulence; Acoustics; Combustion

20030020449 Eidgenoessische Technische Hochschule, Inst. of Fluid Dynamics, Zurich, Switzerland

An Evaluation of LES for Jet Noise Prediction

Rembold, B., Eidgenoessische Technische Hochschule, Switzerland; Freund, J. B., Illinois Univ., USA; Wang, M., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 5-14; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Large-eddy simulation (LES) is an attractive candidate for prediction of jet noise, since it resolves unsteady flow structures over a range of length scales, but it remains unclear how the subgrid-scale modeling affects its noise-prediction capability. The present study makes a direct evaluation of LES using the approximate deconvolution model against a corresponding direct numerical simulation (DNS) of a 5:1 aspect ratio rectangular jet at Mach 0.5. The DNS spectra and directivity are as anticipated for a low-Reynolds-number jet, and we compare these to LES predictions. We find that the LES spectra match the DNS ones at low frequencies, but the higher frequency portions are highly contaminated by spurious waves particularly at upstream angles. A correction for the subgrid-scale contribution to the Lighthill source terms based on approximate deconvolution of the velocities does not change the LES prediction.

Author

Large Eddy Simulation; Noise Prediction (Aircraft); Direct Numerical Simulation; Aspect Ratio; Unsteady Flow

20030020450 Illinois Univ., Dept. of Theoretical and Applied Mechanics, Urbana-Champaign, IL USA

Turbulence Interactions Leading to Far-Field Jet Noise

Freund, J. B., Illinois Univ., USA; Bodony, D. J., Stanford Univ., USA; Lele, S. K., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 15-25; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

It is well understood that it is the development, not just the convection, of jet turbulence that generates fluctuations with supersonic phase velocities which radiate noise to the far acoustic field, but the mechanisms causing this mode conversion are not understood. The relative efficiency of the interactions of turbulence with the mean flow and the turbulence 'self' interactions has not been quantified. In light of this, tools are developed here to analyze the process of mode conversion (scattering of flow energy into acoustic energy) in a jet. Very large scales, with typical lengthscale between the turbulent integral length and the dominant acoustic wavelength, are thought to be capable of radiating to the far-field. Inhomogeneous linearized filtered equations for the very large scale dynamics are derived and presented. The resulting source terms are computed from a well validated DNS database, which also provides an 'deal' subgrid-scale model for their evolution. A capability to analyze the mode conversion in streamwise frequency-wavenumber coordinates is also developed and discussed.

Author

Far Fields; Jet Aircraft Noise; Turbulence; Acoustics; Direct Numerical Simulation

20030020451 California Univ., San Diego, CA USA

Perturbation and Adjoint Analyses of Flow-Acoustic Interactions in an Unsteady 2D Jet

Cervino, L. I., California Univ., USA; Bewley, T. R., California Univ., USA; Freund, J. B., Illinois Univ., USA; Lele, S. K., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 27-40; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

It is well known that noise sources embedded in a jet produce sound fields which refract due to the presence of the flow. The refraction due to the mean flow has been appreciated and modeled for some time, but only occasionally is the significant refractive effect of the unsteadiness of the flow acknowledged. In the present work, perturbation and adjoint analyses of high-frequency acoustic fluctuations are performed in a numerical simulation of a cold 2D jet system at a Mach number of $M = 0.5$ and a Reynolds number based on the jet diameter of $Re(\text{sub } D) = 5000$. The jet system is hydrodynamically excited into a sinuous mode near the jet exit at a Strouhal number of $St = 0.4$, and exhibits the classical vortex roll-up phenomenon. Acoustic perturbations to this flow

system are analyzed at Strouhal numbers of $St = 0.8$, $St = 2$, and $St = 8$ (that is, 2x, 5x, and 20x the vortex roll-up frequency). It is found that the unsteady effects of the flow cause a significant frequency broadening in both the perturbation and adjoint analyses.

Author

Perturbation; Flow Characteristics; Unsteady Flow; Strouhal Number

20030020452 Melbourne Univ., Australia

RANS Calculations of Secondary Flow Structures in Ribbed Ducts

Ooi, A., Melbourne Univ., Australia; Reif, B. A. Petterson, Norwegian Defence Research Establishment, Norway; Iaccarino, G., Stanford Univ., USA; Durbin, P. A., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 43-52; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The spatial structure and effects of secondary flows in ribbed ducts are investigated using numerical data from Reynolds-averaged Navier-Stokes (RANS) calculations. Ducts with ribs placed at different angles to the mean flow are considered. The mean flow is assumed to be fully developed; therefore, only a small portion of the duct is calculated, and periodic boundary conditions are used in the streamwise direction. The computations are carried out using turbulence models based on the concept of isotropic eddy viscosity. Hence, only secondary flows (of the first kind) due to inviscid effects are predicted. Of particular interest is the effect of the secondary flow on the heat-transfer rate through the walls. It is demonstrated that, for ribs perpendicular to the flow, the secondary flow localizes the heat-transfer rate and has a direct effect on the spatial distribution of Nusselt number, Nu , on the smooth side wall of the duct. However, the value of Nu averaged over all the walls is not significantly affected by the presence of the secondary-flow structures. For ribs that are at an angle to the main flow, the presence of secondary flow influences both the spatial distribution and the average value of Nu .

Author

Reynolds Averaging; Navier-Stokes Equation; Ducts; Ribs (Supports); Turbulence Models; Flow Velocity

20030020453 City Coll. of the City Univ. of New York, NY USA

Modeling Convection Heat Transfer and Turbulence with Fire Applications: A High Temperature Vertical Plate and a Methane Fire

Rouson, D., City Coll. of the City Univ. of New York, USA; Tieszen, S. R., Sandia National Labs., USA; Evans, G., Sandia National Labs., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 53-70; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Simulations of the three-dimensional turbulent flow and heat transfer adjacent to a large (3 meter) high temperature (up to 860 K) vertical flat plate and in a large-scale methane flame have been made and compared with experimental data. Results are obtained with a Reynolds averaged Navier-Stokes (RANS) $v(\text{sup } 2) - f$ model, a direct numerical simulation (DNS), and a detached eddy simulation (DES) model. The preliminary results are encouraging, with respect both to heat transfer and to the prediction of large-scale structures in these highly buoyant flow fields.

Author

Reynolds Averaging; Navier-Stokes Equation; Convective Heat Transfer; Turbulent Heat Transfer; Fires; Direct Numerical Simulation; Flow Distribution; High Temperature

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Evaluation of Subgrid-Scale Models in Terms of Time Correlations

He, Guo-Wei, Academia Sinica, China; Wang, Meng, Stanford Univ., USA; Lele, Sanjiva K., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 73-78; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In certain applications such as the computation of turbulent sound sources, Large-Eddy Simulation (LES) is required to predict correctly the space-time correlations of the velocity field. A previous study (He, Rubinstein & Wang 2002) has shown that LES with the spectral eddy-viscosity model over-predicts time correlations. In this work, we evaluate the Smagorinsky model, the dynamic Smagorinsky model and the multi-scale LES method in terms of time correlations. The dynamic Smagorinsky model is shown to give better predictions on time correlations than the constant-coefficient Smagorinsky model, which gives significant over-predictions. The results from the multi-scale LES method are in between. The over-predictions are discussed according to

the random backscatter and the sweeping hypothesis. Based on those discussions, a history-dependent sub-grid scale model is suggested for time correlations.

Author

Scale Models; Dynamic Models; Correlation; Eddy Viscosity; Large Eddy Simulation

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Large-Eddy Simulations with Explicit Equations for Subgrid-Scale Quantities

Carati, Daniele, Free Univ., Belgium; Wray, Alan A., NASA Ames Research Center, USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 79-86; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Various alternative formulations of the LES equations have been explored in which additional evolution equations for variables such as the acceleration, the subgrid-scale stress tensor, or the subgrid-scale force are explicitly carried. Statistics of the velocity field obtained from the equation for the acceleration are shown to depend strongly on the initial conditions. This feature, which is independent of LES modeling issues, seems to prove that the velocity-acceleration formulation of the Navier-Stokes is not useful for numerical simulation. Equations for the subgrid-scale quantities appear to be much more stable. However, models required by this formulation of the LES problem still require additional study.

Author

Large Eddy Simulation; Navier-Stokes Equation; Velocity Distribution

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Investigation of Numerical Errors, Subfilter-Scale Models, and Subgrid-Scale Models in Turbulent Channel Flow Simulations

Gullbrand, Jessica, Stanford Univ., USA; Chow, Fotini Katopodes, Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 87-104; In English; Also announced as 20030020448

Contract(s)/Grant(s): NSF ATM-00-73395; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Turbulent channel flow simulations are performed using second- and fourth-order finite difference codes. A systematic comparison of the large-eddy simulation (LES) results for different grid resolutions, finite difference schemes, and several turbulence closure models is performed. The use of explicit filtering to reduce numerical errors is compared to results from the traditional LES approach. Filter functions that are smooth in spectral space are used, as the findings of this investigation are intended for application of LES to complex domains. Explicit filtering introduces subfilter-scale (SFS) as well as subgrid-scale (SGS) turbulence terms. The former can theoretically be reconstructed; the latter must be modeled. For turbulence models, the dynamic Smagorinsky model (DSM), the dynamic mixed model (DMM), and the dynamic reconstruction model (DRM) are all studied. It is found that for explicit filtering, increasing the reconstruction levels for the SFS stress improves the mean velocity as well as the turbulence intensities. When compared to LES without explicit filtering, the difference in the mean velocity profiles is not large; however the turbulence intensities are improved for the explicit filtering case.

Author

Error Analysis; Scale Models; Large Eddy Simulation; Turbulence Models; Computational Grids; Channel Flow

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Comparison of Recent Dynamic Subgrid-Scale Models in Turbulent Channel Flow

Jeanmart, H., Universite Catholique de Louvain, Belgium; Winckelmans, G. S., Universite Catholique de Louvain, Belgium; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 105-116; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Some recent subgrid-scale models are evaluated in turbulent channel flow at $Re(\text{sub } t) = 395$. The models considered were chosen among those performing best in decaying isotropic turbulence, following the study by Winckelmans & Jeanmart (2001): the dynamic Smagorinsky model (used as a baseline); a dynamic and regularized version of the variational multiscale model of Hughes, Mazzei, Oberai & Wray (2001); a dynamic "Smagorinsky + hyperviscosity" model (here with two dynamic coefficients); and a dynamic Smagorinsky model acting on an artificially-enhanced velocity field. The last three models put more emphasis than the Smagorinsky model on the subgrid-scale (SGS) dissipation at small scales, leading to significant improvement of the results in isotropic turbulence. The last two models combine viscosity and hyperviscosity effects. The dynamic procedure was implemented for each model, with and without adding a test projection in the wall-normal direction. The projection uses a combined "sampling + interpolation" procedure, applied in physical space. The models are assessed and compared to the direct numerical simulation (DNS) data of Moser, Kim & Mansour (1999) on the basis of mean profiles of velocity, rms velocities and

reduced (deviatoric) turbulence intensities. A main outcome is the good behavior of the multiscale model of Hughes et al. as compared to the Smagorinsky model. Good results are also obtained when using the Smagorinsky model acting on an artificially-enhanced velocity field. In all cases, the dynamic procedure without test "sampling + interpolation" in the wall-normal direction leads to better agreement with the DNS data. The poor performance of "sampling + interpolation" is most probably due to the interpolation part, and a possible solution to the problem is proposed.

Author

Channel Flow; Turbulent Flow; Multiscale Models; Isotropic Turbulence; Direct Numerical Simulation

20030020458 Cornell Univ., USA

Tools for Large-Eddy Simulation

Caughey, David A., Cornell Univ., USA; Jothiprasad, Giridhar, Cornell Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 117-127; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A computer code has been developed for solving the incompressible Navier-Stokes equations for test flows that will allow the comparison of various strategies for assessing the accuracy of LES solutions for flows at large Reynolds number, where it is impractical to make direct comparisons with DNS solutions for the same flow. The code includes options for a conventional Smagorinsky subgrid model, as well as hyperviscosity dissipative terms that will allow a greater separation of scales for high Reynolds number flows. In this report, the code is validated for several simple, periodic flows, including the Taylor-Green vortex and decaying isotropic turbulence, and preliminary results are presented, showing good agreement for (forced, periodic) Kolmogorov flow in the limit of high Reynolds number, on relatively modest meshes using the hyperviscosity dissipation.

Author

Computer Programs; Large Eddy Simulation; Incompressible Flow; Direct Numerical Simulation; Algorithms

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Toward Optimal LES on Unstructured Meshes

Haselbacher, A., Illinois Univ., USA; Moser, R. D., Illinois Univ., USA; Constantinescu, G., Stanford Univ., USA; Mahesh, K., Minnesota Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 129-140; In English; Also announced as 20030020448

Contract(s)/Grant(s): B341494; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A new approach for determining the correlation data required by the optimal-LES procedure of Langford and Moser (Optimal LES formulations for isotropic turbulence, J. Fluid Mech., 398, 321-346, 1999) is presented. Based on Kolmogorov's theory for isotropic turbulence, the new approach leads to stencil coefficients in terms of integrated multi-point correlations. The explicit dependence of the optimal-LES method on DNS data is thus eliminated, and its applicability is extended to high Reynolds-number flows in complex geometries. A preliminary verification of the new optimal-LES method for decaying isotropic turbulence showed good results for decay rates.

Author

Unstructured Grids (Mathematics); Large Eddy Simulation; Direct Numerical Simulation; Isotropic Turbulence

20030020460 Electricite de France, France

Colocated Finite-Volume Schemes for Large-Eddy Simulation on Unstructured Meshes

Benhamadouche, S., Electricite de France, France; Mahesh, K., Minnesota Univ., USA; Constantinescu, G., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 143-154; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Code-Saturne is a finite-volume, unstructured-grid code developed at Electricite De France (EDF), which solves the Reynolds-averaged Navier-Stokes equations for incompressible flows. The code has been extensively benchmarked for a variety of industrial applications. The solver has been extended at EDF to solve large-eddy simulation equations, and we found that the numerical methods used in the base RANS code are not directly applicable to LES. This paper uses Code-Saturne to investigate the performance of several numerical schemes for LES of different academic and industrial flows. In particular, the conservation of global kinetic energy and robustness of several numerical schemes are compared and discussed. Finally, Code-Saturne with non-dissipative numerical methods is validated for the swirling flow in a coaxial geometry corresponding to the experiments of Sommerfeld & Qiu (1991). Also, the role of the subgrid-scale (SGS) model is investigated through simulations without a SGS model (coarse DNS), with a constant Smagorinsky model and with a dynamic Smagorinsky model.

Author

Finite Volume Method; Large Eddy Simulation; Unstructured Grids (Mathematics); Mathematical Models; Computer Programs

20030020461 Rice Univ., Houston, TX USA

Discontinuous Galerkin Methods for Turbulence Simulation

Collis, S. Scott, Rice Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 155-167; In English; Also announced as 20030020448

Contract(s)/Grant(s): ATP-003604-0011-2001; NSF MRI-01-16289; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A discontinuous Galerkin (DG) method is formulated, implemented, and tested for simulation of compressible turbulent flows. The method is applied to turbulent channel flow at low Reynolds number, where it is found to successfully predict low-order statistics with fewer degrees of freedom than traditional numerical methods. This reduction is achieved by utilizing local hp-refinement such that the computational grid is refined simultaneously in all three spatial coordinates with decreasing distance from the wall. Another advantage of DG is that Dirichlet boundary conditions can be enforced weakly through integrals of the numerical fluxes. Both for a model advection-diffusion problem and for turbulent channel flow, weak enforcement of wall boundaries is found to improve results at low resolution. Such weak boundary conditions may play a pivotal role in wall modeling for large-eddy simulation.

Author

Galerkin Method; Simulation; Discontinuity; Turbulent Flow; Computational Grids; Mathematical Models

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Toward the LES of Flow Past a Submerged Hydrofoil

Pascarelli, A., Instituto Univ. Navale, Italy; Iaccarino, G., Stanford Univ., USA; Fatica, M., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 169-176; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The fluid flow past a body placed in a steady stream close to a free surface is the object of the current investigation. The viscous, incompressible Navier-Stokes equations, supplemented by linearized dynamic and kinematic boundary conditions at the free surface, are solved so that the water-surface elevation can be integrated into the solution and solved for, together with the velocity and pressure fields. The potential and limitations of the method will be illustrated and discussed.

Author

Fluid Flow; Hydrofoils; Large Eddy Simulation; Mathematical Models; Discretization (Mathematics)

20030020463 Kyoto Univ., Japan

Characterization of Near-Wall Turbulence in Terms of Equilibrium and Periodic Solutions

Kawahara, Genta, Kyoto Univ., Japan; Jimenez, Javier, Universidad Politecnica de Madrid, Spain; Shiba, Makoto, Ehime Univ., Japan; Simens, Mark, Universidad Politecnica de Madrid, Spain; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 179-190; In English; Also announced as 20030020448

Contract(s)/Grant(s): BFM2000-1468; N0014-00-1-0146; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Near-wall turbulence in the buffer region is qualitatively characterized in terms of recently found nonlinear three-dimensional solutions to the incompressible Navier-Stokes equation for wall-bounded shear flows. Jimenez & Simens' (2001) traveling-wave solution for an autonomous wall flow, Nagata's (1990) steady and Kawahara & Kida's (2001) periodic solutions for a plane Couette flow are considered for characterization. These equilibrium and periodic solutions are classified into two families, of which one is dominated by streamwise vortices, and the other by streaks. The former family, which is composed of autonomous solutions, Nagata's upper-branch solutions and time-periodic solutions, is similar to fully-turbulent simulations in the near-wall region.

Author

Incompressible Flow; Navier-Stokes Equation; Turbulent Flow; Wall Flow; Equilibrium Flow

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Large-Eddy Simulation of Turbulent Combustion for Gas Turbines with Reduced Chemistry

Selle, L., Centre Europeen Recherche et de Formation Advance en Calcul Scientific, France; Lartigue, G., Centre Europeen Recherche et de Formation Advance en Calcul Scientific, France; Poinot, T., Centre Europeen Recherche et de Formation Advance en Calcul Scientific, France; Kaufmann, P., Siemens A.G., Germany; Krebs, W., Siemens A.G., Germany; Veynante, D., Ecole Centrale de Paris, France; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 333-344; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

An LES computation has been performed for the complete burner of a partially-premixed gas turbine, for both non-reacting and reacting cases. The flame is described using a two-step chemical scheme combined with the thickened-flame (TF) model. Results show that the inlet boundary conditions (especially the swirl level) have a very large effect on flow topology. With the correct inlet conditions, the overall agreement with experiment is very good, for both cold flow and reacting flows.

Author

Turbulent Combustion; Gas Turbines; Large Eddy Simulation; Reacting Flow

20030020465 Stanford Univ., Stanford, CA USA

MHD Turbulence in the Presence of a Strong Magnetic Field

Kassinis, S. C., Stanford Univ., USA; Knaepen, B., Stanford Univ., USA; Carati, D., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 191-201; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We consider the case of homogeneous turbulence in a conducting fluid that is exposed to a uniform external magnetic field. When the magnetic Reynolds number is vanishingly small (R_m much less than 1), the induced magnetic fluctuations are much weaker than the applied field, and in addition, their characteristic time scale based on their diffusion is much shorter than the eddy turnover time. In this case, it is customary to simplify the governing MHD equations using what is known as the quasi-static (QS) approximation. In practice, the QS approximation is often used even when R_m is moderately high, where its validity is unclear. Here we introduce a new approximation, which we have called the Quasi-Linear (QL) approximation, which is designed to be valid for both small and moderate R_m . The accuracy of both approximations is systematically studied in a series of direct numerical simulations (DNS) of decaying MHD turbulence, in which their predictions are compared with those of the full system of MHD equations. Both approximations are satisfactory for R_m less than or equal to 1, but the QL approximation is clearly shown to be much more accurate for moderately high values, 1 less than or equal to R_m less than or equal to 10.

Author

Homogeneous Turbulence; Magnetohydrodynamic Turbulence; Magnetic Fields; Magnetohydrodynamics; Computational Fluid Dynamics

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Characteristics of Scalar Dispersion in Turbulent-Channel Flow

delAlamo, Juan, Universidad Politecnica de Madrid, Spain; Jimenez, Javier, Universidad Politecnica de Madrid, Spain; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 203-214; In English; Also announced as 20030020448; Sponsored in part by the CTR

Contract(s)/Grant(s): BFM-2000-1468; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The dispersion of a passive scalar by wall turbulence, in the limit of infinite Peclet number, is analyzed using frozen velocity fields from the DNS of del Alamo & Jimenez (2001). The Lagrangian trajectories of fluid particles in these fields are integrated and used to compute the first- and second-order moments of the distribution of fluid-particle displacements. It is shown that the largest scales in the flow dominate turbulent diffusion, and the computed dispersion is in good agreement with measurements in the atmospheric boundary layer. This agreement can be understood by noting that the lifetimes of the large structures are much longer than the time scale of the transition from linear to Gaussian particle spreading in the cross-stream plane. Numerical experiments on computing the Lagrangian trajectories in reference frames moving at different velocities suggest that this transition is controlled by the difference between the mean streamwise velocity and the phase speed of the large-scale structures of the cross-stream velocity field. In the streamwise direction, the effect of the mean shear dominates and produces elongated scalar patches, with dispersion exponents which are different from the transverse ones.

Author

Channel Flow; Turbulent Flow; Velocity Distribution; Displacement; Flow Distribution; Particles

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The Turbulent Flow over a Permeable Wall

Breugem, W. P., J. M. Burgerscentre, Netherlands; Boersma, B. J., J. M. Burgerscentre, Netherlands; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 216-228; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper we discuss some turbulence statistics that are obtained from a Direct Numerical Simulation (DNS) of a turbulent flow in a channel of which one wall is permeable (porous, with zero net transpiration) and the other is impermeable. The flow within the porous wall is modeled using the Volume-Averaged Navier-Stokes equations (VANS). Among others, it is shown that

wall permeability causes a considerable increase in the total drag, and an increased production of all Reynolds stresses when compared to an impermeable wall.

Author

Permeability; Turbulent Flow; Statistical Analysis; Mathematical Models; Wall Flow

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Contrail Formation in Aircraft Wakes Using Large-Eddy Simulations

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In this work we analyze the issue of the formation of condensation trails ("contrails") in the near-field of an aircraft wake. The basic configuration consists in an exhaust engine jet interacting with a wing-tip training vortex. The procedure adopted relies on a mixed Eulerian/Lagrangian two-phase flow approach; a simple micro-physics model for ice growth has been used to couple ice and vapor phases. Large eddy simulations have carried out at a realistic flight Reynolds number to evaluate the effects of turbulent mixing and wake vortex dynamics on ice-growth characteristics and vapor thermodynamic properties.

Author

Aircraft Wakes; Contrails; Large Eddy Simulation; Ice Formation; Mathematical Models; Aircraft Engines

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Entrainment-Zone Restratification and Flow Structures in Stratified Shear Turbulence

Reif, B. Anders Pettersson, Norwegian Defence Research Establishment, Norway; Werne, Joseph, Colorado Research Associates Div., USA; Andreassen, Oyvind, Norwegian Defence Research Establishment, Norway; Meyer, Christian, Colorado Research Associates Div., USA; Davis-Mansour, Melissa, Colorado Research Associates Div., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 245-255; In English; Also announced as 20030020448

Contract(s)/Grant(s): NASW-99026; F19628-02-C-0037; DE-FG03-99ER-62839; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Late-time dynamics and morphology of a stratified turbulent shear layer are examined using 1) Reynolds-stress and heat-flux budgets, 2) the single-point structure tensors introduced by Kassinos et al. (2001), and 3) flow visualization via 3D volume rendering. Flux reversal is observed during restratification in the edges of the turbulent layer. We present a first attempt to quantify the turbulence-mean-flow interaction and to characterize the predominant flow structures. Future work will extend this analysis to earlier times and different values of the Reynolds and Richardson numbers.

Author

Turbulence; Entrainment; Flow Visualization; Stratification

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Waves in Turbulent Stably-Stratified Shear Flow

Jacobitz, F. G., California Univ., USA; Rogers, M. M., NASA Ames Research Center, USA; Ferziger, J. H., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 257-267; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Two approaches for the identification of internal gravity waves in sheared and unsheared homogeneous stratified turbulence are investigated. First, the phase angle between the vertical velocity and density fluctuations is considered. It is found, however, that a continuous distribution of the phase angle is present in weakly and strongly stratified flow. Second, a projection onto the solution of the linearized inviscid equations of motion of unsheared stratified flow is investigated. It is found that a solution of the fully nonlinear viscous Navier-Stokes equations can be represented by the linearized inviscid solution. The projection yields a decomposition into vertical wave modes and horizontal vortical modes.

Author

Shear Flow; Turbulent Flow; Internal Waves; Inviscid Flow

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Adriatic Simulations by DieCAST

Dietrich, D., Mississippi State Univ., USA; Carnevale, G. F., Scripps Institution of Oceanography, USA; Orlandi, P., Rome Univ.,

Italy; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 269-281; In English; Also announced as 20030020448
Contract(s)/Grant(s): N00014-02-1-4047; N00014-97-1-0095; N00014-96-1-0065; NSF OCE-01-28991; NSF OCE-01-29301; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The DieCAST model is modified for simulations of flow in the Adriatic Sea. A ten-year simulation is performed and the ability of the model to capture important features of the Adriatic circulation is demonstrated. A series of numerical experiments on the importance of the Mid Adriatic Pit (MAP) on the circulation is performed. It is demonstrated that the cross-Adriatic current over the northern flank of the MAP, which flows from the Croatian to the Italian coast, is primarily a topographic current and that such a current would reverse direction if the gradient of the bathymetry were reversed.

Author

Adriatic Sea; Simulation; Topography

20030020473 Italian Aerospace Research Center, Capua, Italy

Optimization of Cylinder Flow Control via Actuators with Zero Net Mass Flux

Catalano, P., Italian Aerospace Research Center, Italy; Wang, M., Stanford Univ., USA; Iaccarino, G., Stanford Univ., USA; Sbalzarini, Ivo F., Eidgenoessische Technische Hochschule, Switzerland; Koumoutsakos, P., Eidgenoessische Technische Hochschule, Switzerland; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 297-303; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A direct search method in combination with a DNS/LES numerical approach is applied to optimize the control of the flow around a circular cylinder. The objective is the minimization of the drag coefficient and control is achieved via actuators with zero net mass flux. The optimization process has been first evaluated and validated at Reynolds number 500 and then the more demanding flow at Reynolds number 3900 has been considered. The search of the optimum has been carried out in 2D simulations, and a 3D simulation, indicating similar drag reduction, has been performed using the parameters of the 2D optimization.

Author

Optimization; Circular Cylinders; Flow Characteristics; Drag Reduction; Direct Numerical Simulation; Actuators

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On the Boundary Condition for Water at a Hydrophobic, Dense Surface

Walther, J. H., Eidgenoessische Technische Hochschule, Switzerland; Jaffe, R. L., NASA Ames Research Center, USA; Werder, T., Eidgenoessische Technische Hochschule, Switzerland; Halicioglu, T., NASA Ames Research Center, USA; Koumoutsakos, P., Eidgenoessische Technische Hochschule, Switzerland; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 317-329; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

We study the no-slip boundary conditions for water at a hydrophobic (graphite) surface using non-equilibrium molecular-dynamics simulations. For the planar Couette flow, we find a slip length of 64 nm at 1 bar and 300 K, decreasing with increasing system pressure to a value of 31 nm at 1000 bar. Changing the properties of the interface to from hydrophobic to strongly hydrophilic reduces the slip to 14 nm. Finally, we study the flow of water past an array of carbon nanotubes mounted in an inline configuration with a spacing of 16.4 x 16.4 nm. For tube diameters of 1.25 and 2.50 nm we find drag coefficients in good agreement with the macroscopic, Navier-Stokes values. For carbon nanotubes, the no-slip condition is valid to within the definition of the position of the interface.

Author

Boundary Conditions; Water; Hydrophobicity; Simulation

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Non-Reflecting Boundary Conditions for Acoustic Transfer Matrix Estimation with LES

Polifke, Wolfgang, Technische Univ., Germany; Wall, Cliff, Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 345-356; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The estimation of (thermo-) acoustic transfer matrices from numerically-generated time series of pressure and velocity fluctuations with correlation analysis appears to be an efficient and flexible way of employing CFD for the study of combustion instabilities. In the present investigation, the use of large-eddy simulation (LES) for this technique is explored for the first time. For this purpose, a novel formulation for boundary conditions, which is fully non-reflecting for plane acoustic waves, was derived, implemented and successfully tested. It was observed that large-scale turbulent fluctuations, which are explicitly resolved in LES,

can generate spurious signal contributions inside the computational domain and additional acoustic waves at the outlet boundary of the domain. to allow accurate transfer matrix estimation with LES, these signal components must be suppressed or eliminated from the time-series data by suitable post-processing.

Author

Boundary Conditions; Acoustic Emission; Matrices (Mathematics); Large Eddy Simulation; Computational Fluid Dynamics

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Large-Eddy Simulation of Pool Fires with Detailed Chemistry using an Unsteady Flamelet Model

Rawat, R., Utah Univ., USA; Pitsch, H., Stanford Univ., USA; Ripoll, J. F., Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 357-367; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

An unsteady flamelet approach is implemented as a subgrid combustion model for large-eddy simulation (LES) of buoyancy-dominated large-scale pool fires. In fires, soot plays a major role in the overall heat transfer, and therefore in the dynamics of fires. In simulations of soot formation in laminar flames, it has been shown that an accurate description is crucial to achieving reasonable predictions. Chemical reaction mechanisms accounting for the formation and oxidation of soot and of polycyclic aromatic hydrocarbons are typically described by hundreds of species and therefore are computationally expensive to incorporate if there is no simplification of the LES computation. Unsteady flamelet models permit consideration of detailed chemical kinetic mechanisms and a state-of-the-art description of soot formation and oxidation processes. The Lagrangian Flamelet model is incorporated in an existing LES fire code and compared with data from an experiment on a methane fire in a pool of one meter diameter. Results for soot predictions compare well with qualitative observations from the experiment. to discuss the influence of the description of radiative transport, a three-dimensional post-processing radiation simulation, using an averaged form of the $M_{(sub\ 1)}$ radiation model with mean absorption coefficients, is also performed. For this latter simulation, distributions of temperature and of species volume fraction have been taken from the LES results.

Author

Large Eddy Simulation; Three Dimensional Models; Simulation; Heat Transfer; Flames; Combustion Physics

20030020478 Iowa State Univ. of Science and Technology, Ames, IA USA

Lagrangian PDF Mixing Models for Reacting Flows

Fox, Rodney O., Iowa State Univ. of Science and Technology, USA; Cha, Chong M., Stanford Univ., USA; Trouillet, Philippe, Stanford Univ., USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 369-380; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Lagrangian Fokker-Planck (LFP) model of Fox is further developed to describe multi-stream mixing and reaction. The problem of three-stream mixing is used to illustrate the extension to multi-stream mixing. Qualitative comparisons are made with the direct numerical simulations (DNS) of three-stream mixing of Juneja & Pope (1996). A simplified case with one-step chemistry is used to investigate modeling issues associated with the application of the UP model to a reacting case. Predictions of the DNS results of SRipakagorn et al. (2000), which exhibit varying degrees of local extinction of the flame, are used to validate the UP model for the reacting case. Future modeling challenges are discussed.

Author

Probability Density Functions; Lagrangian Function; Reacting Flow

20030020479 Centre Europeen Recherche et de Formation Advance en Calcul Scientifc, Toulouse, France

Dynamics and Dispersion in Eulerian-Eulerian DNS of Two-Phase Flows

Kaufmann, A., Centre Europeen Recherche et de Formation Advance en Calcul Scientifc, France; Simonin, O., Institut de Mecanique des Fluides de Toulouse, France; Poinot, T., Centre Europeen Recherche et de Formation Advance en Calcul Scientifc, France; Helie, J., Institut de Mecanique des Fluides de Toulouse, France; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 381-392; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A DNS approach for Eulerian-Eulerian dispersed two-phase flows is tested. The need for a subgrid stress term in the dispersed phase momentum equation is identified and a simple model for this stress term allows the calculation of an experimental test case with inertial particles in homogeneous turbulence. Results are compared to Eulerian-Lagrangian simulations.

Author

Direct Numerical Simulation; Two Phase Flow

20030020480 Rouen Univ., France

Analysis and Modeling of the Dispersion of Vaporizing Polydispersed Sprays in Turbulent Flows

Reveillon, J., Rouen Univ., France; Massot, M., Lyon-1 Univ., France; Pera, C., Rouen Univ., France; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 393-404; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Direct numerical simulations (DNS) of turbulent two-phase flows have been carried out to study the polydispersion of a vaporizing spray in statistically-stationary grid turbulence. The evolution of various classes of droplet size has been studied, exhibiting different dynamical behavior for droplets of different sizes. The results have been used to evaluate successfully a new Eulerian model, which proves its ability to capture the polydisperse spray dynamics and vaporization.

Author

Mathematical Models; Dispersing; Numerical Analysis; Vaporizing; Turbulent Flow; Direct Numerical Simulation

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.

20030018862 NASA Langley Research Center, Hampton, VA USA

A Compact Airborne High Spectral Resolution Lidar for Observations of Aerosol and Cloud Optical Properties

Hostetler, Chris A., NASA Langley Research Center, USA; Hair, John W., NASA Langley Research Center, USA; Cook, Anthony L., NASA Langley Research Center, USA; [2002]; 4p; In English; 21st International Laser Radar Conference, 8-12 Jul. 2002, Quebec, Canada; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We are in the process of developing a nadir-viewing, aircraft-based high spectral resolution lidar (HSRL) at NASA Langley Research Center. The system is designed to measure backscatter and extinction of aerosols and tenuous clouds. The primary uses of the instrument will be to validate spaceborne aerosol and cloud observations, carry out regional process studies, and assess the predictions of chemical transport models. In this paper, we provide an overview of the instrument design and present the results of simulations showing the instrument's capability to accurately measure extinction and extinction-to-backscatter ratio.

Author

Aerosols; Cloud Physics; Optical Properties; Optical Radar

20030018881 Michigan Univ., Dept. of Chemistry, Ann Arbor, MI USA

Optimization of Biosensors by Directed Evolution Final Report, 1 Mar. 1997-28 Feb. 1998

Fierke, Carol A.; Jan. 08, 2003; 5p; In English

Contract(s)/Grant(s): N00014-97-1-0431

Report No.(s): AD-A410013; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this work is to develop methodologies for the optimization of field-deployable optical biosensors. We used these Defense University Research Instrumentation Program funds to purchase a Perkin-Elmer GeneAmp PCR system 2400 thermal cycler and a SpectraMax Plus plate reader from Molecular Dynamics. We used the plate reader to develop faster assays for characterizing carbonic anhydrase (CA) variants. We used the thermal cycler to prepare a large library of CA variants. We then completed multiple rounds of selection for variants with enhanced zinc specificity using phage display. We successfully prepared variants with altered metal specificities using these methods. These variants can be used to optimize a carbonic anhydrase-based metal ion biosensor.

DTIC

Optimization; Optical Thickness; Bioassay; Detection

20030018916 Research and Technology Organization, Sensors and Electronics Technology Panel, Neuilly-sur-Seine, France

Experimental Assessment Parameters and Procedures for Characterisation of Advanced Thermal Imagers Final Report Parametres et Procedures d'Evaluation Experimentale pour la Caracterisation d'Imageurs Thermiques Avances

February 2003; 60p; In English; Original contains color illustrations

Report No.(s): RTO-TR-075(II); AC/323(SET-015)TP/21; ISBN 92-837-1095-9; Copyright; Avail: CASI; C01, CD-ROM; A04, Hardcopy; A01, Microfiche; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement

The objective of this study was the development and investigation of experimental assessment parameters and measurement techniques required for characterizing advanced staring of micro-scanned thermal imagers. The task group member nations developed and investigated a number of measures and measurement techniques to characterize advanced thermal imagers. They are presented in this report. These measures and techniques allow assessment of basic, system-relevant sensor parameters, such as spatial resolution and noise, as well as overall sensor performance.

Author

Assessments; Independent Variables; Thermography; Sampling; Sensitivity; Imaging Techniques

20030019193 Columbia-Presbyterian Medical Center, New York, NY USA

Regularization in Tomographic Reconstruction Using Thresholding Estimators

Kalifa, Jerome; Laine, Andrew; Esser, Peter D.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409763; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In tomographic medical devices such as SPECT or PET cameras image reconstruction is an unstable inverse problem due to the presence of additive noise. A new family of regularization methods for reconstruction based on a thresholding procedure in wavelet and wavelet packet decompositions is studied. This approach is based on the fact that the decompositions provide a near-diagonalization of the inverse Radon transform and of the prior information on medical images. Corresponding algorithms have been developed for both 2-D and full 3-D reconstruction. These procedures are fast, non-iterative, flexible and their performances outperform Filtered Back-Projection and iterative procedures such as OS-EM.

DTIC

Tomography; Image Reconstruction

20030019274 Naval Research Lab., Washington, DC USA

Advanced MTADS Classification for Detection and Discrimination of UXO Final Report

Nelson, H. H.; Bell, T. H.; McDonald, J. R.; Barrow, B.; Jan. 31, 2003; 63p; In English; Original contains color images; Prepared in collaboration with AETC, Inc., Arlington, VA

Report No.(s): AD-A409926; NRL/MR-MM/6110-03-8663; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Chemistry Division of the Naval Research Laboratory has developed the Multi-sensor Towed Array Detection System (MTADS) for the detection and classification of buried unexploded ordnance. In order to increase the discrimination ability of the system, we have developed advanced analysis algorithms for the Electromagnetic Induction (EMI) sensor data. In order to critically test the performance of these algorithms, we performed a magnetometer and two EMI surveys of a seeded, 10-acre site on the Impact Area of the Badlands Bombing Range, South Dakota. We quantitatively compare the predictions from a baseline MTADS magnetometry analysis, an advanced EMI analysis, and a probabilistic neural net approach developed in a related SERDP (Strategic Environmental Research and Development Program) program against actual remediation results. In addition, we discuss the performance the EMI system in both a low- and high-SNR (signal-to-noise ratio) environment.

DTIC

Arrays; Frequency Domain Analysis; Multisensor Applications; Towed Bodies

20030019297 Kinki Univ., Osaka, Japan

Holographic Deformation Analysis of the Human Femur

Matsumoto, T.; Kojima, A.; Kato, N.; Watanabe, T.; Tamiwa, M.; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409577; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The deformations of the neck and head of the human dried femur were measured and analyzed with loads applied at the femoral head. Particular attention was paid to measurements of bones with osteoporosis. We used double exposures or real-time holographic interferometry to measure precisely. The distal part of each femur was embedded in super hard plaster, and the load was applied at the femoral head. In order to better simulate the situation of a femur under physiological muscles, we used the 3D finite element method (FEM) for our analyses. After modeling the femur, which consisted of meshing as eight noded elements for each section of diaphysis, we used the 3D FEM to calculate stress and strain. We obtained the following results: (1) the deformations increased with the progress of osteoporosis; (2) femur with osteoporosis showed obvious rotational components in

the femoral shaft and (3) a compressive stress distribution could be found at the medial side of the diaphyseal region by using the FEM.

DTIC

Deformation; Femur

20030019339 Centre National de la Recherche Scientifique, Lab. 13S, Sophia-Antipolis, France

A Novel Approach for Joint Estimation of Time Delay and Scale Factor with Applications to the M-Wave Analysis

Muhammad, W.; Meste, O.; Rix, H.; Farina, D.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409778; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper we propose a method for joint estimation of delay and scale factor between two deterministic and unknown signals. The method is based on the separation of the two parameters. The scale factor is estimated from the autocorrelation functions (ACFs) of the two signals. The ACFs are independent on the delay while they maintain the scale factor. The delay is estimated by scaling one of the two signals by the estimated scale factor, so that the delay estimation is not biased by the scale factor. The method proposed is compared with the maximum likelihood joint estimation and provides better performance for a rather large range of signal to noise ratios. Potential applications of the technique in surface EMG signal analysis are discussed and results related to the M-wave processing are reported.

DTIC

Electromyography; Signal Processing

20030019354 NASA Glenn Research Center, Cleveland, OH USA

Neural-Net Processed Electronic Holography for Rotating Machines

Decker, Arthur J., NASA Glenn Research Center, USA; February 2003; 63p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 323-78-00

Report No.(s): NASA/TM-2003-212218; NAS 1.15:212218; E-13839; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents the results of an R&D effort to apply neural-net processed electronic holography to NDE of rotors. Electronic holography was used to generate characteristic patterns or mode shapes of vibrating rotors and rotor components. Artificial neural networks were trained to identify damage-induced changes in the characteristic patterns. The development and optimization of a neural-net training method were the most significant contributions of this work, and the training method and its optimization are discussed in detail. A second positive result was the assembly and testing of a fiber-optic holocamera. A major disappointment was the inadequacy of the high-speed-holography hardware selected for this effort, but the use of scaled holograms to match the low effective resolution of an image intensifier was one interesting attempt to compensate. This report also discusses in some detail the physics and environmental requirements for rotor electronic holography. The major conclusions were that neural-net and electronic-holography inspections of stationary components in the laboratory and the field are quite practical and worthy of continuing development, but that electronic holography of moving rotors is still an expensive high-risk endeavor.

Author

Neural Nets; Holography; Rotors; Nondestructive Tests

20030019755 NASA Dryden Flight Research Center, Edwards, CA USA

Exploratory Calibration of Adjustable-Protrusion Surface-Obstacle (APSO) Skin Friction Vector Gage

Hakkinen, Raimo J., Washington Univ., USA; Neubauer, Jeremy S., Washington Univ., USA; Hamory, Philip J., NASA Dryden Flight Research Center, USA; Bui, Trong T., NASA Dryden Flight Research Center, USA; Noffz, Gregory K., NASA Dryden Flight Research Center, USA; February 2003; 28p; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 710-55-24-SE-RR

Report No.(s): NASA/TM-2003-210739; H-2519; NAS 1.15:210739; AIAA Paper 2003-0740; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The design of an adjustable-protrusion surface-obstacle (APSO) skin friction vector gage is presented. Results from exploratory calibrations conducted in laminar and turbulent boundary layers at the Washington University Low-Speed Wind Tunnel and for turbulent boundary layers at speeds up to Mach 2 on the ceiling of the NASA Glenn Research Center 8- X 6-ft Supersonic Wind Tunnel are also discussed. The adjustable-height gage was designed to yield both the magnitude and direction

of the surface shear stress vector and to measure the local static pressure distribution. Results from the NASA test show good correlation for subsonic and low supersonic conditions covering several orders of magnitude in terms of the adopted similarity variables. Recommendations for future work in this area consist of identifying the physical parameters responsible for the disagreement between the university and NASA data sets, developing a compressibility correction specific to the APSO geometry, and examining the effect that static pressure distribution and skewed boundary layers have on the results from the APSO.

Author

Measuring Instruments; Skin Friction; Wind Tunnel Tests; Laminar Boundary Layer; Turbulent Boundary Layer; Design Analysis; Product Development

20030019851 Textron Defense Systems, Wilmington, MA USA

Terrain Commander: Unattended Ground-Based Surveillance System

Steadman, Bob; Oct. 2000; 8p; In English; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ.

Report No.(s): AD-A409861; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper describes Textron's remote unattended ground-based surveillance system called Terrain Commander and its major field sensing component called OASIS (Optical Acoustic Satcom Integrated Sensor). Terrain Commander is a powerful new concept in surveillance and remote situational awareness. It leverages a diverse suite of sophisticated unattended ground sensors, day/night electro-optics, satellite data communications, and an advanced Windows based graphic user interface. Terrain Commander OASIS provides next generation target detection, classification, and tracking through smart sensor fusion of beamforming acoustic, seismic, passive infrared, and magnetic sensors. The filtered and processed data derived from these sensors autonomously cues the integrated day/night electro-optics imaging system. The system monitors remote sites 24 hours per day, months at a time, and features high probability of detection with very low false and nuisance alarm rates. With its fully integrated SATCOM system, virtually any site in the world can be monitored from almost any other location in the world. Multiple remote sites such as airfields, landing zones, base perimeters, road junctions, flanks, and border crossings can be monitored with ease from a central location. Intruding personnel or vehicles are automatically detected, classified, imaged, and reported. Comprehensive threat information including target images are rapidly presented to the remote operator for appropriate response.

DTIC

Tracking (Position); Target Acquisition; Surveillance; Sound Detecting and Ranging

20030019871 Jordan Univ. of Science and Technology, Dept. of Biomedical Engineering, Irbid, Jordan

Optimal Design of Experiment for Medical Sensors Calibration

Bani Amer, Mashhour M.; Oct. 25, 2001; 7p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A410149; X5-X5; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents a framework for the optimal design of experiments for medical sensors calibration. A new software program, G-optimal, is developed to demonstrate the optimal design of experiment. This program has been used to find G-optimal design for amperometric enzyme glucose sensor, silicon capacitive absolute pressure sensors and electrochemical oxygen and carbon dioxide partial pressure sensors. The developed software improves the calibration accuracy, reduces the calibration cost, decreases the time and effort required performing a calibration and provides user friendliness.

DTIC

Medical Equipment; Calibrating; Character Recognition; Experiment Design; Pressure Sensors; Electrical Measurement

20030019881 Duke Univ., Medical Center, Durham, NC USA

Molecular Approaches to Optical Biosensors Final Report, 7 Apr. 1997-30 Sep. 1999

Fierke, Carol A.; Sep. 30, 1999; 4p; In English

Contract(s)/Grant(s): N00014-97-1-0573

Report No.(s): AD-A409818; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A carbonic anhydrase-based metal ion biosensor was optimized using molecular biology methods. CA variants were prepared that alter the metal ion specificity, the half-time for metal equilibration, the zinc dissociation constant, and the metal detection

limit. Reagentless signal transduction methods and enhanced immobilization methods were also developed. These methods will be useful in the development of sensor arrays to determine the concentration of multiple metal ions in wastewater and the ocean.

DTIC

Optical Properties; Molecular Biology; Bioinstrumentation; Detectors; Composition (Property)

20030020388 West Virginia Univ., Dept. of Electrical and Computer Engineering, Morgantown, WV USA

Various Applications of NASA's Capaciflector Proximity Sensor

McConnell, Robert, West Virginia Univ., USA; Manzo, Michael, West Virginia Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 438-444; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

A capacitive proximity sensor (capaciflector) developed at NASA (Goddard Space Flight Center) depends upon detecting changes in capacitance when an object is brought within range. This sensor, which is sensitive to conductive and dielectric materials, consists of a capacitive sensing element (sensor) backed by a reflector element (shield) to reduce the effects of stray capacitance. Through the use of the capaciflector several systems were developed at West Virginia University that include: A multiplexing scheme for addressing thirty two separate sensors, An Automatic Docking System for Space Based Orbital Replacement Units (ORU's), An Image Scanning system, and A Robot Controller with Visual and Tactile Feedback.

Author

Controllers; Capacitance; Detection; Sensors; Dielectrics

36

LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.

20030018982 Texas Univ., Microelectronics Research Center, Austin, TX USA

Laser Enhanced System for Ultra-Fine Microstructure Formation Final Report

Chen, Ray; Nov. 30, 2002; 24p; In English

Contract(s)/Grant(s): F49620-01-1-0362; AF Proj. 3484

Report No.(s): AD-A410048; AFRL-SR-AR-TR-03-0006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the past ten years, DOD sponsors over 35 research programs, which Dr. Chen served or has been serving as a principal investigator. All of them are focused on one area - "Optical Interconnects" which is directly related to "Optical Materials (4)", "Polymeric Materials (11)" and "Optoelectronic Computer Networking (13)" of the BMDO/DURIP solicitation. The major thrusts for the existing BMDO program are to generate polymer-based true time delay (TTD) module and to build a system demonstration for phased array antenna usmg BMDO-sponsored polymer-based active and passive photonic devices. High-speed polymer-based EO modulator arrays and polymer-based optical true-time delay modules have been built through the existing programs involving UT Austin (Chen), USC (Steier), UCLA (Fetterman) and Univ. of Washington (Dalton). These devices will be implemented onto a real phased array antenna system driving by polymer-based optoelectronic components. At the UT Microelectronics Research Center we maintain all almost needed fabrication facilities to realize the proposed devices. The equipment required to fulfill the committed task constitutes a "Laser Enhanced End Point Detection Plasma Etching System" through which the fine features of the devices can be fabricated. In 2000, we received financial support from DOD's funding agency, MDA, to acquire a Plasmalab 80 Plus laser enhanced end point detection etch tool from Oxford Instrument Corporation to serve the purposes described above. This system exhibits full laser enhanced end point detection with the accuracy better than + 0.1 micron. Several DOD optical interconnects project have been benefited through the use of this laser, which has been use to fabricate various optoelectronic devices.

DTIC

Microstructure; Lasers; Micromachining

20030019219 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

Beamed Energy (Laser) Propulsion (A Perspective)

Mead, Franklin B., Jr; Jun. 19, 2000; 71p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409833; AFRL-PR-ED-TP-2000-135; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The presentation slides for the briefing for the Beamed Energy (Laser) Propulsion are presented.

DTIC

Lasers; Laser Propulsion

20030019465 Wright State Univ., Dept. of Mathematics and Statistics, Dayton, OH USA

Mathematical Modeling, Simulation, and Control of Physical Processes Final Report, 1 May 1999-28 Feb. 2002

Svobodny, Thomas P.; Feb. 2002; 28p; In English

Contract(s)/Grant(s): F49620-99-1-0261

Report No.(s): AD-A409724; AFRL-SR-AR-TR-02-0451; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Concerning the ablation plume phenomenon, a computational model for the interaction of laser energy with solid matter was developed, as well as analytical and computational models for the plume hydrodynamics, including the chemical reactions. A first task was to understand which variables are the most important. There are approximately 20 input variables that can be varied during the process. Some of these are field parameters, other depend on time, while others, such as electromagnetics, are (time-varying) fields. Contrasted with the many input variables are the desired outcomes from the film. Naturally, there is not time for experiments that vary all of the inputs and to measure the effect on these outcomes as the dimensional complexity is overwhelming. We needed to reduce the experimental effort, via straightforward polynomial regression experimental design and adaptive learning data mining response surface methods. The interaction of laser energy with a solid material takes many different forms depending on the power input and the material properties. That is, thermal conduction is the main methods of energy transport. The justification is that energy transferred is spread out over a vibrationally long time period.

DTIC

Mathematical Models; Ablation; Computerized Simulation; Pulsed Lasers

37

MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.

20030018901 Pukyong National Univ., School of Mechanical Engineering, Busan, Korea, Republic of

Condition Classification of Reciprocating Compressors using Radial Basis Function Neural Network

Yang, Bo-Suk, Pukyong National Univ., Korea, Republic of; Kim, Kwangkeun, Pukyong National Univ., Korea, Republic of; Rao, Raj B. K. N., Sunderland Univ., UK; International Journal of COMADEM; October 2002; ISSN 1363-7681; Volume 5, No. 4, pp. 12-20; In English; Copyright; Avail: Issuing Activity

This paper proposes a condition classification algorithm using the radial basis function neural network (RBFN) for the reciprocating compressors of refrigerators. Generally, the RBFN is used for function approximation, but it can be also used for definition of the relation between the input and the output as the probability. The RBFN is compared to other classification methods such as the self-organizing feature map (SOFM) and the learning vector quantization (LVQ) networks, and the superiority is verified by the real examples. The efficient construction method of the RBFN, according to the hidden layer and the spread constant, is investigated. Especially, the adaptive pattern classifier 3 (APC3), which is a clustering method, is used for making the efficient hidden layer and is compared with the use of the SOFM. In addition, for overcoming the weak point of the classification method using the neural network, the adaptive classification system with the APC3 and the RBFN is proposed.

Author

Algorithms; Compressors; Neural Nets; Reciprocation; Approximation

20030018909 NASA Glenn Research Center, Cleveland, OH USA

Computation of Pressurized Gas Bearings Using CE/SE Method

Cioc, Sorin, Toledo Univ., USA; Dimofte, Florin, Toledo Univ., USA; Keith, Theo G., Jr., Toledo Univ., USA; Fleming, David P., NASA Glenn Research Center, USA; February 2003; 19p; In English; 2002 Annual Meeting, 19-23 May 2002, Houston, TX, USA; Sponsored by Society of Tribologists and Lubrication Engineers, USA

Contract(s)/Grant(s): RTOP 274-00-02

Report No.(s): NASA/TM-2003-212110; NAS 1.15:212110; E-13764; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The space-time conservation element and solution element (CE/SE) method is extended to compute compressible viscous flows in pressurized thin fluid films. This numerical scheme has previously been used successfully to solve a wide variety of compressible flow problems, including flows with large and small discontinuities. In this paper, the method is applied to calculate the pressure distribution in a hybrid gas journal bearing. The formulation of the problem is presented, including the modeling of the feeding system. The numerical results obtained are compared with experimental data. Good agreement between the computed results and the test data were obtained, and thus validate the CE/SE method to solve such problems.

Author

Gas Bearings; Hydrostatics; Lubrication; Computation; Pressurizing; Flow Velocity

20030018938 Army Defense Ammunition Center, McAlester, OK USA

Nailed Floor-Line Blocking Methods TP-94-01, "Transportability Testing Procedures" Final Report

Dec. 2002; 80p; In English; Original contains color images

Report No.(s): AD-A409584; DAC/VED-02-15; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SOSAC-DEV), was tasked by the Transportation Engineering Division (SOSAC-DET) to conduct transportability testing of Nailed Floor-Line Blocking Methods. The testing was conducted in accordance with TP-94-01, "Transportability Testing Procedures", with the exception that the washboard course testing was optional. The Nailed Floor-Line Blocking Methods used during testing on 20 May 2002, 13 August 2002, 16 August 2002, and 22-26 August 2002 successfully completed the Hazard Course Testing and the Road Trip Testing as specified in TP-94-01, "Transportability Testing Procedures". The nailing criteria and procedures for the nailed floor line blocking methods utilized during the successful testing are adequate and safe for transportation of ammunition in closed van trailers for highway movement. The nails that were utilized during the successful testing were hand driven and conformed to the ASTM F1667 requirements for common steel nails.

DTIC

Transportation; Floors; Blocking

20030019076 Indian Inst. of Tech., Applied Mechanics Dept., Madras, India

Diagnosis of Rotor Bearing System in Noisy Conditions using Artificial Neural Networks and Genetic Algorithm

Naresh, J., Indian Inst. of Tech., India; Swarnamani, S., Indian Inst. of Tech., India; Rao, Raj B. K. N., COMADEM International, UK; International Journal of COMADEM; October 2002; ISSN 1363-7681; Volume 5, No. 4, pp. 21-29; In English; Copyright; Avail: Issuing Activity

The classification of machinery faults is a very important aspect in diagnosing the machinery malfunctions. In this paper, classification of the faults from vibration data of Rotating Machinery is done by combining Genetic Algorithms (GA) and Artificial Neural Networks (ANN). ANN is combined with GA to improve fault detection even with acceptable noise levels in the vibration data. It is discovered that the noise addition to input vector of a training pattern may improve the performance of generalization. It is also discovered that selection of most significant feature set from the available large set of potential features improves the classification accuracy. In this paper Genetic Algorithms is used to optimize the derived feature. Noise is injected to the input vector with the noise optimized by Genetic Algorithm to improve the performance of generalization with noisy data. The concept of Feature Selection and Noise Injection is combined to improve the performance of the Neural Network. The performance of Neural Network is taken as the fitness function. The vibration signals were derived by synthesizing different sinusoids normal observed in machine vibrations and faults such as unbalance, misalignment and defects in anti friction bearings. The test results show that the proposed scheme improves the performance of diagnosis from 96.8 to 100% by feature selection concept, with the absence of noise and it also improves the performance from 85.6 to 97.6 by combining the concepts of feature selection and noise injection even with as high as 25% random noise in the input signals.

Author

Genetic Algorithms; Neural Nets; Noise Intensity; Rotor Dynamics; Artificial Intelligence; Bearings; Systems Engineering

20030019200 National Academy of Sciences - National Research Council, Washington, DC USA

Bolonkin Rotary Engine

Bolonkin, Alexandrovich, Inventor, National Academy of Sciences - National Research Council, USA; Oct. 09, 2001; 1p; In English

Patent Info.: Filed 12 Apr. 1999; US-Patent-6,298,821; US-Patent-Appl-SN-290465; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The disclosed Bolonkin rotary engine has high energy efficiency and can be used as an internal combustion engine. a compressor, a pump, or as a motor working on compressed gas or liquid. Bolonkin rotary engine comprises a housing, a rotor

mounted in the housing, separating valves controlling flow of a working fluid within displacement volume of the engine. means for working fluid circulation, and means for coordinating passage of rotor blades through the separating valves. The preferred embodiment of the invention is realized as a rotary internal combustion engine having rotatable glass-shape separating valves, expansion and compression sections, and B bypass channel. Alternative preferred embodiments of Bolonkin rotary engine differ in a type of separating valve use. which can be one of the following: rotatable disc valve, reciprocating slide-slot valve, reciprocating slide valve, and a swaying-lever valve.

Official Gazette of the U.S. Patent and Trademark Office

Rotary Engines; Energy Conservation; Compressors; Internal Combustion Engines

20030019282 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA

Frequency Response Evaluation of Multiple Accelerometers Using a Model Data Acquisition System *Final Report, 1 Oct. 1986-1 Aug. 1987*

Banaszak, David; Jan. 1988; 103p; In English

Contract(s)/Grant(s): Proj-2401

Report No.(s): AD-A409915; AFWAL-TM-87-195; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report describes a technique to get complete frequency response calibrations of 15 accelerometer channels at a time. The accelerometers were mounted to a rigid circular plate attached to a shaker excited by random noise. A digital pulse code modulation data acquisition system acquired and stored the 15 responses. Using the time multiplexed, digital responses, each transducer frequency response was computed by deriving transfer functions between the 15 unknown transducers and a DC responding reference accelerometer. Before using this multiple accelerometer calibration technique, several single channel laboratory calibrations were performed using four methods. The multiple accelerometer technique was tested in the laboratory and on a F-16 wing ground vibration test. A total of 37 accelerometers were evaluated over a range of 0 to 100 Hz. Exciting multiple accelerometers ensures calibration of each transducer at the same temperature, humidity, and force input levels. The technique provides a quick, automated, end-to-end frequency response calibration. Sensitivities versus frequency are close to those obtained using single accelerometer calibration techniques.

DTIC

Accelerometers; Calibrating; Frequency Response

20030019759 NASA Glenn Research Center, Cleveland, OH USA

Novel Damping Concepts for Mechanical Backup Bearings and Passive Magnetically Suspended Rotors *Final Report, Aug. 2001 - Aug. 2002*

Keith, Theo G., Jr., Toledo Univ., USA; March 2003; 4p; In English

Contract(s)/Grant(s): NCC3-907; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The following summarizes the research accomplished under the titled project. The period of research extended from August 2001 to August 2002. The team of researchers consisted of two Senior Research Associates: Mark Siebert and Carl Buccieri. one PhD student: Pete Kenney and one faculty member: Theo Keith, who was the P.I. Karen Balog was the Program Coordinator. The research was performed at both the NASA Glenn Research Center (GRC) in Cleveland, Ohio and at the University of Toledo. Accordingly, periodic group telephone meetings were held with the team members, the NASA technical coordinators and several other University of Toledo researchers working on-site at GRC. Two passive magnetic bearing test rigs were designed and tested as a result of the work of this NRA. Additionally, two technical papers, based on this effort, were generated and are currently being reviewed.

Author

Damping; Rotors; Magnetic Suspension; Magnetic Bearings; Research and Development; Systems Engineering

20030019878 Florida State Univ., Tallahassee, FL USA

Single Wall Carbon Nanotube Alignment Mechanisms for Non-Destructive Evaluation *Final Report, 17 Dec. 2001 - 16 Dec. 2002*

Hong, Seunghun, Florida State Univ., USA; [2002]; 5p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-02022; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

As proposed in our original proposal, we developed a new innovative method to assemble millions of single wall carbon nanotube (SWCNT)-based circuit components as fast as conventional microfabrication processes. This method is based on surface template assembly strategy. The new method solves one of the major bottlenecks in carbon nanotube based electrical

applications and, potentially, may allow us to mass produce a large number of SWCNT-based integrated devices of critical interests to NASA.

Derived from text

Carbon Nanotubes; Nondestructive Tests; Alignment; Nanofabrication

20030020367 Georgia Inst. of Tech., George W. Woodruff School of Mechanical Engineering, Atlanta, GA USA

Enabler: A Lunar Work Vehicle

Brazell, James W., Georgia Inst. of Tech., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 222-226; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Students of the George W. Woodruff School of Mechanical Engineering at Georgia Institute of Technology have researched and designed an Earth-bound concept model for a lunar work vehicle. Designated the "Enabler," the vehicle was designed to be adaptable to the harsh environment a vehicle can be expected to confront on the surface of the Moon. The objective of the project was to design a multipurpose lunar work vehicle. In particular, the vehicle needs to provide capabilities that will be useful in remote investigation of the lunar surface, and it should provide many of the construction capabilities that will be needed for the establishment of a manned lunar base. To meet these general goals the vehicle needs to be simple, strong, light, flexible, and reliable. The Earth-bound concept model is under construction, and is scheduled for preliminary testing in February 1994.

Author

Lunar Surface Vehicles; Joints (Junctions); Chassis

20030020368 Idaho Univ., Dept. of Mechanical Engineering, Moscow, ID USA

Wheeled Articulating Land Rover: WALRUS

Stauffer, Larry, Idaho Univ., USA; DiLorenzo, Matthew, Idaho Univ., USA; Yandle, Barbara, Idaho Univ., USA; Baicy, Eric, Idaho Univ., USA; Barinaga, John, Idaho Univ., USA; Block, Brian, Idaho Univ., USA; Bunce, Wayne, Idaho Univ., USA; Clausen, John, Idaho Univ., USA; Constable, Jay, Idaho Univ., USA; Cresse, William, Idaho Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Aeronautics Design Program and Advanced Space Design Program; [1993], pp. 227-231; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The WALRUS is a wheeled articulating land rover that will provide Ames Research Center with a reliable, autonomous vehicle for demonstrating and evaluating advanced technologies. This vehicle is one component of the Ames Research Center's on-going Human Exploration Demonstration Project. Ames Research Center requested a system capable of traversing a broad spectrum of surface types and obstacles. In addition, this vehicle must have an autonomous navigation and control system on board and its own source of power. The resulting design is a rover that articulates in two planes of motion to allow for increased mobility and stability. The rover is driven by six conical shaped aluminum wheels, each with an independent, internally coupled motor. Mounted on the rover are two housings and a removable remote control system. In the housings, the motor controller board, tilt sensor, navigation circuitry, and control board are mounted. Finally, the rover is powered by thirty C-cell rechargeable batteries, which are located in the rover wheels and recharged by a specially designed battery charger.

Author

Lunar Roving Vehicles; Autonomous Navigation; Unmanned Ground Vehicles; Research Vehicles

20030020375 Minnesota Univ., Dept. of Aerospace Engineering and Mechanics, Minneapolis, MN USA

Design of a Lunar Transportation System

Vano, Andrew, Minnesota Univ., USA; Wright, Michael, Minnesota Univ., USA; Kottke, Dan, Minnesota Univ., USA; Clyde, Nathan, Minnesota Univ., USA; George, John, Minnesota Univ., USA; Edwards, Dan, Minnesota Univ., USA; Gulseth, Greg, Minnesota Univ., USA; Hathaway, Thane, Minnesota Univ., USA; Yang, Chay, Minnesota Univ., USA; McNitt, Mark, Minnesota Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 297-309; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A significant presence on the Moon is necessary if America is to become a spacefaring nation. This presence must not be another Apollo style 'Flags and Footprints' mission; it must be a fully crewed Lunar Outpost. A major investment in a Lunar transportation infrastructure must be made in order to accomplish this mission. In order to achieve this goal by turn of the century, the University of Minnesota Spacecraft Design Team has developed a Lunar Transportation System (LTS). This reusable and cost efficient system will deliver crew and cargo to the Lunar surface well into the 2020 time period. A Lunar orbit rendezvous is used to reduce mass, which splits the vehicle into two parts, each with different mission tasks. The first vehicle is the Lunar Excursion Vehicle (LEV), which is used as a Lunar lander. This cryogenic lander has the capability of carrying a crew of six or 50t of cargo

to the surface of the Moon. In addition, the piloted lander is reusable and returns to Low Lunar Orbit to dock with the LTV at the conclusion of the surface stay. The second vehicle is the Lunar Transportation Vehicle (LTV) which 'ferries' the lander between low Earth orbit and low Lunar orbit. Due to the large masses of the Lunar Transportation System components an exotic but by no means new propulsion concept has been developed for the LTV: a NERVA derived Nuclear Thermal Rocket (NTR).

Author

Spacecraft Design; Systems Engineering; Product Development; Structural Design; Lunar Based Equipment; Lunar Roving Vehicles; Nuclear Engine For Rocket Vehicles

20030020378 Old Dominion Univ., Dept. of Mechanics Engineering and Mechanics, Norfolk, VA USA

Internal Combustion Engines on the Martian Surface

Britcher, Colin P., Old Dominion Univ., USA; Ash, Robert L., Old Dominion Univ., USA; Davis, Keith, Old Dominion Univ., USA; Hoover, Scott, Old Dominion Univ., USA; Lauer, Stephen, Old Dominion Univ., USA; Lawrence, Lori, Old Dominion Univ., USA; Papatistodemou, Christos, Old Dominion Univ., USA; Taylor, Douglas, Old Dominion Univ., USA; Uenking, Michael, Old Dominion Univ., USA; Wiggington, Wesley, Old Dominion Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 326-337; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Previous design teams at Old Dominion University have studied the feasibility of oxygen production by dissociation of the Martian atmosphere and the use of this oxygen to operate internal combustion engines. In combination, this provides a practical option for motive power on Mars, that is the generation of oxidizer (and fuel) from indigenous resources and on-demand shaft power generation. The emphasis in 1993 has been on the refinement of experimental facilities in both areas. Specifically, the Mars Oxygen Processor team has designed a new furnace/vacuum chamber and the Mars Methane Engine team has developed a new engine. Since the Martian atmosphere is mostly CO₂, studies are underway to utilize this component to provide oxygen to support Martian surface operations and earth-return missions, thereby providing large savings in payload from earth. In cooperation with the University of Arizona, ODU is developing an oxygen processor using a zirconia cell. A high temperature chamber has been designed that can operate at pressures equivalent to the Martian surface. The design consists of an alumina shell with internal alumina baffles and tubing and a stainless steel cap. The stainless steel cap will be at a sufficiently low temperature to permit standard fittings to be used. The five alumina tubes will be used for feed and waste gas, oxygen extraction, wiring and instrumentation leads. Since it is feasible to generate oxygen on the Martian surface and since there exist significant sub-surface ice deposits, it is considered relatively straightforward to synthesize methane, from water and CO₂, feedstock, as a fuel. The goal of the Mars Methane Engine team is to develop the technology required for operating internal combustion engines on the Martian surface, fueled by methane and oxygen and using CO₂ as a diluent. A new test-bed has been commissioned, using a standard single-cylinder 4-cycle engine, with a modified carburetor and extensive instrumentation. Preliminary operating data has been obtained, using gasoline-air, methane-air and methane-oxygen-carbon dioxide.

Author

Internal Combustion Engines; Roving Vehicles; Mars Surface; Oxygen Production; Engine Design; Product Development; Photovoltaic Cells; Methane; Payloads

20030020381 Texas Univ., Dept. of Mechanical Engineering, Austin, TX USA

Space Engineering Projects in Design Methodology

Crawford, R., Texas Univ., USA; Wood, K., Texas Univ., USA; Nichols, S., Texas Univ., USA; Hearn, C., Texas Univ., USA; Corrier, S., Texas Univ., USA; DeKunder, G., Texas Univ., USA; George, S., Texas Univ., USA; Hysinger, C., Texas Univ., USA; Johnson, C., Texas Univ., USA; Kubasta, K., Texas Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 363-373; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

NASA/USRA is an ongoing sponsor of space design projects in the senior design courses of the Mechanical Engineering Department at The University of Texas at Austin. This paper describes the UT senior design sequence, focusing on the first-semester design methodology course. The philosophical basis and pedagogical structure of this course is summarized. A history of the Department's activities in the Advanced Design Program is then presented. The paper includes a summary of the projects completed during the 1992-93 Academic Year in the methodology course, and concludes with an example of two projects completed by student design teams.

Author

Design Optimization; Students

20030020383 Utah State Univ., Dept. of Mechanical and Aerospace Engineering, Logan, UT USA

Wheeled Experimental Surface Lunar Explorer (WESLE)

Redd, Frank J., Utah State Univ., USA; Gessaman, Jeff, Utah State Univ., USA; Adams, Lynn, Utah State Univ., USA; Bishop, Travis, Utah State Univ., USA; Clarke, Stephen, Utah State Univ., USA; Crook, Val, Utah State Univ., USA; Henderson, David, Utah State Univ., USA; Holman, Bret, Utah State Univ., USA; Jensen, Scott, Utah State Univ., USA; Adams, Lynn, Utah State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 385-395; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Utah State University 1992-1993 Advanced Space Systems Design Team focused its design effort on a long range lunar rover. The Wheeled Experimental Surface Lunar Explorer (WESLE) was designed such that transport to the Moon could be done with the Artemis Common Lunar Lander which has been conceptualized by a team at the Johnson Space Center. Scientific instruments on board each WESLE include: an alpha-proton-x-ray spectrometer, a visual spectrometer, and an electromagnetic sounder. With these instruments the rovers will be capable of detecting all elements except hydrogen, analyzing the crystalline structure of lunar samples, and mapping subsurface geologic features. The WESLE relies on six conical wheels for mobility and will turn using the "skid-scoff" method, similar to tanks. The semi-autonomous operations for maneuvering requires that an earth-based operator send the rover to a spot that is visible. The rover will be capable of maneuvering over or around various obstacles with an increase in uncertainty of location relative to the point of destination for every obstacle encountered. The rover will telemeter Earth for further information when it has reached the desired location, the uncertainty level has exceeded a preset value, or the rover encounters an obstacle that it cannot negotiate. The WESLE is designed to operate over a range of 1,000 kilometers for approximately one year.

Author

Autonomy; Lunar Geology; Maneuvers; Roving Vehicles; Systems Engineering; Telemetry; Design Analysis

20030020384 Vanderbilt Univ., Dept. of Mechanical Engineering, Nashville, TN USA

Stiffening of Deployable Space Booms and Automated Protein Crystal Growth

Cruse, Thomas, Vanderbilt Univ., USA; Ward, Susan E., Vanderbilt Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 396-402; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The future of space structures rely upon the use of deployable trusses. The vibrations induced by these highly flexible booms are potentially damaging to possible remote experiments. By stiffening the trusses, and therefore increasing the fundamental frequency, the vibrational effects will be reduced. MSFC is developing a space and ground integrated test facility for study of vibrational control of deployable trusses. The Vanderbilt design team developed a system of stiffening using spreaders and tensioning cables attached to the trusses. The passive control system is designed to attach to either a Lanyard or Nut deployed truss and deploy along with the truss. The truss/cabling system will stow in a canister which will attach to an Eagle platform and launched via a minuteman rocket. After launch and deployment, an end mounted vibration system will excite the free and stiffened system. Accelerometers will measure the first modes of vibration. The data will be relayed to earth for analysis and comparison to an earth base experiment at MSFC. The results of the testing will aid future application of deployable, flexible space trusses.

Author

Deployment; Frequencies; Large Space Structures; Launching; Stiffening; Test Facilities; Vibration

38

QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.

20030019888 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Monitoring Initiation and Growth of Crack in a Particulate Composite Material Using Nondestructive Testing Techniques

Liu, C. T.; Mar. 01, 2001; 6p; In English; at SEM Annual Conf. on Experimental Mechanics. Held in Portland, OR, 4-6 Jun 2001
Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A409851; AFRL-PR-ED-AB-2001-044; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In recent years, a considerable amount of work has been done in studying damage characteristics in highly filled polymeric materials, using nondestructive testing techniques. The importance of these studies stems from the fact the damage can significantly affect the constitutive and the crack growth behavior in these materials. Experimental findings reveal that damage, expressed in terms of the attenuation of the acoustic energy, increases with increasing strain rate and the critical damage is

relatively insensitive to the strain rate. They also reveal that the damage state correlates well with the constitutive behavior of the material. In addition, for pre-cracked specimens, the damage state near the tip of a stationary crack is dependent on the loading history. In this study, the damage field near the crack tip in an edge-cracked sheet specimen subjected to a constant strain rate of 0.125 min⁻¹ was investigated using the real-time x-ray technique.

DTIC

Composite Materials; Crack Propagation

39

STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

20030019075 Houston Univ., Dept. of Mechanical Engineering, TX USA

A Comparison of Modal Data Matching and Dynamic Residual Optimization in Structural Damage Detection

Yap, Keng C., Houston Univ., USA; Zimmerman, David C., Houston Univ., USA; International Journal of COMADEM; October 2002; ISSN 1363-7681; Volume 5, No. 4, pp. 5-11; In English; Copyright; Avail: Issuing Activity

Damage assessment of structures using vibration data can be viewed as a parameter estimation process. This process is often posed as a nonlinear optimization problem, which can be formulated mathematically based on model data matching (MDM) or dynamic residual optimization (DRO). In MDM, the objective function is posed to minimize the nonlinear least squares error function between the analytical and measured modal properties. The MDM approach has been studied and used extensively. The main contribution of this work is the development of DRO methods, where a dynamic residual function is defined based on the norm of the reduced dynamic residual between the analytical model and the measured modal properties. Two DRO approaches, namely the gradient-based and dynamic least squares (DLS), are compared with the MDM approach using numerical simulations and experimental test-data.

Author

Mathematical Models; Nonlinearity; Damage Assessment; Structural Vibration; Optimization; Fault Detection

20030019869 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Fracture Mechanics and Service Life Prediction Research

Liu, C. T.; Sep. 07, 2001; 8p; In English

Contract(s)/Grant(s): AF Proj. 2302

Report No.(s): AD-A410141; AFRL-PR-ED-AB-2001-184; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this program is to develop a basis for developing advanced crack growth and service life prediction technologies for predicting the service life of solid rocket motors. The objectives of this program are to: (1) gain a fundamental understanding of fracture and crack growth behavior in solid rocket motors; (2) investigate the effects of damage, material nonlinearity, pressure, and loading rate on crack growth behavior in a solid propellant; (3) simulate crack growth behavior and gain insight for improving crack growth resistance in solid propellant; and (4) determine the crack growth behavior of an interfacial crack in bimaterial bond systems. The main issues in service life prediction of solid rocket motors are the lack of a fundamental understanding of crack growth behavior under service loading conditions and a reliable methodology to predict crack growth. The main technical challenges are micro structure effects on damage initiation and evolution, large and time-independent deformation, short crack and stress raiser interaction, and multi-layer structures with time-dependent material properties and property gradients. The program's basic approach involves a blend of analytical and experimental studies. In general, mechanisms and mechanics involved in cohesive fracture in a solid propellant and adhesive fracture in bond systems are emphasized. In this program, nonlinear viscoelasticity, fracture mechanics, experimental mechanics, damage mechanics, nondestructive testing and evaluation, and numerical modeling techniques will be used.

DTIC

Solid Propellant Rocket Engines; Life (Durability); Fracture Mechanics; Fracture Strength; Crack Initiation

20030020444 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

Fatigue Crack Growth Predictions for Simplified Spectrum Loading: Influence of Major Cycles on Minor-Cycle Damage Rates

Russ, Stephan M., Air Force Research Lab., USA; Rosenberger, Andrew H., Air Force Research Lab., USA; Larsen, James M.,

Air Force Research Lab., USA; Johnson, W. Steven, Georgia Inst. of Tech., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 21-1 - 21-14; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

As part of the Engine Structural Integrity Program, USAF turbine-engine components are subject to a damage tolerance or crack-growth assessment. This assessment involves the prediction of crack-growth lifetimes from an initial flaw size under simulated mission loading. The accuracy of the prediction is dependent upon numerous assumptions and inputs: how well the actual mission is simulated by the simpler load spectrum, the accuracy of the component temperature and stress analysis, the ability to account for load-history effects and time dependency using steady-state crack-growth data, and accounting for thermomechanical fatigue crack growth using isothermal data, to name just a few. It is evident that the life prediction is a very complex problem, and numerous effects are accounted for with empirical factors based on experience and laboratory observations. However, understanding the damage mechanisms and their controlling variables is essential in improving the accuracy of crack-growth predictions, given the complex nature of the problem. Based on reported engine mission spectra, some missions can, in their most simple form, be represented by a major cycle, representing an engine start-up and shut-down, bracketing numerous minor cycles, resulting from in-flight throttle excursions. The major cycle has a stress ratio near zero, and the minor cycles have stress ratios on the order of 0.4 and above. Depending on the number and severity of the minor cycles, the damage, as predicted by available linear damage summation rules, can be dominated by either the minor or major cycle or these may be more evenly partitioned. Thus, there is a need to quantify the effect of tensile underloads, represented by the major cycle, on the minor cycle and vice versa. Data have been generated on a titanium compressor-disk alloy (Ti-17) utilizing a stress ratio of 0.4 or 0.7 to represent the minor cycles and 0.1 to represent a major cycle. Results indicate that simple linear-damage rules can over predict crack propagation life, depending on the ratio of minor to major cycles. Several tests were performed in the vicinity of the fatigue crack growth threshold to scrutinize the effect. It is shown that the crack-growth predictions can be enhanced by slight modifications of the stress intensity range. A relatively new load-sequence method was evaluated to determine its merits relative to inveterate approaches. The method is based on a measure of the crack propagation resistance of the system.

Author

Crack Propagation; Damage; Engine Parts; Fatigue (Materials); Life (Durability); Structural Failure; Turbine Engines

20030020445 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

The Inadequacy of Safe-Life Prediction: Aero-Engine Fan and Compressor Disk Cracking

Wicks, B. J., Defence Science and Technology Organisation, Australia; Antoniou, R. A., Defence Science and Technology Organisation, Australia; Slater, S. L., Defence Science and Technology Organisation, Australia; Hou, J., Defence Science and Technology Organisation, Australia; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 22-1 - 22-10; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The use of a safe-life methodology to ascribe a replacement interval to gas turbine engine components has been used extensively for over 40 years. However there are inherent limitations in the methodology, resulting in significant under-utilisation of component lives, and an inability to account for rogue flaws and other non-representative factors. This paper will present three examples where the safe-life approach was inadequate in predicting the safe working life of critical engine components. These examples illustrate the complexity of the processes that have to be taken into account to produce realistic life estimates.

Author

Predictions; Gas Turbine Engines; Engine Parts; Defects

20030020447 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

A New Modelling of Crack Propagation with Fatigue-Creep-Oxidation Interaction under Non Isothermal Loading

Gallerneau, F., Office National d'Etudes et de Recherches Aerospatiales, France; Burgardt, B., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Kruch, S., Office National d'Etudes et de Recherches Aerospatiales, France; Kanoute, P., Office National d'Etudes et de Recherches Aerospatiales, France; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 24-1 - 24-11; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

This paper deals with the extension of a crack growth model to high temperature complex loading and application to turbine disc. The proposed model is based on an extensive experimental study performed by SNECMA Moteurs on N18 from 450 C to 650 C, in isothermal and also in non isothermal condition, which comprises fatigue with or without hold times and special sequence tests representative to the disc in service. The crack growth model is built up in the framework of classical linear elastic fracture mechanics. Time effects at high temperature are traduced by creep-fatigue and oxidation-fatigue interactions. The

proposed writing in non isothermal condition is very attractive for easy model identification on a large temperature domain. Model predictions are shown for a large set of experimental data including complex loading in non isothermal condition.

Author

Mathematical Models; Crack Propagation; Fracture Mechanics; Temperature Effects; Oxidation

45

ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20030019706 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Demonstration of Removal, Separation, and Recovery of Heavy Metals from Industrial Wastestreams Using Molecular Recognition Technology (MRT) Final Report, Jan. 1999-31 Sep. 2001

Ford, Katherine H.; Nov. 2002; 130p; In English; Original contains color images

Report No.(s): AD-A409943; NFESC-TR-2211-ENV; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report validates the performance and life cycle costs of molecular recognition technology (MRT) for selective heavy metal recovery from industrial process waste streams. MRT selectively removes heavy metal ions using synthetic chemical compounds called macrocyclic ligands. These ligands complex with the targeted heavy metal ions while allowing alkaline earth and alkali metal ions to pass through the MRT system. The captured heavy metal ions can be regenerated in a highly purified concentrated form, which can be recycled back to the industrial process or sold to a metal reclaimer. IBC Technologies, Inc., has patented these macrocyclic ligands as Superligs. MRT can recover in a single process Cu, Cd, Cr (Cr VI or Cr III), Ni, Pb, Zn, and Ag to below regulated discharge limits for industrial wastewater treatment plants. For other applications, MRT can be designed to remove single metal ions such as arsenic (As). This report includes all the data from the operational runs of the pilot scale MRT demonstration at Puget Sound Naval Shipyard's industrial wastewater pretreatment facility (IWPF). At the IWPF, two MRT mixed bed columns were used where Superlig 327 recovered copper, lead, silver, nickel, cadmium and zinc from the influent stream. Superlig 307 and Superlig 310 were used to recover chromium (VI) and chromium (III) respectively. The efficiency of MRT system was calculated and cost data presented along with a discussion of regulatory issues.

DTIC

Alkaline Earth Metals; Heavy Metals; Waste Water; Materials Recovery; Industrial Wastes

46

GEOPHYSICS

Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see 47 Meteorology and Climatology; and 93 Space Radiation.

20030018869 Institute for Advanced Research and Development, Neshet, Israel

Comparison of Atmospheric Transmittance Measurements in the 0.4-0.7micro-m, 1.3-5.5micro-m and 8-12micro-m Spectral Regions with MODTRAN: Considerations for Long Path Geometries Applicable for Theatre Defense Final Report, 21 Jun. 2000-21 Jun 2001

Devir, Adam D.; Oct. 03, 2002; 71p; In English; Original contains color images

Contract(s)/Grant(s): F61775-00-WE013; Proj-SPC-00-4013

Report No.(s): AD-A410060; IARD-61-02(105-1-2); No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report results from a contract tasking IARD Institute for Advanced Research and Development as follows: The contractor will investigate atmospheric transmission modelling techniques. During the research, the contractor will take observations by infrared sensors deployed during tropospheric operations to detect objects on the Earth's surface from a manned aircraft or from an unmanned airborne vehicle (UAV) using long, near-horizontal viewing geometries. The contractor will begin by repeating measurements collected during a previous EOARD contract under desert conditions with additional instruments that will enable us to test the predictions of MODTRAN code in the 0.4-0.7 micro-m (the photopic region), and in the 1.3-5.5 micro-m and 8-12 micro-m spectral regions. The measurements proposed would be performed in Israel in the winter, summer and autumn 2000 with an infrared spectroradiometer having both high signal-to-noise ratio and high spectral resolution. The wide range of absolute humidities and air temperatures will help in the validation of the MODTRAN code with special attention to the negative temperature dependence of the water continuum in the 8-12 micro-m spectral region. The spectroradiometer will be adapted to make the measurements in 1.3-3.0 micro-m spectral region without saturation of its detector. An additional spectroradiometer will

measure the slant path visibility in the 0.4-0.7 micro-m photopic spectral region. The autumn measurements will be synchronized with slant path visibility measurements that will be done in the framework of MEIDEX experiment on NASA STS-107 (November 2000).

DTIC

Atmospheric Models; Infrared Detectors; Infrared Radiation; Spectral Bands; Transmittance; Meteorological Parameters

20030019904 Geophysical Observatory, Sodankyla, Finland

Magnetic Results: Sodankyla, 2001, No. 91

Kultima, Johannes, Editor, Geophysical Observatory, Finland; 2002; ISSN 1456-3673; 42p; In English; This publication is a continuation of the former series "Veroeffentlichungen des geophysikalischen Observatoriums der Finnischen Akademie der Wissenschaften"; ISBN 951-42-6027-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Sodankyla Geophysical Observatory was established in 1913; 1914 was the first year of magnetic recordings. The observatory is situated on the east bank of the river Karmen, ca. 5 km south of Sodankyla village. Until July 31, 1997 it belonged to the Finnish Academy of Science and Letters. Since August 1, 1997 it has been the independent, nation-wide observatory of the University of Oulu. Its geographic, geomagnetic (dipolar) and geomagnetic (corrected) coordinates are provided in this document, along with an extensive history of magnetic measurements dating from 1914.

Derived from text

Finland; Geomagnetism; Magnetic Measurement; Geophysical Observatories

47

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20030019071 Army Research Lab., Sensors Directorate, Adelphi, MD USA

User Manual for the Microsoft Window Edition of the Scanning Fast-Field Program (WSCAFFIP) Version 3.0 Final Report, Oct. 2000-Oct 2001

Noble, John M.; Jan. 2003; 45p; In English

Report No.(s): AD-A410145; ARL-TR-2696; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Scanning Past-Field Program (SCAFFIP) is an atmospheric acoustic propagation model that incorporates many of the effects of the environment on the sound field such as geometrical spreading, refraction, diffraction, molecular absorption, and complex ground impedance. SCAFFIP provides the user with the attenuation levels with range and frequency for a given geometry and meteorological profile. The meteorological profile and geometry provides the model with the ability to calculate the sound speed profile. The geometry profile is required because of the angular dependence of the sound speed on the wind direction relative to the direction of propagation. This model works over a flat earth and non-turbulent atmosphere. Even with these restrictions, the model performs very well for many Scenarios. The model contains a user-friendly interface that requires a minimum amount of information to run the model, yet there are flags that can be set to obtain more detailed information.

DTIC

Scanning; User Manuals (Computer Programs); Acoustic Propagation; Computer Programs; Meteorological Parameters

20030019306 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Validation Study of Operational Battlescale Forecast Model (BFM) Over Western Asian Regions Final Report, Oct.-Dec. 2001

Henmi, Teizi; Raby, John W.; Crunlet, John; Kratzer, Jim; Dec. 2002; 32p; In English

Report No.(s): AD-A409973; ARL-TN-118; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Current version of the Battle scale Forecast Model (BFM) on the U.S. Army Integrated Meteorological System was evaluated by comparing the model's forecast data with observed meteorological data. Two model domains adjacent to Afghanistan, Iran, and Pakistan were selected to run the BFM for 24-hr forecast periods in operational mode. Due to the limited number of observation stations and data, the results obtained in this study should be regarded as qualitative. The following findings were obtained: For surface temperature, the BFM forecast data were in good agreement with the surface observation data for both Iran and Pakistan model domains. Relative humidity forecast by the BFM was also in fair agreement with observation. The BFM showed the tendency to under forecast wind speed throughout the entire forecast period. Similarly, forecast values of horizontal wind vector components u and v tended to be smaller than observed values. Surface wind analysis data calculated by the MM5, AVN, and NOGAPS over western Asia were also compared with the observed data, showing slightly better statistical results than

the BFM over the Iranian model domain. Statistical intercomparisons of different models operated over different model domains, grid configuration, and different initialization data were not valid comparisons. It is suggested that a validation study of the BFM be done over the area where a large number of surface and upper air data are regularly available and where topographical features are complex enough to generate diurnal wind patterns, such as Utah.

DTIC

Meteorological Parameters; Wind Measurement; Atmospheric Temperature; Proving

20030020306 NASA Langley Research Center, Hampton, VA USA

Aviation Weather Information Overview and Status

Stough, Paul, NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 33-50; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents the weather accident prevention project review during the period of June 5, through June 7, 2001. The topics include: 1) Background; 2) Guidance; 3) Plan; 4) System Elements; 5) AWIN System; 6) Market Segments; 7) Technology Development Level; 8) Aviation Safety Program Organization; 9) Partnerships; 10) NASA Facilities; 11) Timeline; 12) AWIN Research Areas; and 13) Cooperative Research with FAA. This paper is in viewgraph form.

CASI

General Overviews; Weather Forecasting; Information Systems; General Aviation Aircraft; NASA Programs; Accident Prevention

20030020308 NASA Dryden Flight Research Center, Edwards, CA USA

Turbulence Detection and Mitigation Element

Bogue, Rod, NASA Dryden Flight Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 73-90; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This paper presents viewgraphs on turbulence detection and mitigation technologies in weather accident prevention. The topics include: 1) Organization; 2) Scope of Turbulence Effort; 3) Background; 4) Turbulence Detection and Mitigation Program Metrics; 5) Approach; 6) Turbulence Team Relationships; 7) WBS Structure; 8) Deliverables; 9) TDAM Changes; 10) FY-01 Results/Accomplishments; 11) Out-year Plans; and 12) Element Status.

CASI

Accident Prevention; Turbulence; Weather; Detection; Commercial Aircraft; Technology Utilization

20030020309 Honeywell, Inc., USA

Weather Information Network Overview

Leger, Dan, Honeywell, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 91-100; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

This paper presents a general overview of the Weather Information Network (WINN). The topics include: 1) Data; 2) System Overview; 3) Ground Processing; 4) Communications; 5) Airborne; 6) Airborne 2; 7) Airborne Displays; 8) Current Status; and 9) Our Airspace System.

CASI

General Overviews; Weather; Information Systems; Display Devices; Communication Networks

20030020313 Rockwell Collins, Inc., USA

Satellite Weather Information Service

Haendel, R. S., Rockwell Collins, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 146-164; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

A viewgraph presentation on the Satellite Weather Information Service is presented. The topic include: 1) Overview; 2) Program Phases; 3) Phase 1 Description; 4) Phase 2 Aircraft Configuration; 5) Satellite World Wide Coverage; 6) Team Members; 7) Phase 2 Status; 8) Weather Graphics; 9) Air Coverage; 10) Data Routing and timing; and 11) Weather Benefits.

CASI

Meteorological Services; Weather Stations; Information Systems; Meteorological Radar; Meteorological Satellites

20030020314 Rockwell Collins, Inc., Hampton, VA USA

Pilot Weather Advisor(tm)

Hoffler, Keith D., Vigyan Research Associates, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 165-178; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on Pilot Weather Advisor(tm), a weather information system which relays weather satellite data to a display device onboard an aircraft. The presentation covers the history of the research and development of the system, its display device, system diagram, and work planned.

CASI

Cockpit Weather Information Systems; Research and Development; Display Devices; Aircraft Instruments

20030020315 Federal Aviation Administration, USA

The Results of the Evaluation of Using Lightning Data to Improve Oceanic Convective Forecasting for Aviation

Nierow, Alan, Federal Aviation Administration, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 179-186; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on an experiment to evaluate the usefulness of lightning data in aviation. The presentation includes a summary of input on enhanced safety and increased efficiency from airlines, the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the Department of Defense (DoD).

CASI

Aviation Meteorology; Lightning; Civil Aviation

20030020316 National Center for Atmospheric Research, Boulder, CO USA

Oceanic Weather Information: Oceanic Convective Nowcasting Demonstration (OCND)

Lindholm, Tenny, National Center for Atmospheric Research, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 187-199; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the Oceanic Convective Nowcasting Demonstration (OCND). The presentation covers oceanic/remote area aviation weather requirements, ongoing research to address the requirements, intelligent weather systems, and the OCND Program.

Author

Marine Meteorology; Nowcasting; Aviation Meteorology; Information Systems

20030020327 National Weather Service, Aviation Services Branch, USA

Impact of Meteorological Data Collection and Reporting System (MDCRS)/Tropospheric Airborne Meteorological Data Reporting (TAMDAR) Data on National Weather Service (NWS) Operations

Weiss, Carl, National Weather Service, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 413-428; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the use of data by the National Weather Service (NWS). The two sources of data, the Meteorological Data Collection and Reporting System (MDCRS) and the Tropospheric Airborne Meteorological Data Reporting (TAMDAR), provide the basis for the National Weather Service's ability to perform Numerical Weather Prediction (NWP). These sources of data are derived from sensors mounted on host commercial airplanes. TAMDAR, an emerging system, will complement the data already received from MDCRS by providing input on the mid-tropospheric region not currently provided by airborne sensors.

CASI

Airborne Equipment; Data Acquisition; Meteorological Services; Numerical Weather Forecasting

20030020329 Massachusetts Inst. of Tech., Lincoln Lab., Cambridge, MA USA

Meteorological Case Studies of Turbulence Encounters

Ferris, Richard, Massachusetts Inst. of Tech., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 433-475; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on numerous case studies of atmospheric turbulence encountered by aircraft. These studies were undertaken because flight data recorder data is not sufficient as the sole determinant of causality regarding the consequences of the encounter. Radar and infrared imagery and specific details of each flight are included, followed by specific and general conclusions.

CASI

Atmospheric Turbulence; Aircraft Accidents; Accident Prevention; Weather

20030020330 NASA Langley Research Center, Hampton, VA USA

Weather Associated with the Fall-2000 Turbulence Flight Tests

Hamilton, David W., NASA Langley Research Center, USA; Proctor, Fred H., NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 476-509; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on three flight tests in which NASA Langley's ARIES B-757 research aircraft was intentionally piloted into areas with a high risk for severe atmospheric turbulence. During its encounter with turbulence, instruments aboard the aircraft monitored wind, temperature and acceleration, and onboard Doppler radar detected forward turbulence. Data was collected along a spectrum, from smooth air to severe turbulence.

CASI

Atmospheric Turbulence; Flight Tests; Turbulence Effects; Flight Conditions

20030020332 North Carolina State Univ., Raleigh, NC USA

Unbalanced Supergradient Flow: Its Role in Organizing Severe Turbulence in Both Convective and Clear Air Case Studies

Kaplan, Michael L., North Carolina State Univ., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 537-554; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the role of supergradient flow in organizing the severe turbulence in convective and clear air case studies. Diagrams of the structure of turbulence are presented, as well as conclusions which include: 1) jet streak entrance regions merge in the presence of curved flow; 2) deformation zone forms as momentum converges and centrifugal force increases; 3) cross-stream (z) vortices are produced in supergradient flow confluence zone; 4) MASS (Mesoscale Atmospheric Simulation System) perturbation (Moist Convection/Frontogenesis) Modifies Along-Flow PGF (Pressure Gradient Force); 5) (Y) vortex converges (Z) vorticity = hazard.

CASI

Atmospheric Turbulence; Pressure Gradients; Simulation

20030020333 National Center for Atmospheric Research, Research Applications Program, Boulder, CO USA

Simulations of Continuous and Discrete Event Turbulence

Sharman, R., National Center for Atmospheric Research, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 555-570; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on the simulation of continuous and discrete event turbulence. Continuous and discrete turbulence is compared. For continuous turbulence, von Karman representations are used for the simulation with advantages and disadvantages of this method described. The von Karman turbulence simulations have applications to radar detection and mesoscale cloud models. Various events are shown as well as the way in which they are simulated.

CASI

Computerized Simulation; Atmospheric Turbulence; Computational Grids

20030020340 NASA Dryden Flight Research Center, Edwards, CA USA

Turbulence JSIT Status

Bogue, Rod, NASA Dryden Flight Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 738-745; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of the turbulence JSIT program. Topics covered include: CAST process, intervention and project statistics, JSAT turbulence model, initial project subject candidates and project status.

CASI

Turbulence; Aircraft Safety; Data Processing; Aircraft Control; Airborne Equipment

51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

20030018842 Beth Israel Deaconess Medical Center, Boston, MA USA

Lymphatic Regeneration within Porous VEGF-C Hydrogels for Secondary Lymphedema *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Contreras, Muricio A.; Jul. 2002; 17p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0152

Report No.(s): AD-A410086; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Lymphangiogenesis occurs in parallel with maturation of the blood vascular system, aberrant lymphangiogenesis contributes to interstitial protein accumulation. Lymphedema therefore, ensues as a result of lymphatic blockage, trauma or dysfunction.

DTIC

Cardiovascular System; Porosity; Proteins; Lymphatic System; Regeneration (Physiology)

20030018843 Bogazici Univ., Inst. of Biomedical Engineering, Istanbul, Turkey

Towards Rapid Screening of Tagged MR Images of the Heart

Goksel, D.; Ozkan, M.; Ozturk, C.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T

Report No.(s): AD-A410090; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The final aim of this work is to perform rapid classification of tagged cardiac MR images as normal and abnormal. In the proposed technique, images are first analyzed using harmonic phase analysis and synthetic tags are computed over the myocardium. Cubic curves are fitted to these tags and curve parameters are compared at various regions of the myocardium. In this initial study, the ratios of curve parameters between normal and diseased hearts, such as dilated cardiomyopathy (DCM) and heart with infarcted regions, are evaluated. If the initial segmentation problems are solved, this method could be a very fast and automatic screening tool for identifying diseased locations in tagged MRI.

DTIC

Heart; Myocardium; Magnetic Resonance; Cardiology; Imaging Techniques

20030018846 Vanderbilt Univ., Medical Center, Nashville, TN USA

The Role of Chk1 Kinase in Cell Cycle Checkpoint Response in Breast Epithelial Cells *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Westfall, Matthew D.; Pietenpol, Jennifer A.; Aug. 2002; 66p; In English

Contract(s)/Grant(s): DAMD17-01-1-0439

Report No.(s): AD-A410123; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

p63 is a recently identified homolog of p53 that is found in the basal layer of several epithelial tissues such as the epidermis, oral mucosa, prostate, urogenital tract, and mammary gland. Studies with p63^{-/-} mice and analysis of several human autosomal dominant disorders with germline p63 mutations suggest p63 involvement in maintaining epithelial stem cell populations. However, the biochemical mechanisms by which p63 functions are not well understood. The objective of the current study is to determine the splice variants that are expressed in primary human mammary epithelial cells (HMECs) and the biochemical activity p63 has in these epithelial cell populations. Progress to date includes: (1) cloning of p63 splice variants and development of assay systems in primary epidermal cell cultures to analyze p63 expression and biochemical activity; (2) determining that p63 represses transcription and binds directly to p53 consensus sites in the p21 and 14-3-3 sigma promoters in vitro and in vitro; (iii) development of optimal growth conditions for primary human mammary epithelial cells. It is critical to obtain a more thorough

understanding of how p63 works at the molecular level in HMECs to better understand the role of p63 in breast cancer development.

DTIC

Cancer; Mammary Glands; Biochemistry; Cells (Biology); Epidermis

20030018848 Universite des Sciences et Techniques de Lille, France

Comparison of Optimised Treatment Plans for Radiosurgery and Conformal Radiotherapy

Kulik, C.; Vermandel, M.; Gibon, D.; Caudrelier, J. M.; Maouche, S.; Oct. 25, 2001; 3p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A410152; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of conformal radiation therapy and of radiosurgery, (Gamma Knife and Multi-beam radiosurgery) is to irradiate the pathological target volume with ionising radiation while avoiding as well as possible the surrounding normal tissues, Considering the accuracy of these treatments, it is interesting to compare the different techniques to evaluate their effectiveness, This comparison involves 8 clinical cases, For each treatment modality, we compare indexes defined in the international literature by the Radiation Therapy Oncology Group (RTOG), This theoretical study shows the interest of the use of intensity modulation in the case of conformal radiation therapy and the improvement of RTOG indexes with using the conformal radiotherapy although the VNT25% and the VNT50% remains better with the radiosurgery.

DTIC

Neoplasms; Radiation Therapy; Ionizing Radiation

20030018850 Purple Hospital, Toulouse, France

The Recognition of Biomedical Engineering Within the International Council for Science

Morucci, J. P.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410155; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Forty years separate the emergence of Biomedical Engineering in a meeting in Paris at UNESCO in 1959 from its recognition together with Medical Physics in 1999 by the International Council for Science. The main problems of definition and of identity of Biomedical Engineering as a scientific discipline are discussed and the different steps which have favored this recognition are A outlined.

DTIC

Bioengineering; Medical Science

20030018851 Rehabilitation Inst. of Chicago, Chicago, IL USA

Development of an Intelligent Stretching Device for Ankle Joints With Contracture/Spasticity

Zhang, L. Q.; Chung, S. G.; Bai, Z.; Xu, D.; van Rey, E. M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T

Report No.(s): AD-A410157; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A stretching device with intelligent control was developed to treat spastic/contractured ankles of neurologically impaired patients and evaluate the outcome. The device stretched the ankle joint safely throughout the range of motion (ROM) to extreme positions until a specified peak resistance torque was reached with the stretching velocity controlled based on the resistance torque. The ankle was then held at the extreme position for a period of time to let stress relax before it was rotated back to the other extreme position. The stretching was slow at the joint extreme positions, making it possible to reach a larger ROM safely, and it was fast in the middle ROM so the majority of the treatment was spent in stretching the problematic extreme ROM. The device was evaluated in five healthy subjects and used to treat four stroke patients. Furthermore, it was used to evaluate treatment outcome in multiple aspects, including passive/active joint ROM, stiffness, viscous damping, and reflex excitability. The intelligent control and yet simple design of the device suggest that the device can be made portable at relatively low cost, making it available to patients/therapists for frequent use in clinics/homes and allowing more effective treatment and long-term improvement.

DTIC

Medical Equipment; Control Equipment; Clinical Medicine; Medical Services

20030018852 Middle East Technical Univ., Ankara, Turkey

Microcontroller Controlled, Multifrequency Electrical Impedance Tomograph

Arpinar, V. E.; Eyuboglu, B. M.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410159; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this study, development of a microcontroller controlled multifrequency electrical impedance tomography system is aimed. In this system, current injection and voltage measurements are both performed by the surface electrodes, which are microcontroller controlled. Data acquisition system process the measured signal using continuous time quadrature demodulator. After that, it converts analog information to digital and transfers it to the PC.

DTIC

Tomography; Electrical Impedance; Data Acquisition; Analog Data

20030018854 Thessaloniki Univ., Salonika Greece

Virtual Drilling - Sculpturing in 3-D Volumes

Kechagias, Lefteris; Bors, Adrian G.; Pitas, Ioannis; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410176; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper we propose a virtual drilling-sculpturing algorithm applied on 3-D objects. The 3-D objects can either be simple geometrical shapes such as cubes and spheres or more complicated objects as teeth. In the second case, we consider that we are provided with a sparse set of parallel and equi-distant slices of the 3-D object. With that set of slices we reconstruct the 3-D object using a volumetric interpolation method. On the created volumes, we simulate the drilling action as a 3-D erosion operation. The proposed technique is applied for virtual drilling of teeth considering various bur tools of different shapes as erosion elements. Furthermore, the algorithm has been extended as a virtual sculpturing method that can be applied in many 3-D objects, simulating the action of chisel tools.

DTIC

Computerized Simulation; Cubes (Mathematics); Algorithms; Dentistry

20030018855 Drexel Univ., Philadelphia, PA USA

Real-time Seizure Detection System Using Multiple Single-Neuron Recordings

Moxon, Karen; Kuzmick, Valerie; Lafferty, John; Serfass, April; Szperka, Doug; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T

Report No.(s): AD-A410177; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Approximately 20% of people diagnosed with epilepsy cannot be treated effectively. Consequently, there exists a significant need for alternative types of treatment. to aid in the effort of solve this problem, we developed a prototype system to detect changes in neural activity prior to the onset of a seizure, This system can be used as warning device or as part of a large system to terminate seizures in their initial stages via drug administration or nerve stimulation, The detection algorithm used data collected from intracranial electrodes, The waveforms were filtered and amplified to identify single neuron action potentials, The time of occurrence of each action potential for each neuron was then passed to a preprocessor algorithm that summed the data into 50ms time bins, Sliding windows consisting of 128 bins for each neuron were cross-correlated. The results were summed and the variance of the cross-correlation was used as a measure of global neuron correlation, The algorithm was implemented in a PC board and tested in rats treated with pentylenetetrazol (PTZ) a known seizure inducing drug. The system was 100% effective at detecting seizures approximately 4,6 seconds before seizure onset and had a false positive rate of 0,3%.

DTIC

Detection; Epilepsy; Neurons; Cross Correlation; Seizures

20030018856 Middle East Technical Univ., Ankara, Turkey

Development of Realistic Head Models for Electromagnetic Source Imaging of the Human Brain

Akalin, Z.; Acar, C. E.; Gencer, N. G.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A410199; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this work, a methodology is developed to solve the forward problem of electromagnetic source imaging using realistic head models. For this purpose, first segmentation of the 3 dimensional MR head images is performed. Then triangular, quadratic meshes are formed for the interfaces of the tissues. Thus, realistic meshes, representing scalp, skull, CSF, brain and eye tissues, are formed. At least 2000 nodes for the scalp and 5000 for the cortex are needed to obtain reasonable geometrical approximation. Solution of the forward problem using our previous Bound an,' Element Method (BEM) formulation with quadratic elements remains to be made,

DTIC

Brain; Magnetic Resonance; Electromagnetic Radiation; Eye (Anatomy)

20030018857 Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA

The Natural History and Risk Factors of Musculoskeletal Conditions Resulting in Disability Among US Army Personnel

Lincoln, Andrew E.; Smith, Gordon S.; Amoroso, Paul J.; Bell, Nicole S.; Jan. 2002; 16p; In English

Report No.(s): AD-A409567; M01-42; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe the natural history of 13 musculoskeletal conditions requiring hospitalization and identify demographic, behavioral, psychosocial, occupational, and clinical characteristics most strongly associated with disability discharge from the Army. Subjects included 15,268 active-duty personnel hospitalized for a common musculoskeletal condition between the years 1989-1996 who were retrospectively followed through 1997. Back conditions had the greatest 5-year cumulative risk of disability (21%, 19%, and 17% for intervertebral disc displacement, intervertebral disc degeneration, and nonspecific low back pain, respectively). Cox proportional hazards models identified the following risk factors for disability among males: lower pay grade, musculoskeletal diagnosis, shorter length of service, older age, occupational category; lower job satisfaction, recurrent musculoskeletal hospitalizations, more cigarette smoking, greater work stress, and heavier physical demands. Among females, fewer covariates reached statistical significance, although lower education level was significant in more than one model. Modifiable risk factors related to work (job satisfaction, work stress, physical demands, occupation) and health behaviors (smoking) suggest possible targets for intervention.

DTIC

Musculoskeletal System; Armed Forces (USA); Personnel; Risk; Disabilities

20030018865 Purdue Univ., Purdue Research Foundation, Lafayette, IN USA

Functional Analysis of the ErbB4 Receptor Tyrosine Kinase Annual Report, 1 Jul. 2001-30 Jun. 2002

Riese II, David J.; Jul. 2002; 85p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0415

Report No.(s): AD-A410069; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

My laboratory studies the signaling network comprised of the epidermal growth factor (EGF) family of peptide hormones and the ErbB family of receptor tyrosine kinases. We are particularly interested in elucidating the roles that these hormones and receptors play in breast cancer and in developing reagents that target these hormones and receptor and may be use in diagnosing or treating breast cancer. In part due to the generous support of this career development award, we have made progress on four fronts. (1) We have identified and characterized novel small-molecule EGFR antagonists. Some of these hold promise as breast tumor imaging agents specific for tumors that overexpress EGFR. (2) We have used a set of constitutively active ErbB4 mutants to determine that ErbB4 signaling inhibits the proliferation of non-malignant and malignant human mammary cell lines. This suggests that ErbB4 may be a mammary-specific tumor suppressor. (3) We have characterized four novel EGF family hormones. (4) Moreover, we have made mutants of two EGF family hormones that have enabled us to identify residues critical for activation of ErbB4 signaling by these hormones. These data may lead to synthetic, specific ErbB4 agonists and antagonists that could be used to define the role of ErbB4 in breast cancer or could be used to prevent breast cancer.

DTIC

Tyrosine; Functional Analysis; Receptors (Physiology); Epidermis; Cancer; Mammary Glands

20030018866 Georgetown Univ. Hospital, Washington, DC USA

Growth Factor Regulation of an Angiogenic Factor, the Fibroblast Growth Factor-Binding Protein (FGF-BP), in Breast Cancer Annual Report, 1 Aug. 2001-31 Jul. 2002

Kagan, Benjamin L.; Aug. 2002; 18p; In English

Contract(s)/Grant(s): DAMD17-00-1-0265

Report No.(s): AD-A410065; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A secreted carrier protein has been described which is able to bind to FGF-1 and FGF-2 in a non-covalent, reversible manner. FGF-2 bound to this protein was not subject to degradation and retained its mitogenic activity. This FGF-binding protein

(FGF-BP) has been studied extensively by our laboratory. FGF-BP is highly expressed in squamous cell carcinomas (SCC) and EGF is able to increase the expression of FGF-BP in SCC derived cell lines through PKC, MEK/ ERK, and p38 MAPK signaling. We have found FGF-BP mRNA to be expressed in two breast cancer cell lines (MDA-MB-468, MCF-7/ADR), by Northern Analysis/Ribonuclease Protection. EGF treatment of MDA-MB-468 cells resulted in an increase in FGF-EP mRNA expression in a time-dependent manner. EGF signaling occurs primarily through the PKC, and p38 MAPK pathways, while EGF induction of the FGF-BF promoter is mediated through CCAAT/enhancer binding protein (C/EBP) and AP-1 transcription factor binding sites on the promoter. Finally, overexpression of C/EBPbeta-LAP upregulates FGF-BP promoter activity 80-fold and is reversed with coexpression of C/EBPbeta-LAP, which is mediated primarily through the FGF-BP promoter C/EBP site.

DTIC

Cancer; Fibroblasts; Mammary Glands; Proteins; Gene Expression

20030018868 Ege Univ., Faculty of Pharmacy, Bornova-Izmir, Turkey

Indicator Based and Indicator - Free Electrochemical DNA Biosensors

Kerman, Kagan; Meric, Burcu; Ozkan, Dilsat; Kara, Pinar; Ozsoz, Mehmet; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410061; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The utility and advantages of an indicator free and MB based sequence specific DNA hybridization biosensor based on guanine and adenine oxidation signals and MB reduction signals have been demonstrated. Indicator free detection system is simple, cost-effective and provides rapid detection. The application of DPV at CPE fulfilled the expectations for the direct detection of hybridization between the known oligonucleotides. This procedure can be employed to detect specific gene sequences related to different viruses, bacterias or even inherited diseases. Improving the immobilization and hybridization steps through the use of covalent attachment schemes or PNA probes should further minimize non-specific adsorption effects and maximize sensitivity and speed. Reports are in progress towards these directions.

DTIC

Bioinstrumentation; Deoxyribonucleic Acid; Electrochemistry; Detection; Nucleotides

20030018870 Fourth Military Medical Univ., Dept. of Biomedical Engineering, Xi'an, China

Application of Adaptive Time-Frequency Analysis in Cardiac Murmurs Signal Processing

Haibin, Wang; Jianqi, Wang; Guohua, Luo; Guohui, Zhao; Ansheng, Ni; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410059; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In order to avoid the disadvantage of low resolution of fixed-kernel time-frequency (TF) analysis, adaptive TF analysis is employed to classify cardiac murmurs including systolic murmur, diastolic murmur. The analysis results of several cases of heart disease with different cardiac murmurs indicate that the TF Spectrum based on adaptive cone-kernel distribution is capable to show the power Spectrum of cardiac murmurs in TF plane and the dynamic course. The TF resolution is high and the characteristics of different kinds of murmurs is obvious.

DTIC

Heart Diseases; Signal Processing; Time Series Analysis; Cardiology; Adaptive Control

20030018872 Universidad Politecnica de Madrid, Madrid Spain

Comparison of Wavelet Packets With Cosine-Modulated Pseudo-QMF Bank for ECG Compression

Blanco-Velasco, M.; Cruz-Roldan, F.; Lopez-Ferreras, F.; Martin-Martin, P.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A410018; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An electrocardiogram (ECG) compression technique based on subband coding has been developed in this paper to compare with compression techniques based on Wavelet Packets (WP). The filter bank designed is a cosine-modulated pseudo-QMF bank using the Kaiser Window Approach (KWA) method that does not have the perfect reconstruction (PR) property, as opposed to WP that are implemented by means of a PR filter bank. In both schemes, the coding process is the same to be able to compare the results. This is earned out using a very easy algorithm based on a thresholding technique, which provides good compression rate. Its main application is to encode long-term registers of digitized electrocardiogram signal, in order to reduce the bit rate. to

preserve the reconstructed signal accuracy, the percentage root-mean-square difference (PRD) is used as an objective measurement parameter, which is selected before compression. The tests have been done for the twelve principal cardiac leads, and the compression degree measurement is evaluated by means of the mean number of bits per sample (MBPS) and the compression ratio (CR).

DTIC

Signal Processing; Electrocardiography; Data Compression

20030018873 Bologna Univ., Dept. of Electronics Computer Science and Systems, Italy

Analysis of Cardiovascular Instability by a Mathematical Model of Baroreflex Control

Magosso, E.; Biavati, V.; Ursino, M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410081; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A mathematical model of the short-term arterial pressure control is used to investigate the possible origin of blood pressure waves (Mayer waves) and of heart rate variability signals. The model includes a pulsating heart, the pulmonary, and systemic circulation, and various feedback regulatory mechanisms. Feedback mechanisms are activated by changes in systemic arterial pressure (arterial baroreflex) and in right atrial pressure (cardiopulmonary, baroreflex) and work on systemic resistance, systemic venous unstressed volume, heart contractility and heart period. The latter involves a balance between sympathetic and vagal activities (sympato-vagal balance). A sensitivity analysis on the parameters of feedback mechanisms revealed that a significant increase in the gains and time delays (up to 9 s) of all the arterial baroreflex sympathetic mechanisms is required to induce instability. In this condition, systemic arterial pressure exhibits spontaneous oscillations with a period of about 20 s. similar to Mayer waves. Moreover, an increase in the gain and time delay (up to 3.5 s) of the arterial baroreflex vagal mechanism causes the appearance of unpredictable fluctuations in heart period, with spectral components in the range 0.08-0.12 Hz. The cardiopulmonary, baroreflex plays a less important role in the genesis of the aforementioned instability phenomena.

DTIC

Baroreflexes; Cardiovascular System; Mathematical Models; Pressure Regulators; Blood Pressure

20030018875 Chinese Univ. of Hong Kong, Dept. of Electronic Engineering, Shatin, Hong Kong

Reduction of Heart Sounds from Lung Sound Recordings by Automated Gain Control and Adaptive Filtering Techniques

Yip, L.; Zhang, Y. T.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A410078; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Auscultation is an attractive, simple, and noninvasive method for the diagnosis of cardiovascular and pulmonary disorders. However, heart sounds contaminates severely lung sound recordings. The results of our previous researches indicated that the Laplacian electrocardiography signal (LECC) could be used as a reference for adaptive filtering to reduce heart sounds. In this paper, an integrated platform including an electronic stethoscope, an automated gain control (AGC), and an adaptive algorithm, has been developed to process the signal in real time. The AGC algorithm allows amplifying the LECC signal in different scales to solve the problem of relative weak LECC signals at right chest. The experimental result shows that the heart-noise reduction at right chest is improved from 43% reported early to 75%. The overall heart sound reduction by our new scheme ranges from 75% to 83% at different chest locations.

DTIC

Cardiovascular System; Lungs; Heart Function; Adaptive Filters; Automatic Control; Acoustics

20030018876 Purdue Univ., Purdue Research Foundation, Lafayette, IN USA

Functional Analysis of the ErbB4 Receptor Tyrosine Kinase Annual Report, 1 Jul. 2001-30 Jun. 2002

Riese, David J., II; Jul. 2002; 29p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0416

Report No.(s): AD-A410075; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

ErbB4 is a member of the signaling network composed of the EGF (epidermal growth factor) family of peptide hormones and the ErbB family of receptor tyrosine kinases. We have hypothesized that ErbB4 is a mammary-specific tumor suppressor. Indeed, we have preliminary data that indicates that overexpression of ErbB4 causes the EGF family hormones EGF and Neuregulin to inhibit DNA synthesis of a human mammary tumor cell line. Furthermore, we have constructed three constitutively active, ligand-independent ErbB4 mutants. We have published data indicating that these mutants do not malignantly transform

the growth of cultured rodent fibroblasts. These data indicate that ErbB4 is not an oncogene. Moreover, we have preliminary data indicating that one of the three constitutively active ErbB4 mutants inhibits proliferation of at least one human mammary cell line. Future experiments are planned to examine whether this response to ErbB4 signaling is observed in a panel of human mammary cell lines. Other experiments are planned to begin to elucidate the signaling transduction pathway that couples ErbB4 to inhibition of mammary cell proliferation.

DTIC

Functional Analysis; Genetics; Hormones; Oncogenes; Tyrosine; Receptors (Physiology)

20030018877 North Carolina Univ., Chapel Hill, NC USA

Tumor Suppressor Mechanism in Breast Cancer: Studies in Genetically Engineered Mice Final Report, 1 Jul. 1999-30 Jun. 2002

Van Dyke, Terry A.; Jul. 2002; 16p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9332

Report No.(s): AD-A410072; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The p53 and pRb tumor suppressor pathways are frequently altered in human breast cancer. Although animal models have begun to explore mechanisms for these proteins, the roles can be different depending on the cancer type. Our previous studies in a mouse brain epithelial tumor model have demonstrated the importance of pRb in tumor initiation and of p53 in tumor progression, and have established p53-dependent apoptosis as a means of tumor suppression. In this model, brain cells are induced to proliferate aberrantly by tissue-specific expression of T121, a small T antigen oncoprotein that inactivates pRb. This causes slow growing, but highly apoptotic tumors. Further inactivation of p53 causes a dramatic decline in cell death and rapid acceleration of tumor growth. We propose similar studies to examine the pRb and p53 roles in breast cancer. The full T antigen oncoprotein (inactivates both pRb and p53) has been shown to induce mammary tumors in transgenic mice. Here, the T - oncoprotein will be tissue-specifically expressed in mammary epithelium by mammary-specific promoters to test the role of pRb.

DTIC

Cancer; Mammary Glands; Tumors; Genetics; Animals; Apoptosis

20030018878 Tokai Univ., Hiratsuka Japan

Basic Investigation on Medical Ultrasonic Echo Image Compression by JPEG2000 - Availability of Wavelet Transform and ROI Method

Hamamoto, Kazuhiko; Nishimura, Toshihiro; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410017; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Lossy pulse-echo ultrasonic image compression by a JPEG baseline system is permitted by DICOM. In addition to the use of JPEG, use of JPEG2000 will be approved in the near future. The main features of JPEG2000 are use of wavelet transform and ROI (Region of Interest) method. It is expected that wavelet transform is more effective than Fourier transform for ultrasonic echo signal/ image processing. Furthermore, ROI method seems to be appropriate compression method of medical images. The purpose of this paper is to investigate the effectiveness of wavelet transform compared with DCT (JPEG) and ROI method for medical ultrasonic echo image compression. The image quality is evaluated by PSNR and the subjective assessment by medical doctors and ultrasonographers. Results reveal that wavelet transform achieves a lower hit rate compared with DCT under the same image quality. In regard to ROI method, it is important that how place of ROI is determined and how much image quality in the other region is reduced.

DTIC

Fourier Transformation; Data Compression

20030018879 Consiglio Nazionale delle Ricerche, Ist. di Fisiologia Clinica, Pisa Italy

Automatic Time Sequence Alignment in Contrast Enhanced MRI by Maximization of Mutual Information

Positano, V.; Santarelli, M. F.; Landini, L.; Benassi, A.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410016; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of contrast medium allows joining the high-resolution anatomical information provided by standard magnetic resonance with functional information obtained by means of the diffusion of contrast agent in tissues or in the vascular net. to effectively use this kind of images for medical diagnosis, quantitative analysis should be performed. We propose an automatic

registration procedure based on maximization of the mutual information that address the requirement of fast and automatic tools for quantitative analysis of contrast medium enhanced MR images. Two optimization algorithms for maximization of the mutual information are discussed, taking into account both time performance and registration quality. We present also preliminary results on cardiac and wrist MR images showing that misalignments and artifacts introduced by patient movement during the examination are greatly reduced by our application.

DTIC

Information Theory; Imaging Techniques; Clinical Medicine

20030018880 Queensland Univ., Brisbane Australia

Asymmetric MRI Systems: Shim and RF Coil Designs

Crozier, S.; Zhao, H.; Forbes, L. K.; Lawrence, B.; Yau, D.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A410015; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have recently introduced the concept of asymmetric clinical MRI systems. The potential advantages of these systems include a reduced perception of claustrophobia by patients and better physician access to the patient. For asymmetric magnet systems to be useful as a clinical system asymmetric shims and RF coils must be implemented and in this work we describe new design methodologies for both.

DTIC

Magnet Coils; Medical Equipment

20030018882 Monash Univ., Clayton Australia

Analysis of HIV Proteins Using DSP Techniques

Cosic, Irena; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A410011; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Our previous studies suggested that digital signal processing methods can be used to analyse linear sequences of amino acids to reveal the functional information within the protein sequence. In this study both spectral and time-frequency methods are applied to the analysis of the functional content of HIV virus envelope proteins. Here, we have identified specific RRM frequency of HIV proteins, predicted active sites in these proteins and compared these predictions with experimentally determined active sites.

DTIC

Signal Processing; Proteins; Numerical Analysis

20030018898 Kuopio Univ., Finland

Software Package for Bio-Signal Analysis

Ranta-aho, P. O.; Tarvainen, M. T.; Koistinen, A. S.; Karjalainen, P. A.; Oct. 15, 2002; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom., The

Report No.(s): AD-A410202; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed a MatlabTM based software package for bio-signal analysis. The software is based on modular design and can thus be easily adapted to fit on analysis of various kind of time variant or event-related bio-signals. Currently analysis programs for event-related potentials (ERP) heart-rate variability (HRV), galvanic skin responses (GSR) and quantitative EEG (qEEG) are implemented. A tool for time varying spectral analysis of bio-signals is currently under construction. by combining different analysis tools it is possible to build analyzing procedures based on the software not only for simple sense or attention related tasks but also e.g. for responses measured during complicated psychological tests. Bio-Signals Matlab

DTIC

Computer Programs; Electroencephalography; Applications Programs (Computers); Time Signals

20030018913 Chitose Inst. of Science and Technology, Chitose, Japan

Phase-Sensitive Fluorescence Study of Mono-L-Aspartyl Chlorin E6

Li, Liming; Kodama, Kunihiko; Saito, Koichi; Aizawa, Katsuo; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409589; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Phase-resolved fluorescence studies of a photo sensitizer for photodynamic therapy mono-L-aspartyl chlorin e6 (ME2906) have been carried out. The experiments were done for its water solutions in the concentration range from 3.13×10^{-7} to 8.00×10^{-5} M and some photophysical parameters have been experimentally determined for the lowest singlet excited state of ME2906. It was confirmed that ME2906 molecules were in the isolated molecular state below 1.00×10^{-5} M. It was also confirmed that the fluorescence in this concentration range was ascribed to the electronic transition from the lowest singlet excited state to the ground state. It was found that above 1.00×10^{-5} M a part of ME2906 molecules form dimers in water solution which causes the red shift of fluorescence spectrum and the enhancement of fluorescence in the 700-750 nm wavelength region. Semiempirical molecular orbital calculation revealed that the sodium aspartate attached to the tetrapyrrole ring through the ethanoic acid group was remarkably bent with respect to the tetrapyrrole plane which seems to hinder the formation of ME2906 dimers up to 1.00×10^{-5} M.

DTIC

Fluorescence; Aspartic Acid; Aspartates; Molecular Orbitals

20030018914 NASA Ames Research Center, Moffett Field, CA USA

Effects of Simulated Hypogravity and Diet on Estrous Cycling in Rats

Tou, Janet C., NASA Ames Research Center, USA; Grindeland, Richard E., NASA Ames Research Center, USA; Baer, Lisa A., NASA Ames Research Center, USA; Wade, Charles E., NASA Ames Research Center, USA; [2003]; 1p; In English; FASEB 2003, 11-15 Apr. 2003, San Diego, CA, USA

Contract(s)/Grant(s): RTOP 121-10-30; RTOP 121-10-40; RTOP 121-10-50; No Copyright; Avail: Issuing Activity; Abstract Only

Environmental factors can disrupt ovulatory cycles. The study objective was to determine the effect of diet and simulated hypogravity on rat estrous cycles. Age 50 d Sprague-Dawley rats were randomly assigned to be fed either a purified or chow diet. Only normal cycling rats were used. Experimental rats (n=9-10/group) were kept as ambulatory controls (AC) or subjected to 40 d simulated hypogravity using a disuse atrophy hindlimb suspension (HLS) model. There was no effect on estrous cycles of AC fed either diet. At day 18, HLS rats fed either diet, had lengthened estrous cycles due to prolonged diestrus. HLS rats fed purified diet also had reduced time in estrus. Plasma estradiol was reduced in HLS rats fed purified diet but there was no effect on progesterone. This may have occurred because blood was collected from rats in estrus. Urinary progesterone collected during initial HLS was elevated in rats fed purified diet. In AC, corticosterone was elevated in chow vs purified diet fed rats. Differences were particularly striking following the application of a stressor with HLS/chow-fed rats displaying an enhanced stress response. Results emphasize the importance of diet selection when measuring endocrine-sensitive endpoints. HLS is a useful model for investigating the effects of environment on reproduction and providing insight about the impact extreme environment such as spaceflight on female reproductive health.

Author

Rats; Hormones; Diets; Hindlimb Suspension; Cycles

20030018915 Southeast Univ., Shantou Univ., Nanjing, China

Detection of Dynamic Rhythms of Electroencephalography by Using Wavelet Packets Decomposition

Shen, Minfen; Suan, Lisha; Chan, F.; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409668; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Wavelet packet decomposition is used to investigate the time-varying characteristics of clinical EEG signals. On the basis of the nonstationary nature of clinical EEG rhythms, wavelet packet analysis is employed for designing filters with different frequency characteristics to detect 4 kinds of EEG rhythms. The coefficients of wavelet transformation corresponding to the rhythms are used to form the dynamic brain electrical activity mapping (DBEAM). In order to understand the dynamic rhythms

of the EEG, some clinical EEG are analyzed and compared. It is indicated from the experimental results that the dynamic characteristics of clinical brain electrical activities can be provided in terms of wavelet packet decomposition.

DTIC

Electroencephalography; Signal Processing

20030018917 Pennsylvania State Univ., University Park, PA USA

The Use of Exercise to Increase CD4 (+) T Lymphocytes Following Chemotherapy Treatment for Breast Cancer *Final Report, 1 Jun. 1998-31 May 2002*

Mastro, Andrea M.; Jun. 2002; 57p; In English

Contract(s)/Grant(s): DAMD17-98-1-8142

Report No.(s): AD-A409683; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Breast cancer is estimated to affect one in eight women in her lifetime. Treatment usually includes chemotherapy which can lead to several serious physical, emotional, and functional side effects. Along with the tumor cells, the normal, continually renewing cells of the lymphatic/immune hematopoietic system are targets for the cytotoxic drugs. One population of lymphocytes, CD4+T cells (T helper cells), major regulators of the immune system, are particularly susceptible to chemotherapy-induced depletion. CD4+T cells levels in the blood frequently fall to those seen in AIDS patients and remain low for many months to several years after chemotherapy ceases. An increase in CD4+ T cells has been measured in normal, healthy females after 3 months of resistance exercise training. In addition, studies have suggested a link between continued exercise participation and improved immune parameters in AIDS patients. Increases in CD4+T cells in HIV seropositive individuals following exercise training have been reported. No further decline or a slight increase was noted in those with CD4+ counts of approximately 200 cells/cu mm. However, in cancer patients who have undergone chemotherapy treatment and have CD4+ counts similar to those in AIDS patients, there are no studies relating exercise and immune parameters. In the human studies the relationship between physical activity and the risk for developing cancer have been examined. The few exercise interventions documented in the literature have focused on outcomes such as fatigue, physical function or quality of life.

DTIC

Lymphocytes; Chemotherapy

20030018919 Rutgers - The State Univ., New Brunswick, NJ USA

Hemodilution: Modeling and Clinical Aspects

Kaya, M.; JLi, J. K.; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom Report No.(s): AD-A409642; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Hemodilution is defined as the dilution of the concentration of red blood cells and plasma constituents by partially substituting the blood with colloids or crystalloids and it is a strategy to avoid exposure of patients to the hazards of homologous blood transfusions. Several mathematical models and computer simulations have been introduced to validate the efficacy of hemodilution; the amount of maximal allowable blood loss and final postoperative hematocrit or hemoglobin has been calculated. The basic prerequisite for preserving tissue oxygenation during hemodilution is adequate oxygen delivery, and therefore all determinants of oxygen transport should be monitored. Compensatory mechanisms such as increased cardiac output and stroke volume occur following hemodilution. When debating the use of colloid and crystalloid during fluid replacement, it is imperative to think about all of the components of the Starling equation. In order to better analyze the clinical outcome of hemodilution, more realistic mathematical models should be developed.

DTIC

Dilution; Blood Cells

20030018939 Silesian Technical Univ., Gliwice Poland

Detection of Characteristic Points of Ventricular Assist Device Driving Signal, Using Wavelet Decomposition

Kostka, P.; Tkacz, E.; Nawrat, Z.; Wrzesniowski, A.; Domider, T.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409585; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Pneumatic and hydraulic pressure and flow signals, measured on working ventricular assist device (VAD) during its test, describe its temporal hydrodynamic conditions, Signals registered as time samples series contain characteristic points or fragments, which reflect consecutive stages of VAD pulsate work, Because of nature of signals describing biological objects, they often can be time-varying, transient, non-stationary and affected by multi-sources noise, It makes in some situations characteristic

points of pressure-flow curves unseen in time domain and automatic detection of these important instants is very difficult or even not possible. We proposed time-frequency (T-F) analysis approach, where signals are decomposed into adaptive, frequency sub-bands, using wavelet transform (WT), which is known as a suitable tool for biomedical non-stationary signal analysis. As a result of using WT, the multi-resolution T-F representation is obtained, which is sensitive and can detect both long-term trends and dynamic, sudden changes in input signal. Our research signal database was created as a result of VAD tests performed for different control parameters on mock circulatory system, designed and made in our Institute. Results of proposed automatic detection procedure were presented for three types of WT basis function. We work on application of our study effects in control algorithm of testing devices for the determination of the critical control parameters of VAD work conditions,

DTIC

Pumps; Circulatory System; Signal Analysis; Control Equipment

20030018941 Massachusetts Inst. of Tech., Harvard-mit Div. of Health Sciences and Technology, Cambridge, MA USA

Motor Unit Action Potentials as a Source of Noise in the Non-Invasive Detection of Fibrillation Potentials

Keller, Steven; Gozani, Shai; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409587; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Denervated muscle fibers produce spontaneous depolarizations termed fibrillation potentials. These potentials are an indicator of neuromuscular pathology and are detected by inserting a needle electrode into the muscle of interest to detect the time-based signal. A proposed noninvasive method measures the spectral energy corresponding to increased spontaneous muscle activity. This paper exams the impact of normal muscle activity on such a method through the use of a computer model of fibrillation potentials and normal motor unit action potentials. A mathematical expression for the surface recorded signal is proposed and used as the basis for analyzing the temporal and spectral characteristics of spontaneous and normal motor activity. Based on these results, filtering methods for the removal of normal motor activity are proposed and future work needed to implement non-invasive detection of fibrillation potentials is discussed.

DTIC

Detection; Arrhythmia; Neuromuscular Transmission; Computerized Simulation; Pathology

20030018942 Tampere Univ. of Technology, Finland

Application of Lead Field Theory and Computerized Thorax Modeling for the ECG Inverse Problem

Puurtinen, H. G.; Hyttinen, J.; Kauppinen, P.; Takano, N.; Laarne, P.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409591; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The ECG inverse problem is a widely studied area, and several different approaches have been used to solve it. The present study introduces the reciprocally calculated lead field concept for solving the ECG inverse problem. The lead field approach based on the reciprocity theorem provides a procedure to calculate the computationally heavy forward problem by a single solution for each ECG lead. In this study, one anatomically detailed 3D FDM model of the human thorax as a volume conductor was employed for forward and inverse estimation of ECG potentials and cardiac sources, respectively. Several equivalent dipole sources were set into the cardiac muscle and the surface potential distributions applying 12, 24, 32, 64, and 120-lead ECG electrode configurations were computed. The inverse problem was solved in order to localize the dipoles based on the information obtained from the simulated ECG recordings and the characteristics of the volume conductor. The dipole localization errors ranged from 2 to 5 mm depending on the number of electrodes. Thus, the lead field method appears to be applicable for the solution of the ECG inverse problem.

DTIC

Electrocardiography; Electrodes; Conductors; Field Theory (Physics)

20030018943 Tampere Univ. of Technology, Finland

Effect of Cardiac Phases and Conductivity Inhomogeneities of the Thorax Models on ECG Lead Selection and Reconstruction

Takano, Noriyuki; Puurtinen, Hanna-Greta; Kauppinen, Pasi; Hyttinen, Jari; Malmivuo, Jaakko; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409592; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

ECG lead selection and reconstruction were investigated in the present study using ECG source-to-measurement transfer matrices computed in inhomogeneous and homogeneous conductor thorax-heart models, which represent end-systolic and end-diastolic cardiac phases. ECG leads were selected from a set of 120 leads for body surface potential mapping. The transfer matrices of the 120-lead system were reconstructed from a transfer matrix of selected leads. Effects of changing the cardiac phase and the conductivities on reconstruction performance are reported here. The number of selected leads well matched to the results of earlier works conducted by other researchers.

DTIC

Electrocardiography; Conductors; Heart; Matrices (Mathematics)

20030018944 Oulu Univ., Finland

The Effect of the Venous Pressure to the Blood Pressure Signals Measured by the Electronic Palpation Method

Vieri-Gashi, E. I.; Sorvoja, H. S.; Myllyla, R. A.; Nissila, S. M.; Sorvisto, M.; Karja-Koskenkarr, P. M.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T
Report No.(s): AD-A409596; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes the venous pressure effect to blood pressure signals measured by the electronic palpation method. It was shown, that in 52 percent of blood pressure measurements made with inflating cuff the linear increase in venous blood pressure was also increasing palpated signal's amplitude linearly. It was found, that the strong increase in venous pressure was not the reason for increased blood pressure amplitudes. The method for determining venous pressure by the electronic method was considered. The electronic palpation method can be used for venous pressure measurement if it is made with inflating cuff and secondly with deflating cuff. In the beginning of the measurements blood pressure should be monitored in the absence of cuff pressure for determining the venous pressure at rest.

DTIC

Blood Pressure; Pressure Measurement; Inflatable Structures

20030018945 Ecole Nationale Supérieure des Telecommunications, Brest, France

Prototype for the Simulation in Shared Virtual Environments. Application to the Supervision and the Learning of the Echographic Gesture

Hamitouche, C.; Gil, D.; Roux, C.; Ibanyez, L.; Plata, A.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T
Report No.(s): AD-A409598; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper presents a prototype of a virtual shared environment in which several users can interact inside a Three Dimensional scene. Actions of a user are visible to others thanks to a protocol of transmission parameters of the scene. The communications are managed under a protocol of distributed objects, the visualization as well as the user interface use multi platform libraries. This prototype is used to teach the echographic gesture.

DTIC

Distributed Interactive Simulation; Personnel Management; Prototypes; Protocol (Computers)

20030018946 Queen Mary and Westfield Coll., School of Medicine and Dentistry, London, UK

The Aorta: Built to Last a Lifetime?

Greenwald, S. E.; Ryder, G. C.; Martyn, C. N.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom
Report No.(s): AD-A409600; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The pulse pressure generated by the heart is determined by the hydraulic input impedance of the circulation which, in turn is governed by the elastic properties and structural arrangement of elastin, a protein found in the arterial walls of all but the simplest vertebrates. We suggest on the basis of scaling arguments, that pulse pressure depends on the elastic properties of the protein elastin and is independent of body mass. Elastin, which, unlike other proteins has a turnover rate close to zero, undergoes fatigue failure in arteries due to cyclic stress, becoming progressively fragmented with age and gradually being replaced by much stiffer fibrous tissue. These changes are well advanced after 1 billion heartbeats, by which time most animals, whatever their size or heart-rate, are nearing the end of their lives. In man this number is achieved by the age of 30 years, which from an evolutionary point of view, is close to the end of useful life. The progressive failure of elastin with age and the consequent increase in arterial stiffness leads to an inexorable rise in blood pressure. Epidemiological investigations have found that raised blood pressure in middle age is

associated with impaired fetal growth. Animal experiments have shown that rats whose mothers were deprived of protein while pregnant (to simulate intra-uterine growth retardation) have stiffer aortas which contain less elastin. Thus elastin in the aortas of individuals who are destined to become hypertensive as they age will undergo fatigue failure sooner than their normotensive counterparts. Over a lifetime, such changes will predispose to higher levels of blood pressure, increased left ventricular mass and generalized cardiovascular disease.

DTIC

Elastic Properties; Aorta; Epidemiology

20030018951 Sloan-Kettering Inst. for Cancer Research, New York, NY USA

The Role of Stat3 in Breast Cancer Tumorigenesis Final Report, 20 Aug. 2001-19 Aug 2002

Bromberg, Jacqueline F.; Sep. 2002; 9p; In English

Contract(s)/Grant(s): DAMD17-01-1-0557

Report No.(s): AD-A409607; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Signal Transducers and Activators of Transcription (STATs) are a family of transcription factors which are normally "inactive" within the cytoplasm of cells and upon tyrosine phosphorylation become "activated" which leads to the dimerization of two Stat molecules. Dimerized Stats are translocated into the nucleus where they bind DNA and activate transcription. Stat dimers are dephosphorylated within the nucleus and transported back to the cytoplasm (1). Virtually all growth factor receptors, cytokines, and tyrosine kinases lead to the phosphorylation of one or more Stat proteins. In "normal" cells this activation is transient, while in an ever growing number of primary tumors and cancer derived cell lines Stat proteins (in particular Stat3) are constitutively activated (1, 2). A causal association between activated Stat3 and cellular transformation or oncogenesis has been made in a large number of cancer derived cell lines. Specifically, removal of Stat3 by the introduction of a dominant negative Stat3 molecule or anti-sense molecule leads to a reversal of the transformed phenotype, induction of apoptosis, decreased angiogenesis or growth arrest (Figure 1).

DTIC

Neoplasms; Cancer; Phosphorylation; Apoptosis; Tyrosine

20030018954 Technische Hochschule, Dept. of Biomedical Engineering, Ilmenau, German Democratic Republic

Beaming Signal Sources in Measurement of Focal Visual Evoked Cortical Potentials

Husar, P.; Berkes, S.; Henning, G.; Plagwitz, K. U.; Schellhorn, K.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410002; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

VECPs (Visual Evoked Cortical Potential) after focal stimulation used in perimetry have weak amplitudes in comparison to the spontaneous EEG, thus the SNR (Signal-to-Noise Ratio) falls off down to -20dB and less. The shape of the VECP waves depends on several parameters and is unknown in general. Then for SNR enhancement and signal detection shape-independent methods can be used only. The most common of them is the stimulus synchronized averaging, which causes cumulative prolongation of the measurement time corresponding to the averaging order. For online measurements of VECP other ways in signal improvement are needed. In this paper a new method for SNR enhancement based on beam forming is introduced. While the anatomical structures of sources generating the focal VECP are known roughly and the electrode positions have sufficient density over the visual cortex, signal sources can be focused by controlling the channel delay.

DTIC

Signal Processing; Sensory Stimulation; Physiological Responses; Cerebral Cortex

20030018956 Manitoba Univ., Dept. of Electrical Engineering, Winnipeg, Manitoba Canada

A New Nonlinear Transform for IFS Compression of ECG and Other Signals

Huang, B.; Kinsner, W.; Oct. 25, 2001; 6p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410005; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents a nonlinear extension of the affine transform as used in the iterated function systems (IFS) to compress signals and data, Compared with Oeien and Narstad's orthogonal transform with compression ratio of 6,0:1 for the electrocardiogram (ECG) signal, the nonlinear approach produces higher compression ratios of 10,2:1, and is more flexible in

finding the corresponding strange attractor of the CC signal, It can model the QRS complex of the ECG signal well, which has been a problem for the affine transform in fractal compression.

DTIC

Data Compression; Transformations (Mathematics)

20030018957 Manitoba Univ., Dept. of Electrical Engineering, Winnipeg, Manitoba Canada

New Domain Block Partitioning Based on Complexity Measure of ECG

Huang, B.; Kinsner, W.; Oct. 25, 2001; 7p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410006; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper introduces a new domain block partitioning scheme for a nonlinear iterated function systems (NIFS) compression of electrocardiogram (ECG) signals based on their complexity measure. The idea behind the scheme is based on the multifractal characteristics of the ECG signal. The partitioning is intended to reduce the time-consuming inverse problem in fractal compression. The proposed technique gives computational complexity of $O(N)$ for a time series with length N , The segmented NIFS achieves a compression ratio of 8.8:1 under a distortion error of 5.8%, as compared to that of 6.0:1 obtained by Oeien and Narstad's orthogonal transform.

DTIC

Signal Processing; Transformations (Mathematics)

20030018958 Manitoba Univ., Dept. of Electrical Engineering, Winnipeg, Manitoba Canada

Feature Extraction From DNA Sequences by Multifractal Analysis

Zhang, H.; Kinsner, W.; Oct. 25, 2001; 7p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410007; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents feature extraction and estimation of multifractal measures of DNA sequences using a multifractal methodology and demonstrates a new scheme for identifying biological functionality, using information contained within the DNA sequences. It shows that the Renyi and Mandelbrot fractal dimension spectra may be useful techniques for extracting the information contained in the DNA sequences.

DTIC

Fractals; Pattern Recognition

20030018959 Technische Hochschule, Germany

Accreditation of Biomedical Engineering Programs in Europe - Challenge and Opportunity

Nagel, Joachim H.; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410009; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Today, more than 100 universities and polytechnic schools in Europe offer educational programs in Biomedical Engineering at all academic levels, but without any international coordination of contents and required qualifications. Transnational mobility for education, training and employment is an essential objective of the European Union. Such mobility is difficult to achieve because of different national practices in education, training and employment and in recognition of outcomes and accreditation. Accreditation plays an important role in ensuring transnational mobility and employability, and offers the additional advantages of confidence for the employer that the employee has the necessary education, training and responsible experience, and confidence for the user of the service, e.g. patients, that those providing the service are effective and competent.

DTIC

Standardization; Education

20030018960 Brunel Univ., Uxbridge UK

AIDMAN: A Versatile Telemedicine Platform

Clarke, M.; Jones, R. W.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom., The

Report No.(s): AD-A410010; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Telemedicine has long promised to be introduced on a wide scale, yet despite dramatic falls in the cost of hardware and increasing power and capability of equipment, there has been little impact on routine medical service. Many projects have been reported in the literature in a wide variety of medical disciplines, but generally these have been pilot and have almost always ceased once funding has ended. The question remains, 'What obstacles remain to be overcome?' The AIDMAN project, based in Chorleywood, UK, has established tele-clinics in many clinical specialities within a single primary care setting so that it becomes routine. To date, tele-clinics in dermatology, cardiology and peripheral vascular surgery (wound care) run routinely. On the clinical side, experience has shown that patients are very satisfied with the video consultation and outcome is at least as good as existing procedures. However the goal is to develop a full range of tele-clinics so that system cost is reduced through re-use of the equipment.

DTIC

Telemedicine; Cost Effectiveness

20030018962 Budapest Univ. of Technology and Economics, Dept. of Control Engineering and Information, Budapest, Hungary
Wavelet-Based Adaptive Denoising of Phonocardiographic Records

Varady, P.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom., The Report No.(s): AD-A410014; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The various noise components make the diagnostic evaluation of phonocardiographic records difficult or in some cases even impossible. This paper presents a novel wavelet-based denoising method using two-channel signal recording and an adaptive cross-channel coefficient thresholding technique. The qualitative evaluation of the denoising performance has shown that the proposed method cancels noises more effectively than the other examined techniques. The introduced method can be used as preprocessor stage in all fields of phonocardiography, including the recording of fetal heart sounds on the maternal abdominal surface.

DTIC

Phonocardiography; Signal Processing

20030018964 Tel-Aviv Univ., Ramat-Aviv, Dept. of Biomedical Engineering, Tel-Aviv, Israel

Dynamic Simulations of Cancellous Bone Resorption Around Orthopaedic Fixative Implants

Gefen, A.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A410019; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Progressive loosening of bone fixation screws is a well documented phenomenon, induced by stress shielding and subsequent adaptive bone remodeling which results in bone loss around the screw. A set of two-dimensional computational (finite element) models was developed in order to test the effect of various screw profiles on the predicted extent of bone resorption. An algorithm simulating local bone adaptation to mechanical stimuli was developed and subsequently used to evaluate the biomechanical performances of the different screw profiles analyzed, i.e., triangular, rectangular and trapezoidal thread shapes. This remodeling algorithm predicted local bone gain or loss in the vicinity of the screw as a response to the resulted mechanical stress distribution. A dimensionless set of stress intensity parameters (SIP) was developed to quantify the bone screw stress transfer, enabling a convenient rating of different screw performances according to the nature of expected adaptation of the surrounding bone. The results indicated that a wide rectangular screw profile is of superior biomedical compatibility, with bone compared to the other profile types. The present work demonstrated that bone remodeling computer simulations can be used as a powerful tool for evaluation of different design parameters of fixative screws, such as geometry, material characteristics and even coatings.

DTIC

Sorption; Bones; Screws

20030018965 Pennsylvania Univ., Dept. of Physics, Philadelphia, PA USA

Characterization of Two-Layer Diffuse Media by Reflection of Gigahertz Photon Density Waves

Sunar, Ulash; Ripoll, Jorge; Akin, Ata; Pourrezaei, Kambiz; Oct. 25, 2001; 3p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images.

Report No.(s): AD-A410020; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Diffuse reflected light is used to characterize optical properties of two-layer turbid media. The source is modulated in gigahertz frequencies. The phase and amplitude of analytical reflectance is fitted to the data generated by adding 2.5% noise in amplitude and 1 degree noise in phase to the solution of diffusion approximation in gigahertz frequency regime. The extracted optical properties are in good agreement with the real values.

DTIC

Optical Properties; Diffusion Theory; Mapping; Tissues (Biology)

20030018970 Cape Town Univ., Medical Imaging Research Unit, South Africa

Eye Feature Extraction for Fetal Alcohol Syndrome Screening

Douglas, T. S.; Martinez, F.; Meintjes, E. M.; Viljoen, C. L.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410027; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Conventional screening for Fetal Alcohol Syndrome in children involves time-consuming and intrusive facial measurements. We are developing an alternative method that will allow automatic measurement of the relevant points from a pair of stereo photographs. This paper describes a method for automatic eye extraction from such photographs using genetic algorithms to match eye templates to face images.

DTIC

Children; Alcohols; Stereophotography; Pattern Recognition

20030018974 Johns Hopkins Univ., Hospital, Baltimore, MD USA

In Vivo Magnetic Resonance Imaging of Catheter-Based Vascular Gene Transfer

Yang, X.; Atalar, E.; Li, D.; Serfaty, J. M.; Wang, D.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom., The original document contains color images.

Report No.(s): AD-A410035; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this study was to develop an in vivo imaging tool to monitor vascular gene transfer, We produced gadolinium/blue-dye and gadolinium/gene-vector media by mixing Magnevist with a trypan-blue or a lentiviral vector carrying a green fluorescent protein (CFP) gene, The gadolinium was used as an imaging marker for MRI to visualize vessel wall enhancement, while the blue-dye/ CFP was used as a tissue stain marker for histology/immunohistochemistry to confirm the success of the transfer. Using Remedy gene delivery catheters, we transferred the gadolinium/blue-dye (n=8) or gadolinium/GFP-lentivirus (n=4) into the arteries of 12 pigs, monitored under high-resolution MR imaging This technical development enabled dynamic visualization of: (i) where the gadolinium/genes distributed; (ii) how satisfactorily the target portion was marked; and (iii) whether the gene transfer procedure caused complications. Our study represents the first direct evidence that catheter-based vascular gene delivery/distribution can be monitored by MR imaging in vivo.

DTIC

Cardiovascular System; Imagery; Gene Therapy; Diseases; Magnetic Resonance

20030018985 Drexel Univ., Philadelphia, PA USA

Structural Assessment of a Tissue Engineered Scaffold for Bone Repair

Laurencin, Cato T.; Borden, Mark; Attawia, Mohamed; El-Amin, Saadig; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409612; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The limitations of current grafting materials have driven the search for synthetic alternatives to cancellous bone. A variety of biodegradable polymer foams composed of poly(lactide-co-glycolide) PLAGA have been evaluated for such uses. However, structural limitations may restrict the clinical use of these scaffolds. We have developed a sintered microsphere scaffold composed of 85:15 poly(lactide-co-glycolide) with a biomimetic pore system equivalent to the structure of cancellous bone. Analysis of the

structural data, indicated that the microsphere matrix sintered at a temperature of 160 degrees C with a microsphere diameter of 355-425 micrometer resulted in an optimal, biomimetic structure with an approximate pore diameter of 75 to 275 micrometer, 35% porosity, and compressive modulus of 272 MPa. The in vitro evaluation of human osteoblasts on the sintered matrix indicated that the structure was capable of supporting the attachment and proliferation of the cells throughout its pore system. Immunofluorescent staining of actin showed that the cells were proliferating 3-dimensionally through the pore system. The stain for osteocalcin showed that the cells had maintained the phenotypic expression for this bone specific protein. Through this work, it was shown that an osteoconductive PLAGA scaffold with a pore system equivalent to the structure of cancellous bone could be fabricated through the sintered microsphere method.

DTIC

Bones; Biomimetics; Bone Mineral Content; Cells (Biology); Grafting

20030018988 Centro de Investigacion y de Estudios Avanzados, Mexico City, Mexico

A Prototype: Reading of Documents Web for Visually Impaired Persons

Santiago, S.; Martinez, A.; Leija, L.; Hernandez, P.; Oct. 25, 2001; 3p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409615; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This article describes a system for knowledge-based information extraction from Web-documents, reading HTML and XML structured documents using logic inference and text categorization. The system uses a multimedia speech synthesizer, into windows environment, The users could be normal persons searching filtered information without paying his whole attention, display-disable readers or visually impaired red persons. In to first stage structured digital texts like public domain books (e-books) it plows read and translated to voice their headed, name of chapters, subdivisions, words key, and paragraphs of the text are read, The user personalizes his filters using keywords and the user can move inside the text through the paragraphs and listening his contents, This project mainly increases the availability of electronic-texts for persons with a reading handicap. Ke%'word% - Text to speech, natural language interface, informaflon extraction

DTIC

Document Markup Languages; Multimedia; Natural Language (Computers); Reading

20030018990 Virginia Mason Research Center, Seattle, WA USA

Eliciting Autoimmunity to Ovarian Tumors in Mice by Genetic Disruption of T Cell Tolerance Mechanisms *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Nelson, Brad H.; Aug. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-01-1-0733

Report No.(s): AD-A409619; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are developing a mouse model for ovarian cancer that will allow monitoring of the in vivo activities of tumor-specific T cell clones as they encounter ovarian tumors in vivo. We proposed to "tag" the neu oncogene with two defined T cell epitopes so as to confer recognition by available T cell receptor (TCR) transgenic T cells. When expressed in the murine ovarian tumor cell line ID8, epitope-tagged neu (designated neu (OT1/OT2)) should induce formation of aggressive ovarian adenocarcinomas that express the epitope tags and hence are recognizable by adoptively transferred TCR transgenic T cells. We successfully made the neu (OT1/OT2) expression construct, but found it to be overly immunogenic in vivo such that tumors were spontaneously rejected. Therefore, we derived a third generation ID8 tumor cell line that has a shorter tumor latency and decreased expression of MHC Class I, which should make it less immunogenic. Meanwhile, we have commenced adoptive T cell transfer experiments using a convenient, transplantable lymphoma model, and have discovered signaling differences between T cells that are responding to antigen-positive tumors versus the same antigen delivered with adjuvant. Finally, Cbl-b^{-/-} mice have been obtained and are currently being backcrossed onto the B6 background for Aim 3.

DTIC

Neoplasms; Genetic Engineering; Cells (Biology); Cancer

20030018991 Georgetown Univ., Washington, DC USA

Characterization of Early Genomic Changes in Mammary Glands in High Risk Women *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Haddad, Bassem R.; Jul. 2002; 12p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9193

Report No.(s): AD-A409620; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because many of the familial breast cancer patients carry a mutation in BRCA1 on chromosome 17 or BRCA2 on chromosome 13, the first genetic event that may occur in their mammary glands to begin the progression toward cancer may be loss of heterozygosity (LOH) on one of these two chromosomes. It is unknown if these genetic changes correspond to a recognizable histopathological abnormality. We hypothesize that such genomic changes may precede morphologic changes and thus we may detect evidence for such changes in morphologically normal breast tissues or benign lesions surrounding breast tumors in BRCA1/2 positive patients. We have recently developed a panel of 15 markers to study LOH in morphologically well characterized and carefully laser capture microdissected, breast tissues from a group of BRCA1/2 positive patients with breast cancer who are followed up by our Cancer Genetics Program at the Lombardi Cancer Center. Our studies so far support our hypothesis. Specifically, we performed a total of 105 analyses at different loci using microdissected breast tissues for areas showing normal morphology or benign changes surrounding the tumor tissues in BRCA carriers with breast cancer. Overall, LOH was detected in 59 studies (56%). In the normal tissues, 15 of 30 analyses (50%) showed LOH and in the tissues with proliferative changes 44 of 55 analyses showed LOH (59%).

DTIC

Cancer; Genetics; Chromosomes

20030018992 Academy of Health Sciences (Army), Fort Sam Houston, TX USA

A Community Needs Assessment to Plan Marketing Strategies for Increased TRICARE Prime Enrollment to the Naval Hospital Corpus Christi Healthcare System Final Report, Jul. 1999-Jul 2000

Ivey, Brian T.; May 2000; 73p; In English

Report No.(s): AD-A409621; AMEDDCS-32-00; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In these changing times of the Military Health System, Medical Treatment Facilities are faced with numerous resource constraints. At the same time, they must justify their existence. Enrollment to TRICARE Prime with a Military Treatment Facility Primary Care Manager is one indicator that is tracked as justification. Naval Hospital Corpus Christi Healthcare System is looking for a framework to guide them in making strategy planning decisions on marketing efforts to increase TRICARE Prime enrollment to the Military Treatment Facility. This paper is documentation of a thorough needs assessment of the beneficiary population to ascertain the eligible population already enrolled and those remaining. It also suggests what the prime target market is for marketing and capturing into TRICARE Prime.

DTIC

Medical Services; Health; Hospitals

20030018993 Landstuhl Regional Medical Center, Landstuhl, Germany

A Cost Effectiveness Analysis of an Orthopedic/Podiatry Minor Procedure Room Final Report, Jul. 1999-Jul 2000

Garcia, Dawn M.; Jul. 2000; 36p; In English

Report No.(s): AD-A409622; AMEDDCS-28-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

National health care reform has fostered a focus on the issues of cost and access. While there continues to be a lot of talk on the issue of access, the foremost attention has been placed on the financing of health care delivery. Efforts to reduce the cost of health care have had a profound impact on surgical practice and specifically on the utilization of services and changing practice patterns. One practice in which alternative methods should be explored is the performance of minor procedures. At Landstuhl Regional Medical Center (LRMC), minor surgical procedures requiring local anesthetics are being done in the main operating room (OR) due to inadequate minor procedure space in an alternative area. This practice leads to higher costs per case. This cost effective analysis showed that by renovating the minor procedure room in the Orthopedic Clinic, positive benefits will be noted to patient time, physician time and a decrease in the current backlog of surgical procedures. This improvement in the process, for those patients that require minor procedures, will be a more efficient use of the available resources to include patient, OR and physician time.

DTIC

Cost Analysis; Medical Services; Orthopedics; Anesthetics

20030018995 Rehabilitation Inst. of Chicago, Chicago, IL USA

Interpreting Changes in Surface EMG Amplitude During High-Level Fatiguing Contractions of the Brachioradialis

Lowery, M.; Rybansky, M.; O'Malley, M. J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409624; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The amplitude of the surface EMG signal may provide a more accurate reflection of motor unit activity during sustained fatiguing contractions than spectral parameters which are more commonly used to estimate muscle fatigue. In this paper, theoretical relationships between surface EMG amplitude measures and mean motor unit firing rates and muscle fiber conduction velocity (MFCV) are established. It is proposed that using these relationships, under conditions where motor unit recruitment and synchronization can be assumed to be negligible, such as at high force levels or in smaller muscles, it may be possible to obtain an estimate of relative changes in motor unit firing rates during a sustained isometric contraction. Using EMG amplitude and MFCV data gathered from the brachioradialis muscle during 80 % maximum voluntary contraction, relative changes in mean motor unit firing rates were estimated in this manner. MFCV and the estimated firing rate changes were then incorporated into a model of the surface EMG signal. Simulated EMG data was generated individually for each subject and EMG amplitude and spectral parameters calculated from the simulated and experimental data were found to compare well. velocity, motor unit firing rates.

DTIC

Electromyography; Spectrum Analysis; Muscles

20030018996 Battelle Pacific Northwest Labs., Richland, WA USA

Protein Microarray Technology for the Noninvasive Diagnosis and Prognosis of Breast Cancer *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Zangar, Richard C.; Varnum, Susan M.; Jul. 2002; 14p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0132

Report No.(s): AD-A409625; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A number of circulating markers have been identified that have the potential to be used in the detection or prognosis of breast cancer. Unfortunately, no single marker is consistently increased in breast cancer patients when compared with the general population. We hypothesized, however, that a sophisticated analysis of large number of circulating markers would accurately detect breast cancer as well as provide a valuable tool for prognosis. Therefore, we proposed to develop a rapid and simple system to measure a large number of blood markers associated with breast cancer. We will accomplish this by developing an antibody microarray with antibodies specific to different blood markers. Currently, we have screened fourteen markers, and generated standard curves for eight of these markers. We have refined the microarray to measure markers with a sensitivity down to 0.5 pg/ml. This sensitivity will allow the use of this microarray to screen up to 200 serum samples from breast cancer patients and control patients. These data will be analyzed using sophisticated computer programs that are designed to find relationships in a complex data set such as this. These studies will result in a prototype chip that can be used for the rapid determination of circulating markers associated with breast cancer.

DTIC

Cancer; Mammary Glands

20030018997 Cold Spring Harbor Lab., New York, NY USA

Adhesion-Dependent Regulation of Cell Growth and Apoptosis in Human Breast Cancer *Final Report, 1 Jul. 1999-1 Jul. 2002*

Helfman, David M.; Aug. 2002; 16p; In English

Contract(s)/Grant(s): DAMD17-99-1-9136

Report No.(s): AD-A409626; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have studied the role of the actin cytoskeleton and myosin II in adhesion-dependent signaling and regulation of apoptosis in normal and transformed epithelial cells. Normal epithelial cells require attachment to the extracellular matrix (ECM) for survival, and disruption of cell-ECM interactions results in induction of apoptosis, a phenomenon termed "anoikis". by contrast, transformed cells do not require interaction with the ECM and do not undergo apoptosis when grown in suspension. This property plays a critical role in the ability of cancerous cells to metastasize. We have found that activation of myosin II is a critical step in the generation of signals that prevent programmed cell death. In addition, these studies show that transformed epithelial "escape" apoptosis due to constitutive activation of signaling pathways dependent on myosin II. We have identified key-signaling pathways that are altered in transformed cells and thereby contribute to the ability of tumor cells to escape anoikis. Collectively these studies provide important new information regarding specific pathways that regulate myosin II and identify potential therapeutic targets for the treatment of breast cancer, as well as other cancers.

DTIC

Apoptosis; Cancer; Muscles; Mammary Glands

20030018998 California Univ., Medical Center, Los Angeles, CA USA

Membrane Estrogen and HER-2 Receptors in Human Breast Cancer *Annual Report, 1 Jul. 2001-1 Jul 2002*

Pietras, Richard J.; Jul. 2002; 101p; In English

Contract(s)/Grant(s): DAMD17-00-1-0177

Report No.(s): AD-A409627; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Patients with breast cancers that express estrogen receptor (ER) commonly receive antiestrogen therapy. The efficacy of this therapy depends on close regulation of breast growth by estrogen. However, as breast cancers progress, they often become resistant to estrogens, and most patients no longer respond to antiestrogen therapy. New antiestrogen treatment options are needed, and alternative therapies may derive from findings showing that some ER molecules occur in plasma membranes of breast cancer cells and interact with transmembrane HER-2 growth factor receptors. Expression of HER-2 receptors occurs in many breast cancers, and the protein kinase activity of HER-2 may modulate ligand-independent activation of ER. If active cross-communication between ER and HER-2 receptor occurs and leads to the promotion of cancer growth, this axis may offer a new target for therapeutic intervention. We have detected a membrane-associated form of ER in breast cancer cells and have evidence that it promotes tumor growth. Using this novel signaling pathway as a target, we are now testing new treatment options to prevent cancer progression in models of human breast cancer. Since HER-2 overexpression in breast cancer is associated with failure of antiestrogen therapy, understanding the basis of associations between ER and HER-2 receptors may help to improve patient management and enhance survival.

DTIC

Cancer; Estrogens; Mammary Glands; Therapy

20030018999 Stanford Univ., Stanford, CA USA

Do Capacitively Coupled Electric Fields Accelerate Tibial Stress Fracture Healing *Annual Report, 15 Sep. 2001-14 Sep 2002*

Hoffman, Andrew; Beck, Belinda; Matheson, Gordon; Bergman, Gabrielle; Oct. 2002; 5p; In English

Contract(s)/Grant(s): DAMD17-98-1-8519

Report No.(s): AD-A409629; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A convenience sample based on availability of tibial stress fracture cases at local Sports Medicine Clinics will be selected over 2-3 years until forty subjects (20 male, 20 female) have been treated. The study is designed to be able to determine if electric field stimulation accelerates the healing of tibial stress fracture and whether there are gender effects. Only posteromedial mid to distal third and proximal medial tibial condylar stress fractures will be investigated. Four imaging approaches will be used at diagnosis (radiographs, bone scan, MRI (Magnetic Resonance Imaging), and CT (Computer Tomography)). All subjects will be identically treated in a double blind fashion using active or passive electric field stimulator devices that apply a sinusoidal wave of 3-6 V, 60 KHz, 5-10 mA, wearing the units for 15-20 hours per day, primarily at night, and other standardized rehabilitation treatments, until healed and not longer than six months. Subjects will be considered healed when hopping on the affected leg is no longer painful. Only MRI will be used for follow-up studies. A grading system will be developed for each of the diagnostic methods and compared to the ability of the MRI grading system to predict time to recovery.

DTIC

Bones; Electric Fields; Fracturing; Tibia; Injuries; Healing

20030019000 Pennsylvania Univ., Medical Image Processing Group, Philadelphia, PA USA

Mechanism of ErbB1 and ErbB2 Hetero-Oligomerization *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Yu, Jong W.; Lemmon, Mark A.; Jul. 2002; 9p; In English

Contract(s)/Grant(s): DAMD17-01-1-0370

Report No.(s): AD-A409630; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are developing an in vivo system using erbB/IL2 receptor chimeras in a B-cell line to investigate the interactions and mechanism of oligomerization between the epidermal growth factor (EGF) receptor family members erbBL and ERBB2. Since erbB2 overexpression has been strongly associated with breast cancer and has been shown to be a valuable target for breast cancer therapies, we are interested in dissecting its mechanism of activation. Heteromeric interaction between the intracellular domains of the IL2 receptor beta and gamma chain will serve as a reporter for direct interaction between the extracellular domains of erbBL and erbB2 by mediating T or B-cell proliferation in the absence of IL2. to date, I have made B-cell lines stably expressing various erbB/IL2 receptor chimeras and I have been able to show erbBL homo-oligomerization and hetero-oligomerization with erbB2 in an EGF (and IL2 independent) manner. With this assay, I plan to assess the ability of specific erbB receptor ligands to induce erbBL and erbB2 hetero-oligomers and determine whether erbBL and erbB2 interact as a hetero-tetramer rather than a

hetero-dimer. by understanding how erbB1 and erbB2 interact, we hope to provide insight into the mechanism by which erbB2 mediates transformation and tumorigenicity in cells.

DTIC

Cancer; Mammary Glands; Cells (Biology)

20030019001 Toledo Univ., OH USA

Measurement of the Electron Density Distribution of Estrogens-A First Step to Advanced Drug Design *Annual Report, 15 Jul. 2001-14 Jul 2002*

Pinkerton, Alan A.; Aug. 2002; 207p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9408

Report No.(s): AD-A409631; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Estrogen derivatives bind as ligands to the estrogen receptor initiating biological reactions, which can cause either initiation/progress or inhibition of tumor growth. Slight structural variations in these molecules can change their carcinostatic potentials from agonistic to inhibitory. The principle objective of this proposal is to relate known biological reactions to physical properties such as point charges of atoms and the electrostatic potential. We are obtaining information about these electronic properties of estrogen derivatives from experimental determination of their electron density using high quality single crystal X-ray crystallography. We derived electron density, electrostatic potential and related properties for six estrogen crystals. We have developed the methodology of the X-ray CCD data treatment and least-squares model refinement in order to extract maximum reliable information from the data. We found that the deformation electron density distributions of all hydroxyl oxygen atoms are near sp³ in shape, their lone pair densities have been reliably located. These configurations as well as the electrostatic potentials around the oxygen atoms are very consistent in the different hydrogen bonding environments. The core estrogen structure is also very consistent between the derivatives. The significant differences are found at the activity-sensitive molecular parts.

DTIC

Estrogens; Cancer; Mammary Glands; Chemotherapy; Crystallography; Electron Density (Concentration)

20030019002 Arizona Univ., Tucson, AZ USA

Effect of Tumor Derived TGF-Beta on the Efficacy of Dendritic Cell Vaccines *Annual Report*

Kobie, James J.; Akporiaye, Emmanuel T.; Jul. 2002; 38p; In English

Contract(s)/Grant(s): DAMD17-00-1-0128

Report No.(s): AD-A409632; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dendritic cell (DC)-based vaccines have exhibited minimal effectiveness in treating established tumors, likely due to factors present in the tumor microenvironment. One such factor is Transforming Growth Factor - beta (TGF-beta), a cytokine which is produced by numerous tumor types and has been demonstrated to impair DC functions in vitro. We have evaluated the effect of TGF-beta on the immunostimulatory activities of DCs. We demonstrate that TGF-beta exposure inhibits the ability of DCs to present antigen, stimulate tumor-sensitized T lymphocytes, and migrate to draining lymph nodes. Neutralization of TGF-beta using the TGF-beta neutralizing antibody, 2G7 enhanced the ability of DC vaccines to inhibit the growth of established 4T1 murine mammary tumors. Treatment of 4T1 tumors transduced with the antisense TGF-beta transgene (4T1-asT) with the combination of DC and 2G7 antibody inhibited tumor growth and resulted in complete regression of tumors in 40% of the mice. These results demonstrate that neutralization of TGF-beta in tumor-bearing mice enhances the efficacy of DC-based vaccines,

DTIC

Vaccines; Cells (Biology); Neoplasms

20030019003 Sloan-Kettering Inst. for Cancer Research, New York, NY USA

Enhancement of Breast Cancer Therapy by 6-Aminonicotinamide *Final Report, 6 Apr. 1998-5 Apr 2002*

Koutcher, Jason A.; May 2002; 19p; In English

Contract(s)/Grant(s): DAMD17-98-1-8153

Report No.(s): AD-A409633; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work was undertaken to determine if 6-aminonicotinamide (6AN) can enhance efficacy of radiation (XRT) and/or chemotherapy (paclitaxel or adriamycin). The study was done in hormone resistant (MDA-MB-435) and hormone sensitive (MCF-7) breast tumors. The interval between 6AN and XRT/chemotherapy was determined by ³¹P NMR spectral changes. Spectral changes were noted post 6AN in perfused MCF-7 and MDA-MB-435 cells including a decrease in the ratio of phosphocreatine to inorganic phosphate (Pi) and an increase in 6-phosphogluconate (a product of the pentose phosphate pathway) to Pi. Similar changes were noted in vivo in the MCF-7. 6AN enhanced the effect of XRT (2 Gy) and adriamycin in the MCF-7 but inhibited the effect of paclitaxel. In the MDA-MB-435, no enhancement was noted in vitro. In vivo, 6AN enhanced the effect

of radiation (5Gy/fraction) and adriamycin in the MCF-7. Treatment with paclitaxel was too toxic with SAN to evaluate. In the MDA-MB-435, enhancement of XRT was noted with 6AN, but not of adriamycin. The latter may have been to a lower dose of adriamycin (5mg/kg) than was used in the MCF-7. 6AN inhibited paclitaxel in the MDA-MB-435. 6AN was effective at non-toxic doses in enhancing the effect of XPT in both MCP-7 and MDA-MB-435, but inhibited paclitaxel in the latter tumors.

DTIC

Chemotherapy; Cancer; Drugs; Mammary Glands; Radiation Therapy; Amino Acids

20030019004 Liaoning Univ., Dept. of Biology, China

Raman Spectroscopy of Serum for Cancer Detection

Li, Xiaozhou; Jin, Huiqiang; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409634; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Laser induced auto-fluorescence and Raman spectra of serum from cancerous and normal people are measured and analyzed. Three Raman peaks were consistently observed from normal blood serum emission using 488.0nm and 514.5nm excitation of an Ar-ion laser whereas no peak or only slight Raman peaks were detected from tumorous cases. The content of (- carotene) in the serum from normal is higher than that from the cancerous one this result agrees with other reports.

DTIC

Blood; Cancer; Serums; Raman Spectroscopy; Diagnosis

20030019005 Army Research Inst. of Environmental Medicine, Natick, MA USA

5196 Mandible Fractures Among 4381 Active Duty Army Soldiers, 1980 to 1998

Boole, J. R.; Holtel, M.; Amoroso, P.; Yore, M.; Oct. 2001; 7p; In English

Report No.(s): AD-A409635; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present the frequencies of various types of mandibular fractures along with associated mechanisms and injuries. Methods: Retrospective analysis of 5,196 mandible fractures in 4,381 patients extracted from the Total Army Injury and Health Outcomes Database (TAIHOD), a comprehensive database developed by the U.S. Army Research Institute of Environmental Medicine (USARIEM) that links population data to all hospitalizations among active duty Army soldiers.

DTIC

Injuries; Medical Services; Bones

20030019006 Georgetown Univ., School of Medicine, Washington, DC USA

The Role of SRC Tyrosine Kinase Signaling Networks in the Development and Progression of Ovarian Cancer in a Mouse Model Annual Report, 1 Sep. 2001-31 Aug. 2002

Taylor, Christopher C.; Chen, Ting; Sep. 2002; 16p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0557

Report No.(s): AD-A409636; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ovarian cancer is among the most common and deadly malignancies in women, accounting for nearly 15,000 deaths per year in the USA. We have developed a mouse model of ovarian cancer, which will allow for new studies into the biochemical changes that occur in the tumorigenic process. We have determined that SRC tyrosine kinase is over expressed and constitutively activated in these mouse ovarian cancer cells. This leads to constitutive activation of downstream kinases such as phosphatidylinositol-3-kinase (PI3-kinase) and focal adhesion kinase (FAK). Pharmacologic inhibition of SRC suppresses cell migration, alters localization of FAK, decreases protein tyrosine kinase phosphorylation, inhibits the PI3-kinase/Akt survival pathway and enhances the cell killing effects of two different classes of chemotherapeutics, taxol, and cisplatin, commonly used chemotherapeutic agents in women with ovarian cancer. Combination treatment of mouse ovarian cancer cells with SRC inhibition and taxol activates a cell-killing pathway involving caspase 3 that is not activated by either treatment alone. We have also generated taxol resistant mouse ovarian cancer cells. Pharmacologic inhibition of SRC restores taxol sensitivity to taxol resistant cells. Thus it appears that SRC provides a potential new target for small molecule, targeted, combinatorial chemotherapy.

DTIC

Cancer; Cells (Biology); Chemotherapy; Ovaries

20030019009 General Hospital Corp., Boston, MA USA

Center for the Integration of Medicine and Innovative Technology Annual Report, 15 Oct. 2001-15 Oct 2002

Parrish, John A.; Nov. 2002; 75p; In English

Contract(s)/Grant(s): DAMD17-99-2-9001

Report No.(s): AD-A409639; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The overall goal of the program has evolved beyond minimally invasive therapy to include other aspects of acute care using high technology approaches. The Center for Integration of Medicine and Innovative Technology (CIMIT) mission is to improve patient care by bringing together scientists, engineers, and clinicians to catalyze development of innovative technology, emphasizing minimally invasive diagnosis and therapy.

DTIC

Therapy; Medical Services; Cardiovascular System

20030019012 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

Expression Profiling of Tyrosine Kinase Genes *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Weier, Heinz-Ulrich; Aug. 2002; 47p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9250

Report No.(s): AD-A409643; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The expression of genes involved in signal transduction (e.g. protein kinases) is often altered in tumors. The aberrant expression of several of these genes typically parallels the progression toward a more malignant phenotype. We developed a cDNA micro-array - based screening system to measure the level of expression of tyrosine kinase (tk) genes. The hardware for preparation of cDNA micro-arrays and basic protocols for hybridization were developed in year 1. In the second year, we finished isolating RNA and cDNA synthesis from 16 breast cancer cell lines and 10 frozen tissues. We optimized protocols for tk-specific PCR amplification and cloning. We continued our DNA sequencing effort and added additional targets to our micro-arrays. Using well-characterized breast cancer cell lines, the system delivered reproducible results about tk gene expression during cell transformation and progression toward a more malignant phenotype. Comparing the absolute expression levels from cDNA micro-arrays with data from Northern blot analyses suggested that our initial approach using mixed-based oligonucleotide primers led to lowered representation of highly abundant transcripts. This problem has been addressed with a new oligonucleotide primer design and a modified DNA amplification protocol that we now apply to investigate the tk gene expression in small tissue samples.

DTIC

Tyrosine; Cancer; Mammary Glands

20030019013 Bonn Univ., Dept. of Epileptology, Germany

Nonlinear EEG Analysis In Epilepsy

Lehnertz, K.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom
Report No.(s): AD-A409644; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This overview presents potential applications of nonlinear time series analysis using EEGs (electroencephalograms) derived from epilepsy patients. Apart from diagnostically oriented topics including localization of epileptic foci in different anatomical locations during the seizure-free interval I discuss possibilities for seizure anticipation which is one of the most challenging aspects of epileptology.

DTIC

Electroencephalography; Epilepsy; Treatment

20030019014 Delaware Univ., Newark, DE USA

Biomechanical Factors in the Etiology of Tibial Stress Fractures *Annual Report, 21 Jul. 2001-20 Jul 2002*

Davis, Irene M.; Aug. 2002; 59p; In English

Contract(s)/Grant(s): DAMD17-00-1-0515

Report No.(s): AD-A409645; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The overall aim of this research is to gain insight into the etiology of tibial stress fractures. Three dimensional motion analysis data along with structural data will be collected from 400 subjects (200 at each site) over a three-year period. 30 of the subjects will have sustained a tibial stress fracture prior to the study and the other 370 will have not. Subjects will be recruited primarily from track teams, running clubs, and physicians local to the University of Delaware and University of Massachusetts. Within this Annual Report, information concerning adherence to work objectives, preliminary results with respect to the proposed hypotheses, and reportable outcomes are presented for the second year of the investigation. Overall, we have adhered to most work

objectives and have proposed plans for rectifying any discrepancies. The preliminary analysis of the data demonstrates encouraging results and support of most hypotheses.

DTIC

Stress (Physiology); Etiology; Fractures (Materials); Tibia

20030019015 Picardie Univ., Amiens, France

Quantitative Evaluation of Trabecular Bone Structure by Calcaneus MR Images Texture Analysis of Healthy Volunteers and Osteoporotic Subjects

Herlidou, S.; Idy-Peretti, I.; Grebe, R.; Grados, F.; Lecuyer, N.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409655; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of this study is to evaluate, in vivo, trabecular bone structure of the calcaneus of healthy volunteers and osteoporotic patients by texture analysis of MR images Automated methods of texture analysis cover a wide range of techniques enabling quantitative analysis of grey level intensity and distribution within a region of interest (ROI), Texture analysis is not used very frequently since the interpretation of the large number of calculated parameters is difficult, We here apply multiparametric data analyses such as Correspondence Factorial Analysis (CFA) and Hierarchical Ascending Classification (HAC) to determine the relevant parameters to differentiate between two sets of images (healthy young volunteers and osteoporotic older patients).

DTIC

Factor Analysis; Osteoporosis

20030019017 Zhejiang Univ., Dept. of Biological Science and Technology, China

Study of High-Frequency Electrocardiogram

Ge, Jiguang; Chen, Hang; Xu, Zheng; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409657; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

High-frequency electrocardiogram (ECG) has been developed for more than 40 years and it is still not applied to clinic because there are some facts of causing high-frequency ECG (HFECG) and its mechanism are not understood well, and the idiosyncrasy of patients appears not too clear formerly. We are interested in the study of high-frequency information (HFI) in QRS complex and use animal models and some extraction methods to make sure its producing mechanism. The purpose of this article is to describe some good results which could explains some phenomena, that is high-frequency notching located on QRS complex associated with myocardial injuries in which the small injury area exactly related with injecting formalin or ligaturing coronary artery. We also pointed that notching processing are necessary, and supplementary parameters should be adopted, that the HFI has very useful value of idiosyncratic, local, early and dynamic characteristics for early diagnosis.

DTIC

Electrocardiography; High Frequencies

20030019020 Naval Research Lab., Washington, DC USA

Intraocular Retinal Prosthesis Test Device

Scribner, Dean; Humayun, M.; Justus, Brian; Merritt, Charles; Klein, R.; Oct. 25, 2001; 7p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409660; No Copyright; Avail: Defense Technical Information Center (DTIC)

There is a growing interest in the development of a retinal prosthesis device based on a number of successful experiments that have demonstrated electrical stimulation of retinal tissue. An introcular retinal prosthesis test device is currently under development at NRL/JHU. The general approach and technology development issues are discussed as well as some neurophysiology interface issues. The final device will enable acute human experiments in an operating room environment.

DTIC

Retina; Prosthetic Devices

20030019021 McGill Univ., Montreal, Quebec Canada

High Throughput Challenges in Molecular Cell Biology: The CELL MAP

Bergeron, John; Desjardins, Miche; Thomas, David Y.; Kearney, Robert E.; Oct. 25, 2001; 2p; In English; Papers from 23rd

Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409662; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The complete elucidation of the protein complement of all compartments of the eukaryotic cell is under way. This poses logistical problems in sample preparation and high throughput but exhaustive characterization. Using examples of protein characterization of organelles by mass spectrometry and the validation of protein function by DNA chips fl engineering and bioinformatics challenges in proteomics and genomics will be illustrated.

DTIC

Proteins; Mass Spectroscopy

20030019024 National Univ. of Malaysia, Dept. of Electronics and Systems Engineering, Bangi, Malaysia

Short-Range Wireless Audio-Video Link for Accident & Emergency Medicine

Zahedi, Edmond; Ali, Mohd; Kuen, Khor K.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409666; No Copyright; Avail: Defense Technical Information Center (DTIC)

In this paper, a wireless, simplex communication link covering a range of 100 ft (indoor) and up to 300 ft (outdoor) is presented. This link establishes a one channel color video and mono audio communication with an emergency vehicle such as an ambulance. To ensure a totally hands-free operation, a miniature camera is mounted on a modified safety helmet. The camera is fitted with a microphone. The video transmitter and supply battery are carried by a pouch tightened to the paramedical's waist. Field tests have shown that the system can reliably transmit audio and video signals from a simulated accident site to an emergency vehicle. Special emphasis has been put on using off-the-shelf available hardware components. Keywords: Telemedicine, wireless, multimedia, accident and emergency

DTIC

Data Links; Emergencies; Medical Services

20030019025 National Univ. of Malaysia, Dept. of Electronics and Systems Engineering, Bangi, Malaysia

Real-Time Cryptography for Vital Signals Transmission

Kion, Ding S.; Zahedi, Edmond; Ali, Mohammed; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409667; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, an approach to design a real-time cryptography system for transferring vital signals is presented. The cryptography requirement is dictated by patient privacy. The system is divided into five main parts, namely symmetric encryption algorithms, key-exchange algorithm, hash function, communication protocol and display. The implemented algorithms are chosen based on parameters such as encryption speed, level of security and complexity. The key-exchange algorithm presented in this paper is based on the Diffie-Hellman key exchange protocol while SHA-1 hash function has been used as a component of authentication. A private message combined with Diffie-Hellman key is hashed to authenticate both parties. Finally, a communication protocol has been proposed for the system.

DTIC

Cryptography; Medicine

20030019028 Liaoning Univ., Dept. of Biology, China

Spectral Changes of Lung Cancer Serum in the Process of Tumor Evolution

Li, Xiaozhou; He, Zhongqiu; Jin, Huiqiang; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409676; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The discrimination and changes of serum fluorescence and Raman spectrum for normal human, lung cancer patient and one after operation in different period and extent were studied. We kept close watch on the tumor progression of a group of patients, and measured their serum spectra using 488.0nm and 514.5nm excitation of an Ar-ion laser once a week. There was no apparent change observed in fluorescence spectrum in different period. However, the relative intensity of three Raman peaks (mode A, B, and C) decreased every week later. For quantitative analysis of such changes, a parameter $I(\text{sub } r)$ (relative intensity of C Raman peak) was introduced and $I(\text{sub } r)$ -value was calculated. Calculation showed that $I(\text{sub } r)$ -value was digressive with tumor

evolution, but caret-a (I sub r5145/I sub 4880) varied irregularly. to the end, no Raman peak was observed. We assumed that three Raman peaks were derived from beta carotene. It indicated that the content of beta carotene decreased with the aggravation of lung cancer.

DTIC

Cancer; Lungs; Quantitative Analysis

20030019029 Catania Univ., Dipt. Elettrico Elettronico e Sistemistico, Italy

Independent Component Analysis of Magnetoencephalography Data

Fortuna, L.; Bucolo, M.; Frasca, M.; LaRosa, M.; Shannahoff-Khalsa, D.S.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409677; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Independent Component Analysis (ICA) is applied to the Magnetoencephalography (MEC) data of a subject performing a yoga breathing exercise specific for the treatment of obsessive compulsive disorder, The spatio-temporal dynamics observed using a whole-head 148-channel MEC instrument are split into the fundamental modes, thus isolating separate brain activity signals, Experiments were performed on data from different brain regions, Spectral analysis of the more significant signals are presented. Moreover a new tool is developed as a Matlab toolbox to support the scientist both in the visualization and computation phases.

DTIC

Brain; Computation; Psychoses; Mental Health

20030019030 Tel-Aviv Univ., Ramat-Aviv, Dept. of Biomedical Engineering, Tel-Aviv, Israel

Hemodynamic Aspects of the Berlin Ventricle Assist Device

Avrahami, I.; Einav, S.; Rosenfeld, M.; Affeld, K.; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409678; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A New Ventricle Assist Device (VAD), with an improved energy converter unit, was investigated both numerically and experimentally. An experimental Continuous Digital Particle Imaging Velocimetry (CDPIV) was combined with a computational fluid dynamics (CFD) analysis. These tools complement each other to result into a comprehensive description of the complex 3D, viscous and time-dependent flow field inside the artificial heart ventricle. A 3D numerical model was constructed to simulate the VAD pump and a time-dependent CFD analysis with moving walls was performed to predict the flow field inside the VAD during the cardiac cycle. A commercial finite element package (FIDAP, Fluent Inc., Evanston) was used to solve the Navier-Stokes equations. In the experimental analysis, an optically clear elastic model of the VAD was placed inside a 2D CDPIV system. Continuous flow visualization and CDPIV calculations of the flow were used for validating the CFD simulations. Once validated, the CFD results provide a detailed 3D and time dependent description of the flow field, allowing the identification of stagnation or high shear stress regions.

DTIC

Flow Visualization; Artificial Heart Valves; Coronary Circulation

20030019031 Istanbul Univ., School of Dentistry, Turkey

Preliminary Findings on the Temporomandibular Joint Sounds of Lateral Cross-Bite Patients

Yildirim, Melek; Marsan, Guelnaz; Uener, Onul; Ergin, Ayseguel; Akan, Aydin; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409680; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper we investigate the relation between lateral cross-bite disorders and the sounds generated by the Temporomandibular Joint (TMJ). TMJ vibrations are recorded clinically by palpation and auscultation and also electronically by accelerometers. TMJ signals are filtered amplified digitized and stored on a computer. Based on joint time-frequency moments calculated from evolutionary spectrum, sounds are categorized into four classes. Palpation, auscultation, and time-frequency classification findings are presented.

DTIC

Classifications; Acoustics

20030019032 Chung Yuan Christian Univ., Dept. of Electronic Engineering, Chung-Li, Taiwan, Province of China

ECG Compression Using Dynamic Tree Vector Quantization in Wavelet Domain

Yen, Heng-Lin; Miaou, Shaou-Gang; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409684; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, we propose a novel vector quantizer (VQ) in the wavelet domain for the compression of electrocardiogram (ECG) signals. A vector called tree vector is formed first in a novel structure, where wavelet transformed (WT) coefficients in the vector are arranged in the order of a hierarchical tree. Then, the tree vectors extracted from various WT subbands are collected in one single codebook. Finally, a distortion-constrained codebook replenishment mechanism is incorporated into the VQ, where codevectors can be updated dynamically, to guarantee reliable quality of reconstructed ECG waveforms. With the proposed approach both visual quality and the objective quality in terms of the percent of root-mean-square difference (PRD) are excellent even in a very low bit rate. For the entire 48 records of Lead II ECG data in the MIT/BIH database, an average PRD of 7.3 % at 146 bits/s is obtained. For the same test data under consideration, the proposed method outperforms many recently published ones, including the best one known as the SPIHT (set partitioning in hierarchical trees). Keywords - wavelet transform, vector quantization, tree vector, distortion-constrained codebook replenishment

DTIC

Data Compression; Electrocardiography; Wavelet Analysis

20030019036 Miami Univ., FL USA

Drug Development and Conservation in West and Central Africa/Performance of Neurochemical and Radio Receptor Assays of Plant Extracts Annual Report, 1 Sep. 2001-31 Aug. 2002

Mash, Deborah C.; Sep. 2002; 6p; In English

Contract(s)/Grant(s): DAMD17-99-1-9043

Report No.(s): AD-A409688; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The main objective of these studies was to study the CNS activity of these plant fractions using specific radio ligand binding assays to identify their selectivity profiles as well as to determine their functional activities as either a full or partial agonist or antagonist.

DTIC

Drugs; Medical Science; Extraction

20030019037 Mayo Clinic, Rochester, MN USA

Natural History of Breast Density and Breast Cancer Risk Annual Report, 1 Jul. 2001-30 Jun. 2002

Vachon, Celine M.; Jul. 2002; 16p; In English

Contract(s)/Grant(s): DAMD17-00-1-0331

Report No.(s): AD-A409690; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the past year, we have identified an additional 241 cases diagnosed from 1999-2001 and 482 controls from the mammography practice and database at the Mayo Clinic. Together with the previous cases identified, we will have approximately 364 cases and 728 controls, instead of the initially proposed 200 cases and 400 controls. All mammograms over the last 10 years have been obtained for all cases to date and progress is continuing on obtaining the mammograms for the remaining controls. Risk factor information has been abstracted on all 364 cases and approximately 217 controls to date. Work on the remaining 511 controls is underway and will take approximately 1.5 additional years to complete. We performed early analyses of percent breast density and dense area from the earliest mammogram and absolute change between the earliest and latest mammograms with breast cancer risk on the 123 cases and 217 controls for which we had complete information to date. These data were presented at the American Association for Cancer Research meetings in April and also will be presented at the DOD meetings in September. The next two years will involve continuation of mammogram retrieval and digitization, chart abstraction, statistical analyses and report writing.

DTIC

Mammary Glands; Cancer

20030019038 Pittsburgh Univ., Pittsburgh, PA USA

Elevated Levels of Somatic Mutation as a Biomarker of Environmental Effects Contributing to Breast Carcinogenesis Annual Report, 1 Jul. 2001-30 Jun. 2002

Grant, Stephen G.; Jul. 2002; 26p; In English

Contract(s)/Grant(s): DAMD17-001-0409

Report No.(s): AD-A409693; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is widely presumed that environmental exposures play a role in the development of breast cancer, but few individual agents have been unequivocally identified as risk factors. Rather than seek out individual agents, we hypothesize that the cumulative effect of environmental exposures on an individual can be quantified through a blood-based assay, and further, that such a 'biomarker' might distinguish breast cancer patients from age-matched controls. Preliminary evidence seems to support this hypothesis, and we have now begun to supplement this preliminary data in a manner that will allow us to determine how environmental exposures and predisposition interact with other known risk factors for breast cancer, such as family history, life history of hormonal exposure and exposure to ionizing radiation. These biomarker data can then be added to a risk assessment procedure for breast cancer, and ultimately, might help identify the types of exposure specifically associated with cancer in the breast.

DTIC

Mammary Glands; Cancer; Mutations; Biomarkers; Exposure

20030019039 Calgary Univ., Alberta Canada

Segmentation and Estimation of the Histological Composition of the Tumor Mass in Computed Tomographic Images of Neuroblastoma

Ayres, Fabio J.; Zuffo, Marcelo K.; Rangayyan, Rangaraj M.; Filho, Vicente O.; Valente, Marcelo; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409694; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The problem that we investigate in the present paper is the improvement of the analysis of the primary tumor mass, in patients with advanced neuroblastoma, using X-ray computed tomography (CT) exams. To achieve this goal, we propose a methodology for the estimation of the histological content of the mass that comprises a technique for semi-automatic segmentation of the primary tumor mass in CT images of neuroblastoma and a statistical method to estimate, from segmented CT images, the histological composition of the primary tumor. The results of the method are compared with the results of histological analysis of surgically resected tumor mass. Keywords - Image segmentation, computed tomography, feature extraction, neuroblastoma

DTIC

Image Processing; X Rays; Computer Aided Tomography; Histology; Neuroblasts

20030019041 Colorado Univ., Health Sciences Center, Denver, CO USA

Mechanisms of Virus-Induced Neural Cell Death Annual Report, 15 Aug. 2001-14 Aug. 2002

Tyler, Kenneth L.; Sep. 2002; 123p; In English

Contract(s)/Grant(s): DAMD17-98-1-8614

Report No.(s): AD-A409696; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Virtually all known neurotropic viruses are capable of killing infected cells by inducing a specific pattern of cell death known as apoptosis, yet the mechanism by which this occurs and its relevance to human disease remain largely unknown. We have shown that apoptosis is an important feature of human CNS viral infections including herpes simplex virus and cytomegalovirus encephalitis, and PML.

DTIC

Neurons; Viral Diseases; Apoptosis; Mitochondria

20030019044 Pittsburgh Univ., Pittsburgh, PA USA

Mitochondrial Mechanisms of Neuronal Injury Annual Report, 1 Sep. 2001-31 Aug. 2002

Reynolds, Ian J.; Sep. 2002; 70p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8627

Report No.(s): AD-A409698; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project is focused on understanding the mechanisms of neuronal injury in acute and chronic neurodegenerative diseases. In particular, we are interested in the role that mitochondria play in both the maintenance of neuronal viability and in the execution of neurons following injurious stimuli. Our prior studies have shown that mitochondria are an essential target for calcium overload

in excitotoxic neuronal injury. In the experiments described here we are pursuing the study of mitochondria in neurons in additional ways. We are developing a model of neuronal injury in an organotypic slice preparation that should provide insights into mitochondrial events in dopaminergic neurons. We hope that this will allow the study of mitochondrial physiology in neurons that are selectively vulnerable in Parkinson's disease. In addition, we are investigating the properties of mitochondrial trafficking in neurons, which, together with an in situ study of mitochondrial DNA replication, will start to provide an unprecedented insight into mitochondrial biogenesis, movement and turnover. We believe that an understanding of the long-term properties of mitochondria in neurons will provide information that is critical to the full appreciation of the mechanisms of neuronal injury in chronic neurodegenerative disease.

DTIC

Nervous System; Injuries; Mitochondria; Neurons

20030019050 Wake Forest Univ., School of Medicine, Winston-Salem, NC USA

A Potential Therapeutic Role of J Series Prostaglandins in PPAR γ Mediated Treatment of Breast Cancer *Annual Report*

Monjazeb, Arta M.; Jun. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-00-1-0489

Report No.(s): AD-A410054; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The peroxisome proliferator activated receptor gamma (PPAR gamma), is a potential therapeutic target for the treatment of breast cancer but the endogenous ligand for PPAR gamma is not yet known. Recent data suggest that the endogenous ligand of PPAR gamma may be a bioactive metabolite of arachidonic acid that is synthesized in normal breast tissue. Activation of PPAR gamma with different agonists (e.g. 15deoxy delta 12,14PGJ2, troglitazone) elicits different physiological responses in breast cancer cells (i.e. differentiation or apoptosis) raising questions of the role PPAR γ plays in normal breast cell physiology. Results from our initial experiments show that prostaglandin metabolites of arachidonic acid inhibit cell cycle progression of MDA-MB-231 breast cancer cells. This cell cycle block induces apoptosis of breast cancer cells and inhibits tumor formation in nude mice. We hypothesize that human breast cancer cell lines (and human breast cancer tumors) have aberrant PPAR gamma mediated signal transduction pathways or contain disrupted pathways for the metabolism of fatty acid derivatives that act as PPAR gamma agonists. Understanding the metabolism of fatty acids in breast cancer cells, and elucidating the molecular and signal transduction events that are mediated by PPAR γ agonists may lead to novel strategies for the prevention and treatment of breast cancer.

DTIC

Mammary Glands; Cancer

20030019052 Oxford Univ., Oxford UK

Comparison of the Transdermal Ballistic Delivery of Micro-Particles into Human and Porcine Skin

Kendall, M. A.; Carter, F. V.; Mitchell, T. J.; Bellhouse, B. J.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A410062; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes a comparative investigation into the impact penetration characteristics of DNA-coated gold micro-particles into human and porcine skin. This work is aimed at establishing the link between the particle parameters required in delivering particles to the epidermis of pigs and humans. The particles are delivered to the skin using the PowderJect concept: a method that accelerates vaccines and drugs in micro-particle form to velocities sufficient to penetrate the skin and achieve a therapeutic effect. Devices are configured to deliver particles to predetermined velocities to both the in-vivo inguinal region of the pig and the ex-vivo skin from the human back and arm. Location of the gold particles within the tissue sites was assayed in histological sections taken from the tissue sites. The penetration results in pig and human tissue are analyzed and compared with calculations performed with a semi-empirical unified penetration model.

DTIC

Epidermis; Skin (Anatomy); Microparticles; Histology; Swine

20030019054 California Univ., San Francisco, CA USA

Molecular Imaging With Optical, Magnetic Resonance, and Radioisotope Techniques: Potentials and Relative Limitations

Budinger, Thomas F.; Oct. 25, 2001; 2p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410073; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The technology advances include photodiode arrays for optical methods high field magnets proposed to 12 Tesla for functional imaging and multinuclear spectroscopy 3D ultrasound and positron tomography systems with 2 mm resolution for animals and people. The engineered molecular probes have the potential to image specific enzyme expression and protein receptor patterns specific to diseases such as breast cancer congestive heart failure drug addiction and progressive stroke. This presentation will highlight current and future technological advances in the context of major diseases such as Alzheimer's disease manic depressive diseases heart failure spinal vertebrae diseases breast cancer and prostate cancer.

DTIC

High Field Magnets; Imaging Techniques; Magnetic Resonance; Ultrasonics; Radioactive Isotopes; Tomography

20030019057 Minnesota Univ., Minneapolis, MN USA

Regulation of the Multidrug Resistance-Associated Protein Gene by Estrogen Final Report, 1 Sep. 1997-28 Feb. 2001

Sanders, Michael M.; Mar. 2001; 21p; In English

Contract(s)/Grant(s): DAMD17-97-1-7270

Report No.(s): AD-A410077; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An observation was made that the mRNAs for two clones, #41 and #44, were rapidly repressed by estrogen in chick oviduct. Clone #44 shared sequence homology with members of the multidrug resistance-associated protein (mrp) gene family. This raised the question of whether the multidrug resistance (mdr) phenotype in breast cancer may be in part due to the loss of repression of MRP expression by estrogen when antiestrogens are administered. The goals of this last year were to complete the identification of clone #41 and to publish a manuscript describing the work completed thus far. The latter goal has been accomplished and is included as Appendix A. The results with MRP1 have considerable significance in light of two recent reports that indicate that MRP mRNA is highly expressed in primary breast cancers, particularly those with poor prognosis. Our observations raise the possibility that one or more of the selective estrogen receptor modulators (SERMs) may be useful in treating those resistant cancers. While we do not as yet have the complete sequence of clone #41, about 1,000 new bp of sequence has been obtained. The [^]1300 bp in hand encodes a predicted protein with about 96% identity to two human and one mouse partial clones of the kelch superfamily.

DTIC

Estrogens; Ribonucleic Acids; Genetics; Proteins; Drugs; Gene Expression

20030019058 Erciyes Univ., Kayseri, Turkey

Case Follow-Up Study the Patients Undergoing Metallic Heart Valves Replacement Through Phonocardiographic Analysis

Kemaloglu, Semra; Kara, Sadik; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A410096; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this study, the synchronous pursuit of hearts sounds together with FCC signals have been realized. For this purpose pre-operative and post-operative clinic data related with the patients with heart valve diseases has been recorded through a computer. Thus, an auxiliary method has been provided to determine the patient's health situation. Heart sounds have been obtained using a transducer insulated from its surroundings and FCC signals using surface FCC electrodes. The heart sound and FCC signals have been amplified and filtered independent of each other. After this process, these signals have been converted into digital data to be transferred to computer via I/O card. Thus, the results of heart sounds and FCC signals have been monitored and stored in computer by a software developed in Delphi Programmer Language. However, signals have been transferred in frequency domain and power density spectrum was drawn in order to minimize possible errors in the medical diagnosis from sound signals stored in time domain. Also, the durations of heart sound signals have been determined and power density field has been

calculated so that graphs can be compared together. The realized system has been tested over heart valve patients at Cardiology Department in Erciyes University Gevher Nesibe Hospital.

DTIC

Cardiology; Patients; Metal Surfaces; Artificial Heart Valves; Acoustics

20030019059 Xian Jiaotong Univ., Inst. of Biomedical Engineering, China

Bursting of Neurons Under Slow Wave Stimulation

Jun-Ling, Zhu; Qiang, Shen; Da-Zong, Jiang; Oct. 25, 2001; 3p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A410097; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Hopf bifurcation of the H-H neuron was computed by numerical methods and discharge of H-H neuron under slow wave stimulation was studied by simulation. It is shown that slow wave can result in neuron bursting, especially the long time-course bursting, and onset of the bursting is related with Hopf bifurcation. The results prompt that bursting and supernormal excitability of neurons can be induced by slow excitatory synaptic reaction when it is big enough. This phenomenon probably can be used to explain the seizure of some diseases (such as epilepsy).

DTIC

Stimulation; Neurons; Wave Excitation; Bifurcation (Biology); Numerical Analysis

20030019066 Aalborg Univ., Center for Sensory-motor Interaction, Aalborg, Denmark

Measurement of Intrafascicular Insertion Force of a Tungsten Needle into Peripheral Nerve

Jensen, W.; Yoshida, K.; Malina, T.; Hofmann, U.; Oct. 25, 2001; 3p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A410107; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Microfabricated silicon array structures, such as those being developed by the VSAMUEL consortium may one day provide inexpensive yet highly selective chronically implanted interfaces to the peripheral nervous system. In the present study, we examined the feasibility, of implanting such microelectrodes into peripheral nerve tissue by characterizing the mechanical forces required for implantation. We conducted in-vitro implantation experiments into excised rabbit peripheral nerve with electrosharpened tungsten needles similar in dimension to the VSAMUEL probes. A needle was manually advanced through the epineurium and perineurium using a micro-manipulator. The force applied to the needle during the insertion process was measured using a custom built force detection device. We found that a force greater than 2 mN was necessary to insert the needle. Clear dimpling of the nerve surface was also observed prior to penetration.

DTIC

Peripheral Nervous System; Tungsten; Sensory Deprivation; Tissues (Biology); Needles; Fabrication

20030019170 Yale Univ., New Haven, CT USA

Outcome Based Screening for Prognostic Phospho-RTK (Receptor Tyrosine Kinase) Antibodies Using Tissue Microarrays Annual Report, 1 Aug. 2001-31 Jul. 2002

Rimm, David L.; Aug. 2002; 49p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0463

Report No.(s): AD-A410085; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Receptor Tyrosine Kinases (RTKs) have been identified as potential targets for both breast cancer prognosis and therapy. We proposed use of tissue microarrays to evaluate the prognostic value of RTKs with emphasis on the phosphorylation status of these receptors. Analysis of a series of phospho-receptor antibodies on large cohorts on tissue microarrays should reveal which RTKs are most likely to be of prognostic and therapeutic value. As of this progress report, we have completed construction of the tissue microarrays and completed collection of the clinical data. We have also completed and submitted a pilot study of RTKs using conventional analysis of this array. In the proposal we show automated analysis of the arrays has potential to reveal relationships that are undetectable by conventional methods. We have now completed our efforts in construction of the device capable of high through-put automated array analysis. We anticipate testing phospho-RTK antibodies using this device within the next year.

DTIC

Antibodies; Mammary Glands; Prognosis; Tyrosine; Cancer; Tissues (Biology); Microanalysis

20030019171 Monash Univ., Clayton Australia

Development of New Computational Amino Acid Parameters for Protein Structure/Function Analysis Within the Resonant Recognition Model

Pirogova, Elena; Cosic, Irena; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A410087; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Resonant Recognition Model (RRM) is a physico-mathematical model developed for analysis of protein and DNA sequences. Biological function of proteins and their 3D structures are determined by the linear sequences of amino acids. Previously, the electron-ion interaction potentials (EIIP) of amino acids have been used to determine the characteristic patterns of different proteins independent of their biological activity. In this study, the effect of various other amino acid parameters on periodicity, obtained using the RRM, were assessed. Here, we are proposing new computational amino acid parameters that could be used successfully for protein analysis instead of EIIP within the RRM.

DTIC

Amino Acids; Deoxyribonucleic Acid; Mathematical Models; Proteins; Molecular Dynamics; Activity (Biology)

20030019172 California Univ., Irvine, CA USA

Anti-Angiogenic Therapeutic Indicators in Breast Cancer Annual Report, 2 Jul. 2001-1 Jul 2002

Su, Min-Ying L.; Aug. 2002; 15p; In English

Contract(s)/Grant(s): DAMD17-01-1-0178

Report No.(s): AD-A410093; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is an IDEA award to study the therapeutic indicators for anti-angiogenic therapy. In vitro and in vivo strategies will be used to measure treatment efficacy of anti-angiogenic compounds in order to facilitate their clinical development. Dynamic contrast enhanced MRI can be applied to measure vascular changes after therapy. We will also study the immunohistochemical angiogenic biomarkers in tumor tissues before and after therapy. During Yr-O1 we studied R3230 AC mammary tumors treated with Taxotere. The treatment did not cause shrinkage of the tumor, rather only slowing down the growth rate. The large size contrast agent Gadomer-17 could detect a reduced vascularity in responders compared to controls. We are also working on developments of immunohistochemical staining procedures for rat tissues. Using available specimens of ENU induced tumors, we stained p53, TSP-17, Factor VIII, and VEGF. The data showed that all ENU induced tumors had wild type p53. The Factor VIII vessel density showed significance differences between malignant and benign tumors. In Yr-O2 we will continue the study to treat ENU induced tumors with anti-angiogenic therapeutic agents. All methods to be used in this study have been developed.

DTIC

Clinical Medicine; Mammary Glands; Cancer; Immunoassay; Histochemical Analysis

20030019179 Universiteit Twente, Faculty of Applied Physics, Enschede, Netherlands

A Sensitive Magnetocardiograph for Fetal Surveillance

Uzunbajakau, S. A.; Golbach, E. G.; Stinstra, J. G.; Peters, M. J.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409714; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To use fetal magnetocardiography for diagnostic purposes, it is important to know the requirements for the instrument. One of the questions to be answered is how sensitive the fetal magnetocardiograph must be. In this paper the requirements will be discussed and a highly sensitive magnetocardiograph, that is optimized for fetal magnetocardiography in a magnetically shielded room, will be presented.

DTIC

Magnetometers; Cardiography

20030019180 Medtronic, Inc., Minneapolis, MN USA

Commercialization of Seizure Prediction Technology Promises and Pitfalls of Biosignal Analysis: Seizure Prediction and Management (A case study)

Rise, Mark T.; Oct. 25, 2001; 3p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A409713; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This presentation will focus on the process of commercializing technology designed to predict/detect seizures. The author will present general design criteria for an implantable device used chronically by an individual with epilepsy to manage their seizures. He will also contrast the requirements of a commercial product with the sophisticated approaches of algorithm developers. Where an implantable product requires low power consumption, small size, and ease of use, the trends of algorithm developers is to make use of increasingly sophisticated mathematical techniques and increasingly affordable, high speed, powerful desktop computers. A discussion of various design approaches will emphasize the trade offs which could be employed to accommodate important advances in algorithm development.

DTIC

Medical Equipment; Disorders

20030019181 Kocaeli Univ., Electronics and Communication Systems Research Center, Izmit, Turkey

Gait Trainer for Children with Spastic Cerebral Palsy

Urhan, Oguzhan; Dincer, Hasan; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409712; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A device is developed to improve the walking ability of children with Spastic Cerebral Palsy, who have damages to the area of their brain which controls the muscle tone and that causes trouble walking like moving by using their toes instead of applying a steady force to their heels. This device can be adjusted to a correct pressure level to the heels and variations from this value can be displayed by audio and visual signals. Addition to all these valuable signals, the data collected during the walking therapy is stored in a microcontroller and transferred to a computer to provide a database for Physical Therapy (PT) and for children with Cerebral Palsy (CP). by using this data, a better walking therapy program can be developed by special PT teachers.

DTIC

Data Bases; Human Performance

20030019182 Marmara Research Inst., Kocaeli, Turkey

Time-Frequency Cardiac Passive Acoustic Localization

Bahadirlar, Y.; Gulcur, H. O.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409711; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In a previous work, the authors have used a novel, radically different approach based on concurrent multi-sensor array measurements and 'super-resolution' array processing scheme for phonocardiographic signals. Using a specially designed passive acoustic array, acoustic 'images' corresponding to the various distinct phases of the heartbeat were obtained. In this paper, this approach is extended using a novel framework, called Time- Frequency Cardiac Passive Acoustic Localization (TF-CARDIOPAL). The Choi-Williams distribution is utilized - to calculate a spatial time-frequency matrix to - characterize the spatial time-frequency distribution for the nonstationary array signals. Distinctive components of this matrix on the time-frequency plane yield important clues on possible source locations in the heart. This finding has been used in extracting localization information from the first heart sound signals from a - healthy human subject. Meaningful source localization results that are well correlated with the mechanical - activation of the heart are obtained.

DTIC

Phonocardiography; Acoustic Imaging

20030019183 Lille-1 Univ., Faculte De Medecine, Villeneuve-d'Asq, France

Health Telematics: A challenge for Healthcare Quality

Beuscart, R. J.; Alao, O. O.; Brunetaud, J. M.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409708; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A better access to medical information seems necessary to improve the coordination of medical professionals and the quality of care. As a consequence, Health Telematics is a striking challenge for: (1) The communication between professionals. Many experiences of professional networks all around the world demonstrate the feasibility and the benefits of such an electronic communication between doctors, nurses, hospitals, labs; (2) The communication between professionals and their patients. Are the professionals ready to provide their patients with relevant info?; (3) A better coordination of tasks and actors. This would result

in an improvement of the efficiency of any Healthcare System. Health Telematics could be one of the technical devices to attain this objective; (4) to improve communication and coordination means that professionals have to share the same information basis. It is time to examine the possibility for all professionals around the world to share a common patient medical record. Challenges are high. But is it possible? Is it feasible? Do we really know what could be a common shared medical record? Medical Professionals have to appropriate these technologies to use them as best as possible for the benefits of their patients.

DTIC

Telemedicine; Communication Networks

20030019184 Bogazici Univ., Inst. of Biomedical Engineering, Istanbul, Turkey

Analysis of Cut-off Points for the CAGE Questionnaire for Alcohol Abuse

Taner, Mehmet T.; Guvenis, Albert; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409707; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Physicians are in a key position to diagnose and treat patients with alcohol-related problems. Early interventions before the onset of these problems may decrease the costly health care as well as the psychological and social burden of alcoholism on the patient as well as the society. At this stage, the need for physicians to screen alcohol users systematically with a simple, effective and accurate instrument is becoming more critical. Being an easy-to-administer, low-cost, sensitive and specific screening tool, CAGE Questionnaire meets these criteria and offers the promise of raising the identification rate of alcoholic patients substantially. However, CAGE has still been reported to miss nearly half of risk-drinkers because of the incorrect setting of the high likelihood criterion for the presence of alcoholism. Therefore, there is a need to determine a clinically significant cut-off point above which CAGE will be diagnostic. This article aims to identify these optimal work-points for three different clinical settings by employing a step-wise application of statistical indices such as the area under the ROC curve, leveling factor and Yonden index. This method will enable health care providers to determine the optimal CAGE scores for different treatment settings and significantly decrease the number of unrecognized at-risk drinkers,

DTIC

Diagnosis; Clinical Medicine; Drugs

20030019185 Middle East Technical Univ., Dept. of Biotechnology, Ankara, Turkey

Development of a Drug Targeting Approach for Cancer Therapy: Drug Carrier-Protein Conjugate

Muvaffak, Asli; Gurhan, Ismet; Gunduz, Ufuk; Hasirci, Nesrin; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409706; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Targeted delivery of anticancer drugs is one of the most actively pursued goals in anticancer chemotherapy. A major disadvantage of anticancer drugs is their lack of selectivity for tumor tissue, which causes severe side effects and results in low cure rates. Any strategy by which a cytotoxic drug is targeted to the tumor, thus increasing the therapeutic index of the drug, is a way of improving cancer chemotherapy and minimizing systematic toxicity. This study covers the preparation of the gelatin microsphere (GM)- albumin (BSA) conjugate for the development of a 'drug targeting' approach in cancer therapy. Gelatin microspheres of 5% (w/v) gelatin content were prepared by crosslinking with glutaraldehyde (GTA) at 0,5% (v/v) concentration. The particle size and morphology of microspheres were analyzed by Particle Size Analyzer and Scanning Electron Microscopy (SEM). Gelatin microspheres were chemically conjugated to bovine serum albumin PBS (0.01M, pH 7.4) at 40C, The solution was then filtered and the GM-BSA conjugates were vacuum dried, The activity of BSA conjugated to GM was tested by using Immunodiffusion Techniques. The percent antigen-antibody binding between BSA and anti-BSA was evaluated by measuring the band widths of precipitates formed in the agar medium.

DTIC

Chemotherapy; Drugs

20030019186 Sir Mortimer B. Davis Jewish General Hospital, Montreal, Quebec Canada

Is Breast Tissue from Women Who Carry Germ-Line BRCA1 or BRCA2 Mutations 'Normal'? An Immuno-Histopathological Study Annual Report, 1 Aug. 2001-31 Jul. 2002

Foulkes, William D.; Alpert, L.; Deschenes, J.; Tremblay, G.; Aug. 2002; 6p; In English

Contract(s)/Grant(s): DAMD17-01-1-0627

Report No.(s): AD-A409774; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Background and Hypothesis: BRCA1/2 mutations confer a substantially elevated risk of breast cancer. It is not known whether breast tissue from BRCA1/2 mutation carriers is normal or not. We hypothesize that breast tissue in BRCA1 or BRCA2 mutation carriers exhibits particular morphological and biological features resulting from BRCA1 or BRCA2 haplo-insufficiency or from other additional non-characterized genetic changes, when compared to age-matched non-carriers. Methods: Forty BRCA1 or BRCA2-related breast cancers and 80 age-matched breast cancers in BRCA1/2 non-carriers diagnosed in Ashkenazi Jewish women will be analyzed. So far we have examined 510 pathology blocks from 43 women with breast cancer. In order to maintain blinded status, the pathologist does not know how many of these women have BRCA1 mutations or BRCA2 mutations. Slides have been cut, mounted, stained and independently reviewed by two pathologists. We plan to evaluate the following biological characteristics: hormonal pathways (estrogen and progesterone receptors, p52), cell cycle regulation (p27, p53, cyclin D1, cyclin E), proliferation (MIB-1, PCNA), proto-oncogene expression (ERBB2), apoptosis (Bcl-2, caspase3), and androgen receptor.

DTIC

Mutations; Mammary Glands; Cancer

20030019187 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

Functional Sites of the erbB-2 Receptor and Its Activator Heregulin Annual Report

Mroczkowska-Jasinka, Joanna E.; Aug. 2002; 18p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9249

Report No.(s): AD-A409773; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over expression of the erbB-2 (HER-2/neu) receptor occurs in up to 30% of human breast cancers and correlates with aggressive disease and poor prognosis for therapy and survival. The growth factor heregulin (HRG) binds to erbB-3 or erbB-4 receptors, promotes dimer formation with erbB-2 and induces autophosphorylation and activation of erbB-2 signaling. It is generally accepted that HRG and erbB-2 do not interact directly. Depending on its concentration HRG can either inhibit or stimulate cell proliferation in cell lines that overexpress erbB-2. This suggests some type of direct interaction between HRG and erbB-2. Solution structure of HRG and other data support the existence of a low-affinity binding site within the EGF-like domain of HRG. The goal of the proposed experiments is to define the predicted sites of interaction between HRG and the erbB-2 receptor, through generation of HRG and erbB-2 deletion mutants. During the third year of funding, I continued the experiments according to the data obtained in the previous years: a) performed proliferation assays using Ba/ F3 cells infected with deletion mutants of erbB-2 as well as autophosphorylation studies. I also infected with erbB-2 deletion mutants 184B5 immortalized human epithelial cells in order to establish a better in vitro system to study erbB-2 induced tumorigenesis; b) continued to work on purification of recombinant proteins containing alanine substitution in heregulin 1 gene and generated cell lines expressing heregulin mutants in cells coexpressing different levels of erbB receptors. The main result of my work was generation of 8 cell lines expressing the erbB-2 receptor containing different deletions in the extracellular domain, which allowed me to map functional site of this receptor, and 15 cell lines with different levels of erbE receptors expressing heregulin with alanine substitutions within the EGF-like domain.

DTIC

Mammary Glands; Cells (Biology)

20030019188 MacCallum (Peter) Cancer Inst., Melbourne, Australia

Breast Tumor/Stromal Cell Interactions in Bone Annual Report, 1 Jun. 2001-30 Jun 2002

Tavaria, Michael D.; Anderson, Robin L.; Jul. 2002; 14p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0371

Report No.(s): AD-A409770; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Metastasis to bone is a common and serious complication of breast cancer. The aim of this project is to use our unique mouse model of breast cancer metastasis to bone to identify the molecular basis for this problem. In the first year, we have investigated the expression of a panel of candidate genes in tumor cells that metastasize to bone compared to those that do not metastasize or that metastasize to other organs. Many of these candidate genes are expressed in the tumor cells and some may be differentially expressed. We have also measured expression of chemokine receptors in these tumor cells but have yet to find one(s) that correlate with bone specific metastasis. to determine the role of osteolysis in metastasis to bone, inhibitors of bone resorption such as osteoprotegerin (OPG) have been investigated. Treatment of tumor bearing mice with OPG appears to reduce metastatic tumor growth in bone and overexpression of OPG reduces tumor cell growth, suggesting that osteolysis is important in the growth regulation of tumor cells. to investigate the role of stromal derived factors in metastasis to bone, beta3 integrin, M-CSF, MMP9 and MMP2 knockout mice have-been bred onto the Balb/c background.

DTIC

Mammary Glands; Cancer

20030019189 North Carolina Univ., Chapel Hill, NC USA

Applications of a Novel Nucleic Acid Detection Method in Breast Cancer: Analysis of Overexpression of HER-2/neu and FAK Final Report, 1 Jul. 1998-30 Jun. 2002

Thorp, Herbert H.; Jul. 2002; 42p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8224

Report No.(s): AD-A409769; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The project 'Applications of a Novel Nucleic Acid Detection Method in Breast Cancer: Analysis of Overexpression of Her-2/neu and FAK' is aimed at utilizing new biosensors based on guanine electron transfer to quantitate messenger RNA for breast cancer genes. In the first two years of the project, methods were developed for attaching nucleic acids to indium tin oxide electrodes and detecting these molecules electrochemically through the catalytic reaction. These methods allow for detection of 0.5 fmol per 0.1 Cm² of electrode area. This method was applied detection of mRNA amplified by RT-PCR and to determination of repeat lengths. In the second two years, molten salts of DNA were developed that allowed for dramatically reducing the electrode size used to do the detection. These materials allowed for DNA detection on electrodes as small as 5 microns; present DNA chips are generally limited to microlocations in the 100 micron range. In the final studies, photoinduced electron transfer was used to probe these novel materials in more detail.

DTIC

Mammary Glands; Cancer

20030019190 Dana Farber Cancer Inst., Boston, MA USA

Regulation of the Activity of AIB1, an Estrogen Coactivator, by Growth Factor Signals Annual Report, 1 Jul. 2001-30 Jun. 2001

Torres-Arzayus, Maria I.; Jul. 2002; 9p; In English

Contract(s)/Grant(s): DAMD17-01-1-0223

Report No.(s): AD-A409768; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

AIB1 is a member of a coactivator family that potentiates the transcriptional activity of nuclear hormone receptors. The AIB1 gene is amplified in certain breast and ovarian cancers. AIB1 amplification is preferentially found in ER and progesterone receptor-positive breast cancers. These findings suggest that AIB1 plays a causative role in breast cancer development. Our lab recently identified AIB1 as a target of the MAPK signaling pathway. This signaling pathway is triggered by growth factors of the insulin-like growth factor (IGF) and epidermal growth factor (EGF) family. These growth factors and their receptors have also been implicated in the development and progression of breast tumors. Based on these findings, we propose that the phosphorylation of AIB1 by MAPK may represent part of the molecular mechanism that integrates signals from steroid hormones and growth factors. Furthermore, we hypothesize that AIB1 phosphorylation may contribute to the role that AIB1 plays in the development of breast cancer. In order to identify the sites of AIB1 that are phosphorylated by MAPK, seven potential MAPK phosphorylation sites were targeted for deletion and mutations. In vitro phosphorylation of the point mutations and internal deletions by Erk2 revealed 4 major sites of phosphorylation. In the future we plan to test these mutants for their ability to function as coactivators. Our study will help to understand how AIB1 activity is modulated by MAPK. This may help to determine how AIB1 is involved in the development of breast cancer.

DTIC

Estrogens; Mammary Glands; Cancer

20030019192 City Univ., London UK

Merging Telemedicine with Knowledge Management: The M2DM Project

Bellazzi, R.; Carson, E. R.; Cobelli, C.; Hernando, E.; Gomez, E. J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409765; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes the EU-funded M2DM project which is developing multi-access services for the management of diabetes mellitus. Key features of the proposed system include the merging of telemedicine with knowledge management. The issues needing to be addressed in this connection are considered, together with the setting of the project within an overall systemic, model-based framework.

DTIC

Diabetes Mellitus; Biomedical Data; Information Systems

20030019197 Texas Univ., Biomedical Engineering Program, Arlington, TX USA

Computer-Based Clinical Instrumentation for Processing and Analysis of Electroneuromyographic Signals in the Upper Limb

Nazeran, Homer; Jaberzadeh, Shapour; Behbehani, Khosrow; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409562; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A computer-based clinical instrument was developed to simultaneously acquire, process, display, quantify and correlate electroneuromyographic (ENMG) activity in the upper limb in humans, This system was designed around AMLAB analog modules and software objects called ICAMs, The system consists of a nerve stimulator block, a time domain EMG block with evoked response averaging capability, a counter block and a data storage and retrieval block, The system acquires and displays the raw electromyographic (EMG) signal in the Flexor Carpi Radialis (FCR) muscle and quantifies its root-mean-squared (RMS) value, It also acquires the elicited H-reflex and M-response and displays them along with raw EMG signals in one integrated environment, This system has been designed to study the H-reflex and M-response in the upper limb of normal subjects and Carpal Tunnel Syndrome (CTS) patients, It could be easily modified to acquire, process and analyze the ENMG signals in other parts of the human body to assess the continuity and function of the sensory and motor pathways.

DTIC

Electromyography; Limbs (Anatomy)

20030019205 Seville Univ., Spain

Segmentation and Classification of Burn Color Images

Acha, Begonya; Serrano, Carmen; Roa, Laura; Oct. 25, 2001; 5p; In English; Original contains color illustrations; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference CD-ROM. All DTIC reproductions will be in black & white

Report No.(s): AD-A409879; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of the algorithm described in this paper is to separate burned skin from normal skin in burn color images and to classify them according to the depth of the burn. The segmentation procedure consists of an elaborated treatment of color representation, followed by a grayscale segmentation algorithm based on the stack mathematical approach. The proposed algorithm has been developed to be applied to skin wound images, but it works properly as a general segmentation approach. In the classification part, we take advantage of color information by clustering, with a vector quantization algorithm, the color centroids of small squares, taken from the burnt segmented part of the image, in the (V1, V2) plane into two possible groups, where V1 and V2 are the two chrominance components of the CIE Lab representation.

DTIC

Image Processing; Classifications; Burns (Injuries)

20030019206 Universite de Picardie Jules Verne, Biophysics and Image Processing Lab., Amiens, France

Numerical Study of the Cerebro-Spinal Fluid (CSF) Dynamics Under Quasistatic Condition During a Cardiac Cycle

Fin, Loic; Grebe, Reinhard; Baledent, Olivier; Idy-Peretti, Ilana; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409878; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this study, we present a method to perform a numerical simulation of the flow dynamics of the Cerebrospinal Fluid (CSF) based on anatomical Magnetic Resonance Images (MRI). The Computational Fluid Dynamics (CFD) software, written in language C, integrates different numerical schemes to solve the governing equations. The time derivatives were discretized using the Crank-Nicolson scheme. The equation of continuity was modified by introducing an artificial compressibility and discretized by a finite difference scheme. The meshed boundary of the CSF was immersed in a Marker-And- Cell staggered grid for to take into account fluid-structures interactions. Equations of hydrodynamics were solved with an iterative method under different quasi-static conditions. The anatomical basis of our simulations was generated from individual MRI scans. The surface of the anatomical flow channels of interest was extracted by segmentation and fl% triangulated. In parallel to the acquisition of the anatomical data CSF flow has been measured by MRL to characterize a whole cardiac cycle sixteen equidistant velocity measurements have been performed. In addition, a home made software was implemented to visualize computed data (velocities, pressure).

DTIC

Numerical Analysis; Computational Fluid Dynamics; Cerebrospinal Fluid; Magnetic Resonance; Imaging Techniques

20030019208 Southampton Univ., Inst. of Sound and Vibration Research, UK

Automatic Lumbar Vertebrae Segmentation in Fluoroscopic Images Via Optimised Concurrent Hough Transform

Zheng, Yalin; Nixon, Mark S.; Allen, Robert; Oct. 28, 2001; 5p; In English; Original contains color illustrations; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409875; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Low back pain is a very common problem in the industrialized countries and its associated cost is enormous. Diagnosis of the underlying causes can be extremely difficult. Many studies have focused on mechanical disorders of the spine. Digital videofluoroscopy (DVF) was widely used to obtain images for motion studies. This can provide motion sequences of the lumbar spine, but the images obtained often suffer due to noise, exacerbated by the very low radiation dosage. Thus determining vertebrae position within the image sequence presents a considerable challenge. In this paper, we show how our new approach can automatically detect the positions and borders of vertebrae concurrently, relieving many of the problems experienced in other approaches. First, we use phase congruency to relieve difficulty associated with threshold selection in edge detection of the illumination variant DVF images. Then, our new Hough transform approach is applied to determine the moving vertebrae, concurrently. We include optimization via a genetic algorithm as without it the extraction of moving multiple vertebrae is computationally daunting. Our results show that this new approach can indeed provide extractions of position and rotation which appear to be of sufficient quality to aid therapy and diagnosis of spinal disorders.

DTIC

Images; Spine; Fluoroscopy

20030019210 University of Medicine and Pharmacy, Faculty of Medical Bioengineering, Iasi, Romania

Investigations of Cardiac Rhythm Fluctuation Using the DFA Method

Lavinia, Slabu; Catalina, Negoita; Anca, Sandu; Liviu, Amariei; Constantin, Corduneanu; Oct. 25, 2002; 6p; In English; Original contains color illustrations; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409869; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Considering the highly nonlinear and non stationary features of the ECG signal proven by latest researches the most appropriate methods of analysis are based also on the nonlinear dynamics we used a modified root mean square analysis of a random walk named detrended fluctuations analysis (DFA) which proved efficacy as diagnostic tool and advantages on the existing related methods. Our studies were conducted on two groups of young and old subjects totally 24 patients and the different behavior being related to the underlying dynamics of the heartbeat. We compare the data results using the DFA method: first when a line segment is fitted and second when a quadratic polynomial is fitted in the least-squares sense. Applications of this analysis may lead to new and safe diagnosis for patients and to evaluation of the patient status in systemic diseases that may affect in time the cardio-vascular system.

DTIC

Heart Rate; Electrocardiography; Rhythm (Biology)

20030019228 Victoria Univ., Dept. of Electrical and Computer Engineering, British Columbia Canada

Confocal Microwave Imaging for Breast Tumor Detection: A Study of Resolution and Detection Ability

Fear, E. C.; Stuchly, M. A.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409821; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Confocal microwave imaging (CMI) is a recently introduced method of breast tumor detection that utilizes techniques adapted from ground penetrating radar for mine detection. Initial feasibility studies performed with simulated data indicate that CMI is a promising method for tumor detection and localization. In this paper, we explore the detection ability and resolution of the system. The detection ability is examined by imaging tumors of small diameter, while resolution is investigated by imaging 2 tumors located in close proximity. Results indicate that tumors located 3 cm deep and of 3-mm diameter and greater are detected. Resolution is estimated to be 1 cm for two 6-mm diameter tumors.

DTIC

Test Equipment; Mammary Glands; Cancer; Detection; Microwave Imagery

20030019229 University of Southern California, Inst. for Biomedical Engineering, Los Angeles, CA USA

Injectable Sources of Locally Controlled Electrical Fields to Facilitate Tissue Repair

Kaplan, H. M.; Loeb, G. E.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409820; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Both pulsatile (AC) and continuous (DC) electrical fields have been reported to increase growth or healing or otherwise modify the structure of various tissues, including nerves, bones and skin. Systematic application of these techniques in both animal research and clinical treatment has been hampered by the limitations of currently available technology. We describe a new modular approach in which one or more wireless, microminiature, programmable current generators can be injected or implanted in a wide range of sites. Each device has its own address and can be powered and commanded via an external RF field to produce 10, 100 or 500 micronA DC and/or pulse trains of 0.2-30 mA at %512 microns duration. The implants are 2 mm in diameter and 16mm long. They are made from hermetically sealed, biocompatible materials, so they can be used indefinitely or left in situ after treatment is complete.

DTIC

Tissues (Biology); Stimulation; Clinical Medicine; Electric Fields; Injuries; Implantation; Bones

20030019230 Milan Univ., Biomedical Engineering, Italy

Cochlear Maturation and Otoacoustic Emissions in Preterm Infants: A Time-Frequency Approach

Tognola, G.; Ravazzani, P.; Parazzini, M.; Grandori, F.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409819; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Click-evoked otoacoustic emissions (CEOAEs) from preterm infants were analyzed to characterize developmental changes of cochlear active mechanisms. Due to their strong time-varying properties, CEOAEs were studied with the wavelet transform. Results obtained in our study give a clear indication that time-frequencies characteristics of CEOAEs are not fully developed in preterm babies and reach the complete maturation at about 38 wks post-conception. Also, in agreement with previous physiological and behavioral findings, our results show that the maturation of cochlear active mechanisms is not the same along the cochlear partition but exhibit a spatial gradient proceeding from base to apex.

DTIC

Auditory Signals; Cochlea; Children

20030019235 Scripps Research Inst., La Jolla, CA USA

The Role of Deregulated Cyclin E Proteolysis in Breast Cancer Development *Annual Report, 1 May 2001-30 Apr. 2002*

Strohmaier, Heimo M.; Reed, Steven; May 2002; 35p; In English

Contract(s)/Grant(s): DAMD17-00-1-0428

Report No.(s): AD-A409788; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In breast cancer, the regulatory mechanisms that operate to control proper progression of the cell through each cell cycle are perturbed, leading to uncontrolled cell division. A key regulator of cell cycle passage is the G1 cyclin, cyclin E, which regulates the transition from G1 phase into S phase where replication of the DNA occurs. Cyclin E is synthesized and associates periodically with its catalytic subunit, the cyclin-dependent kinase CDK2, followed by its rapid destruction in early S phase. Abnormal accumulation of cyclin E is frequently observed in breast cancer. The levels of cyclin E correlate with the advanced stage and grade of the tumor and with a poor prognosis for breast cancer patients. Previous work has suggested that defects in the proteolytic destruction of cyclin E may account for its accumulation in these tumors. In the first year of this study, we have shown that the turnover of cyclin E is controlled by the ubiquitin- dependent SCF pathway. We have also isolated a novel human F-box protein, designated hCDC4, that specifically directs ubiquitination of cyclin E in a phosphorylation-dependent manner. In the second year of this proposal, we have extended the characterization of this newly identified pathway and we have addressed the question whether mutations to components of the pathway might account for accumulation of cyclin S in tumor cells.

DTIC

Cell Division; Cancer; Mammary Glands

20030019237 Rutgers - The State Univ., Piscataway, NJ USA

Phosphorylation of Intracellular IGF Binding Protein-3 by the IGF Signaling Cascade is Essential for Its Growth-Enhancing Effect in Mammary Epithelial Cells *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Cohick, Wendie S.; Jul. 2002; 6p; In English

Contract(s)/Grant(s): DAMD17-01-1-0619

Report No.(s): AD-A409764; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The insulin-like growth factors (IGF) are involved in processes leading to tumorigenesis and metastasis. The IGFs stimulate growth of mammary epithelial cells, the site of origin of ductal breast carcinomas. Their ability to stimulate growth is modulated by IGF binding protein-3. The goal of these studies is to determine how IGFBP-3 enhances IGF action. Two established mammary epithelial cell lines genetically engineered to express IGFBP-3 will be the experimental models. We have found that the ability of IGF-I to activate chemical signals within the cell that lead to gene activation is enhanced in cells expressing IGFBP-3. Studies in progress will determine if IGFBP-3 enhances IGF-I stimulated cell cycle progression in these cells and if IGF-I phosphorylates IGFBP-3 via IGF receptor activation. Establishing whether or not the IGF signaling cascade results in phosphorylation of IGFBP-3 is central to the overall hypothesis that intracellular IGFBP-3 plays a role in IGF-I stimulation of cell cycle progression. Further work in this area using breast tumor specimens will determine whether this pathway is disrupted in breast cancer. Potential therapies for breast cancer may include treatments that alter phosphorylation or dephosphorylation of the IGFBP-3 protein.

DTIC

Mammary Glands; Cancer; Proteins

20030019238 Aalborg Univ., Center for Sensory-Motor Interaction, Aalborg, Denmark

Addition of an Intrafascicular Electrode at the Site of Application of a Multipolar Nerve Cuff Enhances the Opportunity for Selective Fascicular Activation

Riso, R.; Dalmose, A.; Stefania, D.; Schuttler, M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409876; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Multipolar nerve cuffs are being developed to apply to peripheral trunk nerves in an effort to limit the number of implanted components of an FES system, while at the same time allowing specific fascicles within the cuffed nerve to be independently activated. Because the electrode contact sites of a multipolar circumferential fitted cuff are positioned only at the surface of the cuffed nerve, it is difficult to activate fascicles that are located deep within the nerve. This situation might be improved if one or more additional electrode contacts were provided within the core of the nerve. An obvious choice for such a contact is to use an intrafascicular electrode (IFE) such as those described by Horch and his colleagues. In our present study we inserted a single IFE into a trunk nerve that subserves the forelimb muscles in an adult anaesthetized pig. An 18 pole multichannel nerve cuff was then applied to the nerve at the same site. We stimulated different combinations of the cuff contact sites with and without the IFE while monitoring the evoked EMGs from an array of innervated forearm and shoulder muscles to assess the ability to activate different fascicles independently. The results have shown that the use of the IFE in combination with the normal cuff contacts can afford modest improvements in the degree of selective muscle activation that is possible.

DTIC

Activation; Nerves

20030019239 Texas Univ., M. D. Anderson Cancer Center, Houston, TX USA

Novel Peptide/Protein Delivery System Targeting erbB2-Overexpressing Breast Cancer Cells *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Yu, Dihua; Aug. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-99-1-9271

Report No.(s): AD-A409871; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The major goal of this study is to develop a penetratin-based delivery system targeting specifically ErbB2-overexpressing breast cancer cells. During this funding year, we focused on the delivery of erbB2 signal-blocking ESP peptides (objective 2). Because of the complexity of biotin-penetratin-AHNP-ESP, the synthesis was unsuccessful. We therefore began to try different approaches. We take Stat3 as an alternative target because we found that Stat3 activation is correlated with erbB2 expression levels, which constitutes a promising therapeutic target in treating erbB2-overexpressing breast cancers. We successfully

synthesized Stat3-blocking peptide (Stat3BP), and further conjugated Stat3BP to NeutrAvidin. Through the interaction between NeutrAvidin and biotin, Stat3BP could be linked to biotin-penetratin-AHNP.

DTIC

Mammary Glands; Cancer

20030019240 National Technical Univ., Dept. of Medical Instrumentation Technology, Athens, Greece

Tikhonov Regularization Using a Minimum-Product Criterion: Application to Brain Electrical Tomography

Ventouras, E. M.; Papageorgiou, C. C.; Uzunoglu, N. K.; Christodoulou, G. N.; Oct. 25, 2001; 5p; In English; Presented at the Annual Int'l Conference of the IEEE Engineering in Medicine and Biology Society (23rd) held in Istanbul, Turkey on 25-28, Oct. 2001. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409939; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this study, Tikhonov regularization is applied to the inversion of EEG potentials. The discrete model of the inversion problem results from an analytic technique providing information about extended intracranial distributions, with separate current source and sink positions. A three-layered concentric sphere model is used for representing head geometry. The selected regularization parameter is the minimizer of the product of the norm of the Tikhonov regularized solution and the norm of the corresponding residual. The simulations performed indicate that this regularization parameter selection method is more robust than the empirical Composite Residual and Smoothing Operator approach, in cases where only gaussian measurement noise exists in the discrete inverse model equation. Therefore, the minimum-product criterion can be used in real evoked potentials' data inversions for the creation of brain electrical activity tomographic images when the amount of noise present in the measured data is unknown.

DTIC

Electroencephalography; Mathematical Models; Tomography; Brain; Bioelectric Potential

20030019241 Chinese Univ. of Hong Kong, Dept. of Electronic Engineering, Shatin, Hong Kong

Noninvasive and Cuffless Measurements of Blood Pressure for Telemedicine

Chan, K. W.; Hung, K.; Zhang, Y. T.; Oct. 25, 2001; 3p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409929; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents a new method for obtaining the blood pressure readings noninvasively with telemedicine application. Through the pulse transit time technique, the systolic, diastolic, and mean blood pressures can be predicted using the time interval between the electrocardiogram (ECG) and photoplethysmography (PPG). The data can then be relayed to the Internet for analysis and viewing. The wireless application protocol (WAP) is used for displaying the information on portable wireless devices. The subjects' cardiovascular condition can thus be obtained for monitoring or pre-diagnosis purposes.

DTIC

Blood Pressure; Telemedicine; Portable Equipment; Cardiovascular System; Electrocardiography

20030019242 Instituto Tecnológico de Morelia, Mexico

Computer Game Motivating Rehabilitation with Objective Measures of Improvement in Motor Function

Leder, Ron S.; Murillo, Narda; Ibarra, Carlos P.; Gushiken, Hiyoroku C.; Anaya, Guillermo M.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T

Report No.(s): AD-A410001; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We constructed and interfaced an actuator/sensor to a game of pong TO PRODUCE HIGHLY MOTIVATING REHABILITATION FOR PERSONS WITH ARMS PARTIALLY PARALYZED FROM A STROKE. In addition to moving the pong paddle the subject's motions can be recorded to provide objective measures of improvement in movement range, accuracy, and dynamics. A preliminary patient study revealed a high level of patient interest and satisfaction. Even patients who had no familiarity with computers (the prototype is connected to a computer) and approached the system with trepidation, were soon interested and involved. One hemiparetic aged man initially refused to use the system because he did not think his arm could perform the task, but after a short session in which he performed well, he asked if he could take it home. Patients get very involved and show a high level of concentration.

DTIC

Actuators; Computers

20030019243 Technische Hochschule, Ilmenau, German Democratic Republic

Fractal Dimension as a Feature for Adaptive Electroencephalogram Segmentation in Epilepsy

Kirlangic, M. E.; Perez, D.; Kudryavtseva, S.; Griessbach, G.; Henning, G.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409984; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In previous studies the fractal dimension (FD) has been shown to be a useful tool to detect non-stationarities and transients in biomedical signals like electroencephalogram (EEG) and electrocardiogram (ECG) The changes in FD are shown to characterise alterations in EEG due to changes in physiological states of brain, not only in normal but also in pathological functioning like epilepsy. The importance of long-term EEG monitoring for clinical evaluation ill epilepsy has been also emphasised. Adaptive EEG segmentation and classification of the obtained segments have been addressed to be a convenient solution to the problem of visual inspection of huge EEG data sets, The performance of adaptive segmentation plays an essential role iii correct evaluation of the recordings. Thus, our aim iii this study is to analyses the FD as a feature for adaptive EEG segmentation and compare its performance with those of previously used features oil epileptic EEG data.

DTIC

Electroencephalography; Electrocardiography; Epilepsy

20030019244 Ritsumeikan Univ., Dept. Ofrobotics, Shiga, Japan

Feasibility of Measuring the Volition Level in Elderly Patients When Using Audio Encouragement During Gait Training Physical Therapy

Tejima, N.; Bunki, H.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409709; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this study is to find a method for measuring the volition level in elderly patients during gait training physical therapy. First, both the walking speed and tempo of the elderly patients were experimentally measured with a video camera under musical stimulation, however, neither walking speed nor tempo was directly related to the subjects' will or level of enthusiasm to undergo the gait training physical therapy. Second, the FmO activities of EEC signals were experimentally measured while performing a psychological task at a desk. These FmO activities seemed to be related to the subjects' enthusiasm, however, their high level of deviation and the influence of artifacts minimized their usefulness for this purpose.

DTIC

Aging (Biology); Physiological Effects; Therapy

20030019245 Budapest Univ. of Technology and Economics, Budapest, Hungary

Catheter Calibration Using Template Matching Line Interpolation Algorithm

Nagy, L.; Szilagyi, L.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409981; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents a study case of specific angiographic X-ray image processing, such as quantitative cardiac analysis During QCA it is very, important to get precise and accurate results because these data are used to make a diagnosis or to plan an eventual intervention, The two main requests are influenced by many factors, such as: image resolution, type of the calibration, algorithm used for contour detection, size of the FOV, other parameters of the image The studied calibration method is the one using catheter size, and it looks to find a general solution for all size FOVs and catheters, The algorithm can be implemented either on acquisition systems - in order to allow direct and fast quantification of the recorded sequences -, or on review stations - in order to enhance the 2D post-processing functionality Ke% 'wrn%Is - X-ray angiography, QCA, catheter calibration,

DTIC

Algorithms; Templates; Angiography; X Rays; Catheterization

20030019247 Universite de Technologie de Troyes, Lab de Modelisation et Surette des Systems, Troyes, France

Changes in Impedance at the Electrode-Skin Interface of Surface EMG electrodes During Long-Term EMG Recordings

Hewson, D. J.; Duchene, J.; Hogrel, J. Y.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409602; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Changes in the impedance at the electrode-skin interface of SEMG electrodes on tibialis anterior were assessed in nine subjects. SEMG signals were recorded using a bipolar electrode configuration that conformed to the SENIAM recommendations for SEMG data collection. Impedance measurements were made between a pair of bipolar electrodes using a custom-built device consisting of a PC and an impedance conversion circuit. The impedance device enabled the simultaneous application and recording of a waveform constructed of a known combination of sinusoids passed between the two electrodes. SEMG recordings at 10% of each subject's maximal voluntary force during ankle dorsiflexion were made for a 30-s period every 15-min over a two hour period. Impedance was measured immediately before and after each SEMG recording. All subjects gave their written informed consent.

DTIC

Impedance; Electromyography; Impedance Measurement

20030019250 Ohio Univ., Dept. of Mechanical Engineering, Athens, OH USA

Comparison of Image Generation and Processing Techniques For 3D reconstruction of The Human Skull

MEHTA, B. V.; MARINESCU, R.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409700; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of our study was to compare the accuracy of an unconventional, non-invasive and relatively inexpensive Microscribe (3D digitizer) with a standard widely used and expensive CT-Scan and/or MRI for 3D reconstruction of a human skull, which will be used for biomechanics studies. Two models of the human skull were developed (reconstructed), one using the 3D coordinates generated by the Microscribe 3D digitizing unit and another one using the CT-Scans (2D cross-sections) obtained from a CE scanner. Both models were then subjected to stress analysis using a Finite Element Analysis program. Additionally, a few image processing software - OSIRIS ? ii, SCION IMAGE 2 EFILM 3 3D DOCTOR 4 and OPTIMAS 5 were compared in order to find the best software that could function as an interface between medical and engineering software and in the same time to have a 3D reconstruction algorithm.

DTIC

Computer Programs; Image Processing

20030019251 Tokyo Univ., Graduate School of Frontier Sciences, Japan

Bone Mechanical Strength Estimation from Micro X-ray CT Image

Matani, A.; Terakawa, K.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409699; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

(Quality of Life) in old ages has received much attention. Fracture of bones is seriously related to the QOL and is mainly caused by osteoporosis in old ages. BMD (Bone Mineral Density), an index to evaluate the mechanical strength of the bone, does not always reflect the strength. On the other hand, micro X-ray CT has revealed the inner structure of bone. Under such circumstances, an image compression technique was employed to find a better index for the evaluation. MRA (Multi Resolution Analysis) and a measure for the subband images are popular in the technique. In this study, the MRA with Harr functions and the power spectra of the subband images were employed. A linear estimation with the power spectra was performed to estimate the strength. To evaluate this method, the micro X-ray CT imaging and a destructive test of rat lumber vertebrae were performed. The newly determined index is higher correlated to the bone mechanical strength than the BMD. Situation of human bone may not be so different from the rat bones. This method may be, therefore, beneficial to estimating the bone mechanical strength.

DTIC

X Rays; Destructive Tests; Bones; Osteoporosis; Fracturing; Bone Demineralization; Data Compression

20030019252 Fujimoto Hayasuzu Hospital, Miyazaki, Japan

Virtual Baby Used as a Virtual Environment for Patients with Severe Dementia

Yonemitsu, S.; Nakamura, K.; Itoh, A.; Higashi, Y.; Fujimoto, T.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409691; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We gave patients with severe dementia a baby-like doll to serve as a virtual baby in a therapeutic program and after dinner when the subjects missed their homes. In the therapeutic program, an occupational therapist provided the patients with two soft

plastic dolls and one silicone doll, complete with dress and cap, for 90 seconds. The activities of the patients were observed by the occupational therapist and classified into four categories (no reaction, close observation, care of the doll, communication with other residents and caregivers). In the 60-minute therapeutic program, the total number of activity episodes was around 300. The dolls were also placed in the main hall after dinner but the only patients who noticed them were those interested in the virtual babies. The patients appeared much happier and less agitated when handling the dolls. Although doll therapy is not suitable for everybody, it is a useful tool in occupational therapy.

DTIC

Therapy; Disorders

20030019253 Mugla Univ., Mugla, Turkey

Computer Assisted Learning for Biomedical Engineering Education: Tools

Ystanbullu, Ayhan; Gueler, Ynan; Oct. 25, 2001; 3p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409689; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Interactive multimedia learning environment is being proposed for development as a learning/teaching aid for biomedical engineering students, Multimedia has attracted increasing attention from all walks of life, It has been proved that multimedia has great impact on educational and industrial development. In this study, some descriptions about Computer Assisted Learning (CAL) are given and some tools used in this area are explained. Together with the developments in the area of distance education technologies, this study can be introduced as a cost effective alternative solution for developing countries in lack of expert teachers and didactic resources.

DTIC

Medical Science; Computer Assisted Instruction; Engineering; Learning

20030019254 Stanford Univ., Stanford, CA USA

Combining Electron with Intensity Modulated Photon Beams for Breast Cancer Annual Report, 1 Jul. 2001-30 Jun. 2002

Xing, Lei; Jul. 2002; 136p; In English

Report No.(s): AD-A409653; DAMD17-01-1-0635; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This Concept Award was awarded to the principal investigator (PI) for the period of July 1, 2001- June 30, 2002. Because of the late arrival of the postdoctoral fellow (Dr. David Y. Yang) for this project, we have filed a no-cost extension to June 31, 2003 (see attached Assistance Agreement). This proposal is aimed at developing a hybrid treatment method of intensity modulated radiation therapy (IMRT) and conventional electron for breast cancer and exploring the potential benefit of the approach. The specific aims of the proposal are: (1) to demonstrate that the combination of the two modalities can lead to more conformal dose distributions that would not otherwise be possible for breast cancer treatment; and (2) to show that substantially improved dose distributions can be realized in practice. Under the generous support from the U.S. Army Medical Research and Materiel Command (AMRMC), the PI has contributed significantly to breast cancer research by applying physics and engineering knowledge to breast cancer research. A number of conference abstracts and refereed papers have been resulted from the support. The preliminary data obtained under the support of the grant has also enabled the PI to start new research initiatives and significantly advanced my academic career. In this report, I summarize the highlights of my past year's research.

DTIC

Electrons; Photon Beams; Mammary Glands; Cancer

20030019255 Patras Univ., Greece

Structuring Expert-led Medical Protocols for Tele-Medicine Systems

Mammas, K. S.; Madellos, G. J.; Economou, G. P.; Lymberopoulos, D. K.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409652; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The structuring of standardized medical protocols that can be used in distributed tele-medicine systems (TS) is dealt. The protocols are needed to handle the medical data exchange between TS; TS can be considered as an aggregation of medical data

sources and communication servers. The medical protocols have been integrated in an already presented TS tested on the field by means of a pilot project consisting of twenty-two (22) medical nodes.

DTIC

Standardization; Medical Services; Telemedicine

20030019256 Georgetown Univ., Washington, DC USA

Modulation of Epidermal Growth Factor Receptor Expression by Chemotherapeutic Agents in Breast Cancer Cell Lines
Annual Report

Welch, James N.; Jul. 2002; 28p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0275

Report No.(s): AD-A409651; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The epidermal growth factor receptor (EOFR) is a cell-surface protein that relays signals from the extracellular environment into the cell by binding specific polypeptide hormones followed by activation of intracellular signal transduction pathways. Although rarely an oncogene, the ability of EGFR-mediated signaling to generate diverse responses including growth, differentiation, stress response, apoptosis suppression, and altered mobility makes this protein a potentially powerful tumor promoter. The association between higher EOFR expression and poorer prognosis in breast cancer and the frequency of higher EGFR levels in more aggressive/metastatic breast tumors reinforce this possibility. Our research aims to uncover a link between chemotherapeutic exposure and increased expression of EOFR in breast cancer cells with the hope of explaining why higher levels of EGFR are common to more advanced breast tumors. We have shown that exposure of MCF-7, T-47D, and ZR-75-1 breast cancer cells to the anti-metabolite compound methotrexate causes an up-regulation of EGFR receptor expression. Our work demonstrates that the EGFR up-regulation usually occurs at both the mRNA level and protein level (with increased expression on the cell surface) and that this may be accompanied by changes in the expression of EGFR ligands. We also demonstrate that the methotrexate-induced EOFR expression in these cells alters EGF-mediated phosphorylation of ERK and AKT (causing changes in the specificity, timing and intensity of EOFR signaling through these pathways in a cell specific manner). ERK and AKT signaling pathways have been shown to mediate anti-apoptotic effects. We therefore hypothesize that increased EOFR expression and signaling in these cells provides a survival advantage by suppression of chemotherapy induced apoptosis, possibly explaining the prevalence of EGFR over-expression in drug resistant cell lines and more aggressive breast tumors.

DTIC

Chemotherapy; Mammary Glands; Cancer

20030019257 Colorado Univ., Boulder, CO USA

Understanding Single-Stranded Telomere End Binding by an Essential Protein *Final Report, 1 Aug. 1999-31 Jul. 2002*

Anderson, Emily M.; Wuttke, Deborah S.; Aug. 2002; 75p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9150

Report No.(s): AD-A409649; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

CDCl3p is an essential protein from *S. cerevisiae* that binds to the single-stranded ends of telomeres with high specificity and affinity. CDCl3p perform functions in concert with two protein complexes - protecting the end of the chromosome from degradation and regulating telomere length through the enzyme telomerase. CDCl3p binds yeast single-stranded telomeric DNA (sstelo DNA) in vitro with high affinity ($K_{(sub d)}=0.3$ nM). The modular DNA-binding domain of the protein has been mapped by deletion analysis and proteolysis. We are investigating the structural and biochemical basis for high affinity binding and sequence specificity of the single-stranded DNA binding domain. We have used heteronuclear, multidimensional NMR spectroscopy to solve the high-resolution solution structure of the domain bound to a single-stranded telomeric DNA 11-mer. We have used isotope filtered and select/filter NOE experiments to determine the single-stranded DNA conformation in the complex and observe protein-DNA contacts. Also, the thermodynamic contribution of amino acids at the interface has been probed by site-directed mutagenesis and filter-binding.

DTIC

Cells (Biology); Proteins; Mammary Glands; Cancer

20030019258 Sloan-Kettering Inst. for Cancer Research, New York, NY USA

Mammary-Specific Gene Transfer for Modeling Breast Cancer *Annual Report*

Li, Yi; Aug. 2002; 8p; In English

Contract(s)/Grant(s): DAMD17-99-1-9312

Report No.(s): AD-A409648; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The TVA retroviral gene transfer system allows for the examination of multiple genetic lesions in vivo without the need to create and breed individual transgenic lines. The system is based on the use of the RCAS virus (an avian leukosis virus vector of subgroup A) to deliver genes to mammalian cells or tissues that have been engineered to produce the avian viral receptor TVA. Transgenic mice have been generated to express TVA in the mammary gland. Mammary tumors can be induced in these mice by in vivo infection of mammary glands with virus encoding polyoma middle T antigen. Mammary cells, isolated from the TVA mice that have been bred to p53 nullizygosity, can be infected ex vivo with RCAS vectors expressing oncogenes, and the transplantation of the infected cells into the fat pad of non-transgenic mice results in rapid development of mammary tumors. This somatic gene delivery system may be useful for dissecting genetic interactions that operate in breast cancer.

DTIC

Genes; Mammary Glands; Cancer

20030019259 Technische Univ., Graz Austria

Adaptive Mean and Trend Removal of Heart Rate Variability Using Kalman Filtering

Schloegl, A.; Fortin, J.; Habenbacher, W.; Akay, M.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images
Report No.(s): AD-A409647; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Analysis of heart rate variability requires the calculation of the mean heart rate, Adaptive methods are important for online and real-time parameter estimation, In this paper we demonstrate the use of Kalman filtering to estimate adaptively the mean heart rate and remove the trend.

DTIC

Kalman Filters; Statistical Analysis; Heart Rate

20030019261 Saint Mary's Hospital, Oncology Center, Montreal, Quebec Canada

Preliminary Evaluation of Preoperative Chemohormonotherapy-Induced Reduction of the Functional Infrared Imaging Score in Patients with Locally Advanced Breast Cancer

Keyserlingk, John R.; Yeassa, Mariam; Ahlgren, Paul; Belliveau, Normand; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom
Report No.(s): AD-A409618; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

20 successive patients who received preoperative chemohormonotherapy (PCT) for locally advanced breast cancer underwent high resolution digital Infrared imaging (IR) both before and after PTC and prior to surgery. The images were graded using a five scale. Initial pre-PCT IR imaging revealed obvious and often dramatic angiogenesis-related findings in all our patients. Following PCT there was a significant decrease in both the IR score and in the clinical size of those with measurable disease. Four of six patients with complete pathological response also saw their IR revert to normal. In nine patients the elevated pre-PCT IR score lingered longer than the clinical findings. IR provides a very safe and convenient alternative functional imaging modality to monitor PCT. Further study and follow-up is required to assess whether the IR changes the reflectance effect of PCT on tumor vascularity also provide an additional valuable prognostic indicator for this subset of patients with aggressive tumors.

DTIC

Hormones; Infrared Imagery; Chemotherapy; Cancer; Imaging Techniques

20030019262 Hillsborough Community Coll., Dept. of Computer Science, Ybor City, FL USA

Asynchronous Transfer Mode, Computer Aided Detection: Teleradiology

Sheybani, Ehsan; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409610; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A fiber-optic network derived by a set of ATM (asynchronous transfer mode) switches in association with CAD (computer aided diagnosis/detection) algorithms has been set up as the first prototype of on-line, real-time cancer detection/ diagnostic system. Expanding diagnostics and treatment beyond the local level will bring better health care to a wider range of people at a reduced cost. This work describes the Asynchronous Transfer Mode (ATM) Teleradiology Network (ATMTN) and the high-speed fiber backbone architecture as a new technology that offers real-time, on-line, more accurate screening, detection and diagnosis of breast cancer with less need for invasive treatment. ATMTN is a fully automatic, robust and high-speed network integrated with

DICOM standards, and IP protocols and associated with Computer Assisted Detection/Diagnostic (CAD) methods for digital mammography.

DTIC

Fiber Optics; Computer Techniques; Mammary Glands

20030019264 University Hospital, Huddinge, Sweden

Intra- and Interobserver Reproducibility in Off-Line Extracted Cardiac Tissue Doppler Velocity Measurements and Derived Variables

Gaballa, M.; Lind, B.; Stora, C.; Brodin, L. A.; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409597; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Using post-processing software it is possible to extract tissue velocities from color-coded Doppler information in numerous positions in the myocardial wall. From velocity other variables such as displacement and deformation (strain) can be calculated. For adequate clinical assessment multiple measurements are needed. This is why reproducibility of the method must be evaluated. Methods: A moderately experienced observer measured systolic and diastolic basal velocity, displacement, strain rate and strain in right and left ventricular walls in 14 patients. The measurements were compared to those acquired by an experienced observer. Results: The inter-observer variability for the systolic longitudinal and radial velocity was 6.9% and 12.0% for the right and 5.8% and 11.9% for the left ventricle respectively. The results with the least reproducibility were obtained for the radial strain rate where the inter-observer variability was 27.9% and 16.2% for the right and left ventricles respectively. Left ventricular velocity measurements had slightly better reproducibility than right ventricular. Derived calculations had a larger variation. Conclusion: Basal velocity measurements and displacement calculations could be performed in the clinical routine by different observers with high reproducibility. Derived variables depending on multiple measuring locations could still be performed but with a method uncertainty of almost 15%.

DTIC

Velocity; Measurement; Myocardium

20030019265 University Hospital, Leuven, Belgium

Detection of Autoregulation in the Brain of Premature Infants Using a Novel Subspace-Based Technique

Morren, G.; Lemmerling, P.; Huffel, S. V.; Naulaers, G.; Devlieger, H.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409588; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A recent study 1 suggests that, under certain circumstances, concordant changes in cerebral intravascular oxygenation and mean arterial blood pressure reflect impaired cerebrovascular autoregulation. In this paper, we propose a new measure to quantitate this concordance, derived from the common subspace of these signals. The method is compared to correlation and conference analysis with respect to our application, but it is also suited for other biomedical signals. Furthermore, this model-based approach is not restricted to applications involving only 2 signals.

DTIC

Infrared Spectroscopy; Near Infrared Radiation; Blood Vessels; Blood Pressure; Intravascular System; Oxygenation; Brain Circulation

20030019267 Georgia Inst. of Tech., Atlanta, GA USA

Feature Parameter Optimization for Seizure Detection/Prediction

Esteller, R.; Echaz, J.; Alessandro, M. D.; Vachtsevanos, G.; Litt, B.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409937; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

When dealing with seizure detection/prediction problems, there are three main performance metrics that must be optimized: false positive rate, false negative rate, detection delay or, if the problem is seizure prediction, it is desirable to obtain the greatest prediction time achievable. Tuning specific extracted features to individual patients can lead to improved results. The processing window length is also an important parameter whose optimization may significantly affect performance. In this study we propose

an approach for selecting the window length for the particular detection/prediction problem. This approach is applicable to other feature parameters suitable for tuning or optimization.

DTIC

Seizures; Electroencephalography; Optimization; Detection; Independent Variables

20030019270 Bogazici Univ., Inst. of Biomedical Engineering, Istanbul, Turkey

Compressibility Analysis of the Tongue During Speech

Unay, Devrim; Ozturk, Cengizhan; Stone, Maureen; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409932; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The motivation of this study is to observe the compressibility of the tongue during speech. The tongue has a complicated muscular structure. Real-time MRI (Magnetic Resonance Imaging) (16 frames/s) with tagging has been used for imaging during the utterance of four short syllables, "sha", "ga", "ta" and "ba". Four-dimensional parametric motion field analysis has been used which allows point tracking everywhere on the tongue. In this paper, 3D (Three-dimensional) compression and expansion analysis of the tongue will be presented. Patterns of expansion and compression have been compared for different syllables and various repetitions of each syllable. The long-term objective of this research is to provide important information about the motion of the internal tongue muscles and shed light on the intricate relationship between these muscles and the final shape of the tongue during regular and abnormal speech patterns.

DTIC

Abnormalities; Compressibility; Tongue; Speech; Muscles

20030019271 New South Wales Univ., School of Biomedical Engineering, Sydney, Australia

Identifying Physiologically Significant Pumping State Transitions in Implantable Rotary Blood Pumps Used as Left Ventricular Assist Devices: An In-Vivo Study

Ayre, P. J.; Lovell, N. H.; Morris, R. W.; Wilson, M. L.; Woodard, J. C.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409930; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The VentrAssist implantable rotary blood pump (IRBP) is a centrifugal pump that uses a hydrodynamic bearing to support its impeller. The pump is to be used as a left ventricular assist device (LVAD). Varying pump speed can control the degree of left ventricular assistance. by increasing impeller speed, it is possible to transition from the normal physiological state of ventricular ejection (VE) to a state where the aortic valve remains closed (AC) throughout the cardiac cycle. Using the non-invasive parameter of instantaneous impeller speed in an ovine experimental model (N=3), we investigated state transitions. The cardiovascular system of the animal was perturbed by pharmacological intervention or by exsanguination. A total of six pump speed set point changes that caused physiological state transitions (VE to AC) were examined. A state transition index (STI) derived originally from data obtained in an in-vitro mock loop setup was found to be directly applicable in the in-vivo studies and showed statistically significant ($p < 0.0005$) reliability in differentiating between no change in state and change in state. These data indicate that the STI may be a valuable mechanism to in optimal LVAD control.

DTIC

In Vitro Methods and Tests; In Vivo Methods and Tests; Blood; Implantation; Hemorrhages; Blood Pumps

20030019272 National Cardiovascular Center Research Inst., Dept. of Cardiovascular Dynamics, Suita City, Japan

Development of Online Monitoring of Myocardial Elastance by Imposing Dual-Frequency Minute Vibration

Sugimachi, M.; Shishido, T.; Kawada, T.; Inagaki, M.; Sunagawa, K.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409928; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is necessary to determine both ventricular and myocardial mechanical properties for the assessment of cardiac contractility, in patients with heart disease. It is important to establish a framework to integrate myocardial properties into ventricular time-varying elastance for understanding the pathophysiology of heart failure. We measured myocardial mechanical properties by imposing minute sinusoidal vibration of different frequencies. Analysis between the amplitude and phase of force relative to those of displacement of at least two frequencies yielded elastance, viscosity and inertia. of these, elastance and viscosity were

time varying, while inertia was constant during cardiac cycle. Applications of vibration of two different frequencies simultaneously have realized the online monitoring of myocardial properties continuously.

DTIC

Myocardium; Physiology; Diseases

20030019273 Hwa Hsia Coll. of Technology and Commerce, Chungho, Taiwan

Aid Training System for Upper Extremity Rehabilitation

Chen, Yu-Luen; Kuo, Te-Son; Chang, Walter H.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409927; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research involves developing an aid training system for the upper extremity rehabilitation. Included in this system are a hand-training unit, a signal converting interface and a computer. The hand-training unit is a platform with multiple reed-relays and an arm-skate for the patients to operate on the platform. The selected items and figures on the computer activate specific designs linking with each reed-relay and are displayed on the computer screen. The patients then draw the same figures on the platform by the arm-skate with their hands. The corrections and time elapsed can be recorded and sent back to computer unit through the signal converting interface. The flexion, extension, and coordination of hand muscle will be achieved after repeatedly performing this training. Meanwhile, in addition to multiple training items of corresponding figures, this system also provides functions for building a patient database to offer clinicians scientific data for long-term monitoring the rehabilitation effects.

DTIC

Muscles; Therapy; Appendages; Injuries

20030019276 Osaka Univ., Graduate School of Engineering, Osaka, Japan

The Present State and Future Perspective of Biomedical Engineering in Japan

Sata, Shunsuke; Kajiya, Fumihiko; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409923; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Medicine has been directly involved with life of organisms, including humans as primary focus with treatment or therapy as one of the important aims. An organism at any level of complexity possesses a variety of physiological functions. Understanding these biological functions and their complex and exquisite mechanisms is also another basic aim of medicine. Remarkable progress in medicine are made by introducing a variety of medical equipment including X-ray CT (Computer Tomography) and NMR (Nuclear Magnetic Resonance) and the medical application of computers and their network systems. Modern medicine and medical treatment cannot be fully utilized without these equipment.

DTIC

Japan; Medical Services; Bioengineering

20030019278 Strang Cancer Prevention Center, New York, NY USA

Statistical Analysis of Multivariate Interval Censored Data in Breast Cancer Follow-Up Studies *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Wong, George Y.; Jul. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-99-1-9390

Report No.(s): AD-A409921; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Interval-censored (IC) data are encountered in three areas of breast cancer research. The most common application is in clinical relapse follow-up studies in which the study endpoint is disease-free survival. When a patient relapses, it is usually known that the relapse takes place between two follow-up visits, and the exact time to relapse is unknown. In statistics, we say relapse time is interval censored. Interval censoring is also encountered in breast cancer registry studies in which information on family history of cancer is updated periodically. The Strang Breast Surveillance Program for women at increased risk for breast cancer, for instance, has enlisted over 800 women with complete pedigree information which is verified and updated continuously. Family history data such as age at diagnosis of a specific cancer, or a benign but risk-conferring condition, are obtained from each registrant at each update. Time to a cancer event, and definitely time to first detection of a benign condition, are at best known to fall in the time interval between the last update and age at diagnosis. A third but increasingly important area of application of interval censoring is in breast cancer chemoprevention experiments or prevention trials, which involve the observation of one or more surrogate endpoint biomarkers (SEB) over time. The scientific question of interest here is the estimation of time for the SEB

to reach a target value, and time from cessation of intake of a chemopreventive agent to the loss of its protective effect. Unfortunately, the exact values of both these time variables are known only to lie in between two successive assay inspection times.

DTIC

Cancer; Mammary Glands; Histories

20030019279 National Taiwan Univ., Dept. of Electrical Engineering, Taipei, Taiwan, Province of China

Wavelet-Based Fluctuation Analysis of Laser Doppler Blood Flux on Renal Cortex in Rats

Chan, P. T.; Jan, M. Y.; Huang, C. Y.; Wang, Y. Y.; Wang, W. K.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409919; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Fluctuations of peripheral blood flux are related to its physiological or pathological condition. The oscillations of skin and muscle are well studied. Due to hard to install the probe, fewer studies about the oscillation of fluctuations of peripheral blood flux on internal organ are investigated. In this study, using a fast Laser-Doppler flowmetry (LDF) with a signal fiber probe, we measured the renal cortical flux (RCF) and abdominal aortic blood pressure (AABP) simultaneously in rats. With a continuous wavelet transform, we analyzed the fluctuations of RCF and estimate their weights on RCF.

DTIC

Flowmeters; Blood Pressure; Flow Measurement; Laser Doppler Velocimeters

20030019284 National Health Research Inst., Div. of Medical Engineering Research, Taipei, Taiwan

Miniature Active Concentric Ring Sensor for Localized Body Surface EMG measurement

Lu, Chih-Cheng; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409911; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

EMG detection is critical in gait analysis. Localized EMG detection usually calls for invasive method using needle electrode. Body surface EMG provides global information about the muscle activity of a general area. This global information is not as useful compared with the localized EMG signal Concentric ring electrode with build-in amplifier provides superior localized EMG signal from body surface. A light weight (2 gm) miniature (15mm in diameter 3.5 mm in thickness) active concentric ring sensor (Harbinger Technology HT-EMG, Chung-Ho City, Taipei County, Taiwan) with high input impedance (10 G omega) is used to obtain localized EMG activity form body surface without skin preparation. The amplifier is mounted directly above the concentric ring electrode with low system noise (0.7mV rms at gain of 1000) with a high pass filter of 15 Hz and a low pass filter at 10KHz. The reference connection is at the back, on top of the active sensor. The high common mode rejection ratio (118dB typical) with high input impedance and lightweight makes concentric ring EMG active sensor user-friendly and easily adaptable to most EMG acquisition system.

DTIC

Electromyography; Electrophysiology

20030019285 Karlsruhe Univ., Inst. of Bioengineering, Germany

Non-Contact Measurement of the Electrical Impedance of Biological Tissue

Riedel, C. H.; Doessel, O.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409909; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The measurement of the impedance of biological tissue is a non-invasive method to find new data of diagnostic relevance. A danger in the impedance for example can give a prediction of the healing process of wounds or of skin irritations. The traditional way is to apply the current and measure the voltage with electrodes. This leads to stray capacitance between the electrodes as well as between the ground and patient at frequencies above 500 kHz. In the present report two sensitive systems are presented using computer simulations which can detect conductivity gradients. The systems are built up with two coils. In the first simulation the excitation coil is designed as a gradient coil to excite a magnetic field and a rectangular coil to measure. In the second simulation a rectangular coil is used as an exciting coil and a gradiometer coil is used to measure. The tissue block is divided into two halves

with different conductivities. The sensors give no signal with a homogeneous tissue block. In presence of a conductivity gradient, the systems are sensitive. The main difference of the two systems is the geometrical arrangement of the eddy currents.

DTIC

Measurement; Impedance; Electric Coils; Tissues (Biology)

20030019286 Friedrich-Schiller Univ., Jena Germany

Brain Surface Current Density Mapping in Pianists and Non-Pianists

Haueisen, J.; Knoesche, T. R.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409905; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Brain surface current density reconstructions are widely used to analyze magnetoencephalographic data arising from electrical activity in the human brain. Commonly, this mapping is performed in single subjects. We present a methodology to apply brain surface current density mapping to group studies. The technique includes stepwise transformation of the magnetic sensors into a standard sensor system and linear scaling of individual heads in Talairach space. We demonstrate the usefulness of the technique with a comparison of the motor activation in pianist and non-pianist while listening to piano pieces.

DTIC

Brain; Mapping

20030019287 Forschungszentrum Juelich G.m.b.H., Juelich, Germany

Nonlinear Time Series Analysis

Grassberger, P.; Oct. 25, 2001; 2p; In English; Presented at Annual Int'l. Conf. (26th) of the IEEE Engineering in Medicine and Biology Society, held in Istanbul, Turkey, on 25-28 Oct. 2001. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409904; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We start by opposing the two paradigms of stochasticity (most clearly represented by Gaussian autoregressive models) and deterministic chaos. We present several examples (heart, nephrons epileptic seizures) where evidence for the latter has been found. We then start the more technical part by discussing time delay embeddings and the choices of parameters for them. After that we shall discuss noise reduction algorithms and algorithms for signal separation based on the geometry of embeddings. In particular we shall present the extraction of fetal heart beat from a univariate ECG signal. We then discuss classical invariants (metric entropy attractor dimension Lyapunov exponents) and argue why using them as indicators for chaotic determinism is not very useful. The same should be true also for alternatives like false nearest neighbors or forecasting errors. In contrast we shall argue that strict determinism is not needed for the arsenal of nonlinear time series analysis to be useful. We shall argue that the above observables can indeed be very useful in clinical applications. As an illustration we shall discuss evidence that epileptic seizures can be predicted and epileptic foci can be localized by using dimension-like observables. Typical features of deterministic chaos are the existence of unstable periodic orbits and the possibility to control such systems by arbitrarily small perturbances. We shall comment on claims that such periodic orbits have been found in biomedical systems and we shall discuss whether chaos control could eventually be used in intelligent heart pacemakers. Finally we shall discuss various methods to study interdependencies between different time series. These include cross correlation and coherence mutual information phase synchronization and other interdependence measures. We shall discuss their usefulness in EEG analysis in particular for epilepsy patients.

DTIC

Nonlinearity; Aerospace Medicine; Clinical Medicine; Statistical Analysis

20030019289 Surabaya Inst. of Tech., Dept. of Electrical Engineering, Indonesia

Temperature Distribution Pattern in Normal and Cancer Tissues: The Effect of Electromagnetic Wave

Nuh, Mohammad; Jazidie, Achmad; Kuswadi, Son; Kemalasari.; Oct. 25, 2001; 6p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409902; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Temperature distribution pattern on normal and cancer tissues caused by the Electromagnetic wave effect is presented in this paper. First, the pattern is modelled by using Bio Heat Transfer Equation and then the Galerkin Finite Element method is used to solve the equation via computer simulation. From the simulation results it can be shown that the temperature change on the cancer tissues is relatively constant and 0.4 degrees Celsius higher than the change on the normal tissues. From this phenomenon it can be understood that the damage of the cell of the cancer tissues is greater than the damage of the cell of the normal tissues. Therefore it is possible to use the Hyperthermia technique with electromagnetic wave for cancer therapy. The simulation results

can be also used to decide the control strategy for giving the dose energy of electromagnetic wave which is flowed out to the cancer tissues.

DTIC

Hyperthermia; Cancer

20030019290 Gebze Inst. of Tech., Dept. of Earthquake Engineering, Turkey

A Three Dimensional Numerical Interaction Model for the Fixation of Mandibular Fractures

Uckan, E.; Ak, S.; Uckan, S.; Keypour, H.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409901; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Two and three dimensional finite element models (FEM) were developed to simulate the behavior of a fractured jaw bone and the fixation materials. Mini-plates with various geometric and material properties and screw combinations were considered. Their effects on the variation of maximum stress contours were investigated. The geometric and material properties of the plate screw and bone were seen to play important roles in effecting the relative displacement at the fractured surface and the spatial variation of the maximum stress across the jaw bone. Softer materials yielded less stress concentrations around the screws while increasing the relative deformation at the fractured surface and stiffer ones caused higher stress concentrations while decreasing the displacements. Results were also seen to be dependent on the loading and the need for the use of patient specific 3D solutions was emphasized.

DTIC

Stress Analysis; Surgery; Bone Demineralization; Three Dimensional Models

20030019292 I-Shou Univ., Dept. of Electronic Engineering, Ta-Hsu, Taiwan, Province of China

Shape Optimization of Cochlear Implant Electrode Array Using Genetic Algorithms

Choi, Charles T.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409899; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Finite element analysis is used to compute the current distribution of the human cochlea during cochlear implant electrical stimulation. Genetic algorithms are then applied in conjunction with the finite element analysis to optimize the shape of cochlear implant electrode array based on the energy deposited in the spiral ganglion cells region. The goal is to improve the focus of electrical energy delivered to the spiral ganglion cells in the human cochlea, thus, reducing energy wasted and improve the efficiency and effectiveness of the cochlear implant system.

DTIC

Optimization; Arrays; Electrodes

20030019293 Strathclyde Univ., Glasgow UK

Automatic Echocardiographical Feature Extraction for Left Ventricular Wall Motion and Volume Changes Visualization

Soraghan, John J.; Setarehdan, S. K.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images

Report No.(s): AD-A409898; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes a new fully automatic fuzzy multiresolution-based system for cardiac left ventricular (LV) sequence analysis. The edge detection process utilized in the system uses multiscale spatial and temporal information in a fuzzy multiresolution framework to identify a single moving edge point for each one of the epicardial and endocardial boundaries for all frames in a cardiac cycle. The raw extracted boundaries are processed in the wavelet domain and finally scale-space filtering is used to define the close LV boundaries. The system is used to automatically extract ejection fraction and volume changes for real short axis echocardiographic data. The dynamics of the LV wall are also visualized.

DTIC

Echocardiography; Numerical Analysis

20030019294 Chinese Univ. of Hong Kong, Shatin, Hong Kong

Modeling of Equivalent Nonlinear Resistance and Capacitance of Active Cochlea

Yao, J.; Zhang, Y. T.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International

Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom. The original document contains color images
Report No.(s): AD-A409897; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents an ear model that combines the classical transmission-line cochlear model, the active cochlear partition model, and the active model of a single outer hair cell (OHC). This model can successfully generate 'tall and broad' basilar membrane response and otoacoustic emissions. Result show that, owing to the OHC activities, the active cochlear partition has an equivalent resistance always lower than the resistance of a passive cochlear partition; and that the active cochlear partition has an equivalent capacitance always higher than the capacitance of a passive cochlear partition.

DTIC

Mathematical Models; Cochlea; Acoustic Emission

20030019298 Middle East Technical Univ., Dept. of Electrical and Electronics Engineering, Ankara, Turkey

Magnetic Resonance-Conductivity Imaging Using 0.15 Tesla MRI Scanner

Birgul, O.; Ozbek, O.; Eyuboglu, B. M.; Ider, Y. Z.; Oct. 25, 2001; 5p; In English; Original contain color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409573; No Copyright; Avail: Defense Technical Information Center (DTIC)

A novel imaging method for electrical impedance tomography is implemented. In this method, the magnetic flux density generated by current flowing in a 2D slice is measured using MRI scanner and recorded data is used to reconstruct relative conductivity images. The measurements are done from all parts of the imaging region, and therefore sensitivity is space independent. The magnetic flux density is extracted from phase images of the MRI image and a sensitivity based image reconstruction algorithm is used to reconstruct relative conductivity images. The magnetic flux density measured and the conductivity image reconstructed for an insulator object placed in the middle of the imaging region are presented.

DTIC

Electrical Impedance; Computer Aided Tomography; Magnetic Resonance

20030019304 Flinders Univ., School of Informatics and Engineering, Adelaide, Australia

A Fuzzy Inference System for Detection of Obstructive Sleep Apnea

Nazeran, Homer; Almas, Asher; Behbehani, Khosrow; Burk, John; Lucas, Edgar; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. Prepared

Report No.(s): AD-A409977; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A fuzzy inference system (FIS) was developed to detect obstructive sleep apnea (OSA) by analyzing the respiratory airflow signal in adults, The parameters analyzed were the normalized area and the standard deviation of consecutive 3-second intervals of baseline adjusted and rectified airflow signal, Fuzzy logic was used to process these parameters to detect apnea and hypopnea when the output values were within a specified range extracted from OSA patient data, The FIS comprised of three major stages of computation: fuzzification, fuzzy rule evaluation and defuzzification,

DTIC

Sleep Deprivation; Fuzzy Systems; Respiration; Sleep

20030019311 Pakistan Univ. of Engineering and Technology, Dept. of Biomedical Engineering, Karachi, Pakistan

Design of Tactile Sensor Using Dynamic Wafer Technology Based on VLSI technique

Baig, Mirza H.; Asim, Rasool; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409949; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The study had been accomplished in the desire to obtain real time control analysis with tactile sensors. This has lead to the design and fabrication of a cost-effective artificial tactile sensor. This wafer technology is based on Potentiometric principles. In the process in-depth study has been made keeping in view the reliability, accuracy, data processing, and flexibility. Very large scale integration (VLSI) computing array techniques have been incorporated to develop an independent logic control for real time analysis.

DTIC

Simulation; Very Large Scale Integration; Touch; Design Analysis; Tactile Sensors (Robotics); Measure and Integration

20030019312 Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

Therapeutic and Chemopreventive Actions of a Novel Polyamine Analog Against Breast Cancer *Final Report, 1 Sep. 1999-31 Aug. 2002*

Davidson, Nancy E.; Sep. 2002; 59p; In English

Contract(s)/Grant(s): DAMD17-99-1-9231

Report No.(s): AD-A409999; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The intracellular polyamines, spermidine, spermine, and putrescine, play an important role in the proliferation and death of normal and malignant cells. As a consequence, our work has focused on development of inhibitors of this metabolic pathway. A phase II trial of diethylnorspermine (DENSpm) for women with advanced breast cancer was completed. No major toxicity was observed but clinical activity was not sufficient to warrant further testing of DENSpm at the dose and schedule used. Analysis of DENSpm- and control-treated breast cancer tumors derived from discarded mastectomy tissue showed that DENSpm can modulate expression of the SSAT enzyme on some specimens. This could potentially serve as a biomarker of effect. The efficacy of several new polyamine analogs as treatment for established breast cancer in a nude mouse model xenograft has been demonstrated. Future studies will focus on these agents.

DTIC

Cancer; Inhibitors; Enzymes; Tissues (Biology)

20030019313 Veterans Administration Connecticut Healthcare System, West Haven, CT USA

Psychological and Neurobiological Consequences of the Gulf War Experience *Final Report, 7 Jun. 1996-6 Jun 2000*

Southwick, Steven; Jul. 2000; 23p; In English

Contract(s)/Grant(s): DAMD17-96-1-6125

Report No.(s): AD-A409998; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

PROJECT OBJECTIVE: to examine memory function and longitudinal course of illness in veterans of Operation Desert Storm. SPECIFIC AIMS: to measure hippocampal volume, memory function, consistency of memory for traumatic events and longitudinal course of illness in veterans of Operation Desert Storm compared to reservists who did not serve in the Gulf.

DTIC

Sicknesses; Memory

20030019317 Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA

A Laboratory Comparison of Clockwise and Counter-Clockwise Rapidly Rotating Shift Schedules, Part III: Effects on Core Body Temperature and Neuroendocrine Measures *Final Report*

Boquet, Albert; Cruz, Crystal E.; Nesthus, Thomas E.; Detwiler, Cristy A.; Knecht, William R.; Holcomb, Kali A.; Nov. 2002; 20p; In English

Report No.(s): AD-A409994; DOT/FAA/AM-02/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Most researchers suggest that shift rotation in a forward or clockwise direction produces less disruption of circadian rhythms than those that rotate in a backward or counter-clockwise direction. This is based upon extrapolation from quasi-experimental studies of shift-workers and research on the effects of jet lag, which indicate that westward travel results in less disruption of circadian rhythms. The effect of direction of rotation on cortisol, melatonin, and core body temperature was examined in participants randomly assigned to either a clockwise or counter-clockwise shift rotation. Twenty-eight participants worked a day shift (0800-1600) for one week followed by either a clockwise (n=14=14) or counter-clockwise (n=14=14) shift rotation for two weeks. Participants wore a flexible rectal temperature sensor for the three weeks of the study and were allowed to remove the sensor for 90 minutes each day. Saliva samples were collected at the end of the baseline week for later assay for melatonin and cortisol, and were time-locked to collection times during the two "shiftwork" weeks. No group differences were found for cortisol for either of the workweeks. The clockwise group, however, had a significantly greater increase in melatonin during the early morning shift, compared with the counter-clockwise group. Finally, the analyses of core body temperature revealed a significantly lower amplitude and a delay of the acrophase for the counter-clockwise group during both weeks of testing. While cortisol levels did not appear to differ based on direction of shift rotation, there were inherent differences with melatonin secretion and core body temperature. Precisely why such differences exist remains unclear but may be similar to that seen with circadian resynchronization during westward travel. Furthermore, it is not clear if these differences would persist in individuals exposed to longer periods of shift rotations.

DTIC

Circadian Rhythms; Neurology; Body Temperature; Neurophysiology

20030019320 Shandong Univ., Jinan China

Implementation of Spectral Maxima Sound Processing for Cochlear Implants by Using Bark Scale Frequency Band Partition

Xianhua, Han; Kaibao, Nie; Oct. 25, 2001; 6p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410084; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A new method on the basis of Bark scale frequency-band partition was presented to improve the recognition performance of cochlear implants, in the nature of physics, it consists with human's cochlea filter properties. Also the mechanism of a cochlear implant and its spectral maxima sound processing (SMSP) strategy were presented. The time frequency analyzing property of human's cochlea was analyzed. The theoretical determination of Bark scale frequency-band was also given with formula. Simulation results using Bark scale transform signal processing were discussed in detail and results show that the new method is feasible in speech processors for cochlear implants.

DTIC

Bandpass Filters; Signal Processing; Cochlea; Frequencies; Implantation

20030019321 Texas Univ., MD Anderson Cancer Center, Houston, TX USA

Training Program in Breast Cancer Research at the University of Texas M.D. Anderson Cancer Center Annual Report, 1 Sep. 2001-31 Aug. 2002

Hung, Mien-Chie; Sep. 2002; 182p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9264

Report No.(s): AD-A410083; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

With the continuous funding from the US army/DOD, the training program on breast cancer research at MDACC has had a successful third year. The training program has supported four predoctoral and two postdoctoral fellows. Each trainee has made notable progress as evidenced by publications and presentations at national meetings. Significant strides have been made within the scope of the original specific aims in the following research areas: 1) Therapeutic approaches for breast cancer through regulation of oncogene and tumor suppressor gene expression, and control of signal transduction, apoptosis, and DNA repair; 2) Use of animals to understand the biology of breast cancer and to provide models for preclinical therapeutic and preventive studies; 3) Novel preventive strategies for breast cancer; 4) Population-based studies on breast cancer; 5) Molecular diagnostic/prognostic factors for breast cancer; and 6) The basis biology of breast cancer. In addition to laboratory pursuits each trainee has participated in departmental group meetings, journal clubs, and retreats. The goal of the training program is to further the successful training of fellows who will develop research programs of their own which continue to tackle problems of breast cancer.

DTIC

Cancer; Education; Mammary Glands; Oncogenes; Apoptosis; Clinical Medicine; Research and Development

20030019322 Washington Univ., Saint Louis, MO USA

Radiolabeled Matrix Metalloproteinase Inhibitors for Breast Cancer Therapy Final Report, 1 Sep. 2001-31 Aug. 2002

Anderson, Caroyln J.; Sep. 2002; 12p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0666

Report No.(s): AD-A410082; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Matrix Metalloproteinases (MMPs), a family of over 20 types of enzymes, collectively are capable of degrading all the components of the extracellular matrix. MMP-2 and MMP-9 (also known as gelatinases) are specifically thought to play critical roles in tumor cell invasion and are frequently co-expressed in breast cancer. Cyclic peptides containing the sequence HWGF have been described as selective inhibitors of MMP-2 and MMP-9. We tested the hypothesis that gelatinase expression may provide a target for in vivo tumor imaging using a radiolabeled gelatinase inhibitor. The peptide, DOTA-CTTHWGFTLC (DOTA-CTT), was labeled with Cu-64 T 1/2 1/2% = 12.7 h., which has a decay scheme suitable for both PET imaging and cancer therapy. This conjugate maintained MMP-2 inhibitory activity comparable to %Ilomastat, a broad-range inhibitor of MMPs. An increase in the MMP-2/9 activity of human metastatic breast cancer MDA-MB-435 tumors in nude mice was observed from 4 to 10 weeks post-implantation. MicroPET images of Cu-64-DOTA-CTT in the tumor-bearing nude mice showed tumor uptake at 8-wk post-implantation; however, the same mouse with 5-wk palpable tumors showed no uptake of the tracer, suggesting that the MMP-2 and MMP-9 activity is related to the stage of tumor growth. These data suggest the potential of radiolabeled gelatinase inhibitors as markers for imaging the metastatic capability of human breast cancer.

DTIC

Mammary Glands; Cancer; Radioactive Isotopes; Proteins; Imaging Techniques

20030019323 Chieti Univ., Dept. of Clinical Sciences and Bioimaging, Chieti Scale, Italy

Diagnosis of Sub-Clinical Varicocele by Means of Infrared Functional Imaging

Merla, Arcangelo; Ledda, Andrea; Di Donato, Luigi; Romani, Gian Luca; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A410066; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Infrared Functional Imaging (IRFI) was used to detect sub-clinical varicocele. The evaluation of varicocele related hyperthermia and the different thermal properties of healthy and unhealthy testicles were used to detect the presence of the disease. A mild cold thermal stress performed on the scrotal region highlighted differences in the thermal recovery between the contralateral testicles and pampiniform plexuses. Mismatches in the equilibrium temperatures and in the recovery curves were used as objective parameters to infer the presence of varicocele, in a sub-clinical stages. 60 subjects, without any previous varicocele related symptoms, underwent the IRFI. 22 subjects out of the 60 showed abnormal values of the chosen parameters; Clinical and Echo-Color-Doppler examination confirmed the presence of a sub-clinical first or second degree varicocele.

DTIC

Infrared Imagery; Clinical Medicine; Vasodilation; Diagnosis; Signs and Symptoms

20030019324 Universidade Estadual de Paulista, Guaratingueta, Brazil

A Simple Constant-Current Neural Stimulator With Accurate Pulse-Amplitude Control

DeLima, J. A.; Cordeiro, A. S.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410000; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A simple constant-current electrocutaneous stimulator for high-impedance loads using low-cost, standard high-voltage Components is presented. A voltage-regulator powers an oscillator built across the primary of a transformer whose secondary delivers, after rectification, the high-voltage supply to switched current-mirrors in the driving stage. Since the compliance high-voltage is proportional to the stimulation current, overall power consumption is minimized. by adjusting the regulated voltage, control of the pulsed-current amplitude is achieved. A prototype with readily available components features stimulation currents of amplitude and pulsewidth. Pulse-repetition spans from 1 Hz to 10 Hz. Worst-case ripple is 3.7% $I(\text{skin})=1$ mA. Measured pulse fall-time is shorter than 32 microns. Overall consumption is 4.4W $I(\text{skin})=20$ mA. Subject isolation from power line is 4KV.

DTIC

Electronic Equipment; Electric Potential; Energy Consumption; High Voltages; Low Cost; Voltage Regulators

20030019328 National Technical Univ., Athens, Greece

Automatic Reconstruction of Catheters in CT Based Brachytherapy Treatment Planning

Milickovic, Natasa B.; Baltasw, Dimos; Zamboglu, Nikolaos; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409987; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of this study was to develop an automatic reconstruction of brachytherapy catheters using CT data, Previously no such automatic facility has existed in any treatment planning software, to achieve this aim we have developed algorithms for the automatic reconstruction (which we term autoreconstruction) of plastic and nietallic catheters, Our algorithm overcome a number of difficulties which arise when a large number of catheters are present. These include situations with intersecting catheters and with loop techniques.

DTIC

Algorithms; Catheterization; Medical Equipment

20030019329 Linköping Univ., Sweden

Non-Invasive Blood Flow Monitoring on the Wrist

Maier, M.; Lindberg, L. G.; Oct. 25, 2001; 3p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409986; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Blood flow changes was measured by PPG in vitro and in patients utilizing a new custom designed optical sensor, The results indicate that the sensor may monitor central related blood pressure variations and congestive heart failure.

DTIC

In Vitro Methods and Tests; Blood Pressure; Blood Flow

20030019331 Middle East Technical Univ., Dept. of Mechanical Engineering, Ankara Turkey

A Three-Dimensional Model of the Mandible Using Two-Dimensional CT Images

Mutlu-Sagesen, L.; Roroslu, R.; Parnas, L.; Suca, S.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409983; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In dentistry, instead of conventional prosthetic applications, dental implant prosthesis has recently been used in edentate patients. Biomechanical effects are known to be one of the most important factors in the failure of these implants. In this work, a three-dimensional model of the edentate mandible is formed to use in three-dimensional finite element method for the stress analysis of chewing forces. The computerized three-dimensional solid geometric mandible model is formed by using commercially available CAD tools on a series of two-dimensional CT images obtained from a Hi-speed CT/I imaging system. Satisfactory results on several implant schemes on this model are obtained by applying various critical chewing forces.

DTIC

Implantation; Dentistry; Biodynamics; Imaging Techniques

20030019332 Bologna Univ., Italy

A Mathematical Model of Cardiovascular Response to Dynamic Exercise

Magosso, E.; Felicani, A.; Ursino, M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409982; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A mathematical model of cardiovascular response to dynamic exercise is presented, The model includes the pulsating heart, the systemic and pulmonary, circulation, a functional description of muscle exercise hyperemia, the mechanical effects of muscle contractions on hemodynamics, and various neural regulatory, mechanisms working on systemic resistance, venous unstressed volume, heart rate and ventricle contractility These mechanisms comprehend the direct effect of motor command signals on cardiovascular and respiratory, control centers (the so called central command), arterial baroreflex and the lung-stretch receptor reflex, The model is used to simulate the steady state response of the main cardiovascular hemodynamic quantities (systems arterial pressure, heart rate, cardiac output, systems vascular conductance, and blood flow in working muscle) to various intensity levels of two-legs dynamic exercise, A good agreement with physiological data in the literature has been obtained, The model sustains the hypothesis that motor command signals em an emanating from cerebral cortex provide the primary, drive for changes of circulation and respiration during exercise, The model may represent an important tool to improve understanding of exercise physiology, Keywords: Dynamic exercise, central command, autonomic nervous system.

DTIC

Physiological Effects; Cardiovascular System; Central Nervous System; Command and Control; Pulmonary Circulation

20030019333 Calgary Univ., Alberta Canada

Identification of a Hammerstein Model of the Stretch Reflex EMG using Cubic Splines

Dempsey, Erika J.; Westwick, David T.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409942; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of cubic splines instead of polynomials in representing static nonlinearities in block structured models is considered. A system identification algorithm for the Hammerstein structure a static nonlinearity followed by a linear filter is developed in which the static nonlinearity is represented by a cubic spline. The identification algorithm based on a separable least squares Levenberg-Marquardt optimization is used to identify a Hammerstein model of the stretch reflex EMG recorded from a spinal cord injured patient. The resulting model provides more accurate predictions of the reflex EMG, even in novel data than more

conventional models which use polynomial representations of the nonlinearity. Furthermore the spline based optimization appears to be less sensitive to its initialization than a similar polynomial-based approach.

DTIC

Cubes (Mathematics); Electromyography; Nonlinearity; Spline Functions; Splines; Mathematical Models

20030019335 Bogazici Univ., Inst. of Biomedical Engineering, Istanbul, Turkey

Image Segmentation in MRI Using True T1 and True PD Values

Buyuksarac, B.; Ozkan, M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409940; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Segmentation of tissues in magnetic resonance images is essential especially for a radiologist to be able to identify a disease, tumors, or any tissue. In any magnetic resonance image there exists many different types of tissues each with characteristic T1 and T2 decay times and proton densities. If these parameters of tissues can be calculated from the regular magnetic resonance images, the type of tissue could also be determined on any MR image independent of MR hardware characteristics. One such important hardware limitation is the varying sensitivity of an imaging coil span ally. Segmentation algorithms can not distinguish between an intensity variation caused by the imaging coil sensitivity or a variation by tissue change. Calculated T1, T2, and PD images provide consistent pixel intensity corresponding to the same tissue therefore easier to utilize in conventional segmentation algorithms. to be able to calculate true T1 and PD parameters, a slice of human head were imaged sixteen times by holding TE fixed and changing TR each time. Levenberg-Marquardt Method is applied to the data and T1 and PD values were estimated. The true T1 and true PD images were produced. The maximum likelihood classification is then applied successfully to four MR images of different slices of human head and the robustness of this method in segmenting CSF, WM, and CM is illustrated.

DTIC

Algorithms; Imaging Techniques; Magnetic Resonance; Tissues (Biology); Radiology

20030019336 California Univ., San Francisco, CA USA

Does Pregnancy Immunize Against Breast Cancer? Final Report, 16 Jul. 2001-15 Jul 2002

Campbell, Michael J.; Aug. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0499

Report No.(s): AD-A409787; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Epidemiological evidence suggests that pregnancy at an early age and multiparity provide protection against the development of breast cancer. However, the mechanism(s) of this protection remains unclear. Endocrinological factors have been proposed to play a role. In addition, a few studies have suggested that immunological factors may be involved. We are interested in these latter immunological factors. Our overall objective is to answer the question: Does pregnancy immunize against breast cancer and can this explain, at least in part, the protective effect of pregnancy on breast cancer? Our hypothesis is that immune responses generated against normal breast tissue antigens during pregnancy/lactation protect against subsequent development of breast cancer by targeting the same antigens expressed on breast cancer cells. Our long range goals are to determine how pregnancy might immunize against breast cancer, identify the antigens involved, and use this information for developing novel diagnostic and therapeutic strategies. In this study, we generated phage display libraries from breast cancer cell lines and screened these libraries with sera from nulliparous or multiparous women to identify antigens that were specifically recognized by only the multiparous sera. If pregnancy is immunizing against breast cancer, then the antigens identified from these studies may be ideal candidates for preventative vaccines.

DTIC

Pregnancy; Cancer; Mammary Glands; Antigens; Vaccines

20030019337 Health Research, Inc., Buffalo, NY USA

Delivering DNA Vaccine by Transdermal Electroporation Annual Report, 1 Aug. 2001-31 Jul. 2002

Hui, Sek-Wen; Aug. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0530

Report No.(s): AD-A409785; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The HLA-A2 binding peptide, KIFGSLAFL, derived from breast cancer associated antigen HER-2/neu, is to be delivered transdermally by electroporation to the dermal Langerhans cells (LC), to stimulate the cytotoxic T-lymphocyte (CTL) response to breast cancer cells. We have extended, by using anionic lipids, the upper molecular weight limit of transdermal delivery of macromolecules by electroporation to is less than 10,000. This enables the delivery of antigenic peptides but not minigenes. We

measured the transdermal flux of antigenic peptides (M.W.⁹,000) to be in the order of 1-10 mug/cm²/min, when 1 msec pulses of 100V were applied to the skin at 1 Hz. The KIFGSLAFL peptide was delivered to HLA-A2/Kb transgenic mice as a vaccine by transdermal electroporation. CTL response to delivery of the peptide vaccine KIFGSLAFL has so far been negative. We attribute the lack of response to either that the peptide delivered was insufficient, or that the adjuvants in transdermal electroporation were absent because of molecular weight limitation. Increase the amount of delivery, with or without co-injection of adjuvant, could overcome the problem.

DTIC

Peptides; Vaccines; Cancer; Mammary Glands

20030019341 Fox Chase Cancer Center, Philadelphia, PA USA

Gamma Synuclein Promotes a Metastatic Phenotype in Breast and Ovarian Tumor Cells by Modulating the Rho Signal Transduction Activity *Annual Report, 1 May 2001-30 Apr. 2002*

Godwin, Andrew K.; May 2002; 66p; In English

Contract(s)/Grant(s): DAMD17-01-1-0522

Report No.(s): AD-A409762; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The synucleins (alpha, beta, gamma synoretin) are a family of small, highly conserved proteins expressed predominantly in neurons. While alpha-synuclein is implicated neurodegenerative diseases, gamma-synuclein is expressed in the majority (greater than 85%) of late-stage breast and ovarian carcinomas and is not expressed in normal mammary and ovarian epithelium. In spite of their significance, the normal and pathological roles of synucleins are not fully understood. to address the biological function of gamma-synuclein and its role in the malignancy of breast and ovarian cancer, we ectopically over-expressed gamma-synuclein in several cancer cell lines. Recently we found that gamma-synuclein is associated with two major mitogen-activated kinases (MAPK), i.e., extracellular signal-regulated protein kinases (ERK1/2) and c-Jun N-terminal kinase 1 (JNK1). Over-expression of gamma-synuclein lead to constitutive activation of MERK1/2, and down-regulation of JNK1 in response to stress (UV, sodium arsenate, and heat shock). In this study, we further characterized the effects of gamma-synuclein on paclitaxel, a commonly used chemotherapeutic drug, and nitric oxide induced apoptosis. We found that gamma-synuclein over-expressing cells were more resistant (4- to 5-fold) to paclitaxel or nitric oxide as compared to the parental cells. This resistance to paclitaxel could be partially restored when ERK activity was inhibited using U0126, a MEK1/2 inhibitor. In addition, activation of the mitochondrial apoptotic pathway (JNK and/or caspase 3 activation) by paclitaxel and nitric oxide was blocked by ectopic expression of gamma-synuclein. Collectively, these data indicate that gamma-synuclein may be involved in the pathogenesis of breast and ovarian cancer by promoting tumor cell survival under adverse conditions and by providing resistance to certain anti-cancer drugs.

DTIC

Physiological Responses; Chemotherapy; Mammary Glands; Ovaries; Cancer

20030019343 Health Research, Inc., Rensselaer, NY USA

Antibody Probes to Transcript-Specific Peptides Provide a Novel Tool to Investigate the Role of Alternate Estrogen Receptor Promoter Use in Breast Cancer *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Pentecost, Brian T.; Luo, M.; Jul. 2002; 14p; In English

Contract(s)/Grant(s): DAMD17-01-1-0529

Report No.(s): AD-A409760; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Estrogen receptor alpha (ER) plays an important role in the development and progression of breast cancer, and it is routinely used as a marker for hormone sensitivity in breast cancer patients (1). Positive ER status is a useful indicator for a first-line therapy with antiestrogens (2). ER is expressed from at least two promoters (Fig. 1). The resulting transcripts from these two promoters differ only in the non-coding region upstream of the major ER open reading frame (ORF); the ER proteins from these two promoters are identical. The proximal promoter transcript contains a 20 residue ORF which closes 52 nt upstream of the main ER ORF. which affects expression from the downstream ER ORF. Our central hypothesis is that the action of the proximal transcript uORF is exerted at the translation level. C-terminal truncated (Phe20 or Gly 19 to stop) prox-uORFs are highly effective and enhanced translational inhibitors. The presence of the natural C-terminal residue of the proximal uORF modifies (weakens) the inhibitory potential of the uORF. An ongoing goal aim is to under define critical regions for the inhibitory effect and to address mechanism.

DTIC

Antibodies; Estrogens; Mammary Glands; Cancer

20030019344 Baylor Coll. of Medicine, Houston, TX USA

Functional Significance of Mutant p53 in Breast Cancer *Annual Report, 1 Jul. 1999-30 Jun. 2002*

O'Lear, Rene; Rosen, Jeffrey; Jul. 2002; 17p; In English

Contract(s)/Grant(s): DAMD17-99-1-9074

Report No.(s): AD-A409759; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Approximately 50% of human cancers have accumulated missense mutations in the gatekeeping tumor suppressor protein p53, usually resulting in genomic instability and a very poor prognosis. The wild-type p53 protein is required for assessing DNA damage in cells and making the decision to either induce cell cycle arrest to facilitate DNA repair, or to induce a suicide response in those cells with irreparable damage. In human tumors, many hot-spot mutations are found within the DNA-binding domain of p53, rendering it incapable of sequence-specific transactivation of target genes such as p21, bax, and mdm2. Some of these mutants, in addition to having dominant-negative functions, also gain novel functions by interacting with proteins differently from the wild-type p53 protein. One such gain-of-function p53 mutant possesses an Arg to His substitution at codon 175 (172 in mice) and has been shown to be involved in the dysregulation of centrosome duplication leading to abnormal mitoses and subsequent aneuploidy. Because centrosome abnormalities and aneuploidy are often seen in high-grade breast tumors, unraveling the mechanism behind the involvement of p53^{172 R-H} in centrosome dysregulation will help us to understand the progression of mammary carcinogenesis. In order to identify potential indirect target genes regulated by this mutant, we employed a suppressive subtractive hybridization technique to generate a cDNA library specific to p53 null mammary epithelial cells (MECs) expressing the 172 R-H mutant. cDNA made from p53 null mammary epithelial cells transiently transfected with wild-type p53 was subtracted from cDNA made from mutant p53 transfected cells. The subtraction procedure generated a pool of cDNAs differentially expressed in the presence of the mutant protein; many interesting genes were revealed to be candidates for regulation by mutant p53. Some of these include developmental, metabolic, transcriptional,

DTIC

Mutations; Mammary Glands; Cancer

20030019345 Ohio State Univ., Research Foundation, Columbus, OH USA

A Novel Phosphatase Gene on 10q23, MINNP, in Hereditary and Sporadic Breast Cancer *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Eng, Charis; Aug. 2002; 28p; In English

Contract(s)/Grant(s): DAMD17-00-1-0390

Report No.(s): AD-A409758; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

PTEN is a tumor suppressor gene on 10q23 and encodes a dual specificity phosphatase. One of the major substrates for PTEN is phosphatidylinositol (3,4, 5) triphosphate in the PI3 kinase pathway. When PTEN is dysfunctional or absent, P-Akt is high and hence, anti-apoptotic. PTEN is a major susceptibility gene for Cowden syndrome (CS), a hereditary disorder with a high risk of breast and thyroid cancer, and appears to be involved in a broad range of tumors. In addition, germline PTEN mutations have been found in a developmental disorder, Bannayan-Riley-Ruvalcaba syndrome (BRR) as well. Previously not thought to be associated with cancer risk, BRR families and cases with germline PTEN mutations have recently been shown to be at risk for cancers and especially breast tumors. Between 10-80% (mean 60%) of CS families and 60% of BRR individuals have germline PTEN mutations. Families that do not have germline PTEN mutations are not inconsistent with linkage to the 10q22-23 region. Thus, genes with related function to PTEN in the 10q21-q25 region are good candidate genes for PTEN mutation negative CS, BRR and related sporadic tumors, e.g., those of the breast and thyroid. MINPP1 lies no more than 1 Mb upstream of PTEN and encodes an inositol polyphosphate phosphatase. In Year 2 of the award, we have found no germline intragenic MINPP1 mutations in 30 CS, 35 BRR and 15 CS-like. However, we have found at least 2 CS probands with germline deletions involving MINPP1 and PTEN, and 1 CS with a deletion involving part of PTEN. In addition, at least 2 CS probands without PTEN or MINPP1 alterations have been found to have germline BMPR1A mutations (this gene lies just upstream of MINPP). While we have not found somatic intragenic MINPP1 mutations in 50 sporadic breast cancers, we have found somatic deletions encompassing PTEN and MINPP1. More interestingly these deletions involve the neoplastic epithelium and/or the surrounding stroma.

DTIC

Genetics; Mammary Glands; Cancer

20030019347 Suleyman Demirel Univ., Dept. of Electronics and Communication Engineering, Isparta, Turkey

An Evaluation for Coupling of Human to Magnetic Fields in Human Ellipsoidal Models With Frequency up to 100kHz
Ozen, Sukru; Comlekci, Selcuk; Cerezci, Osman; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409750; X5-X5; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Recently, so many studies were carried out about interaction between magnetic field on the band of 0-100kHz and human biology. Many of them are addressed to the cancer risk of children. In this paper, certain band fields to the ellipsoid human models were investigated. As ellipsoid human models, average man, average woman, average endomorphic (fat) man, 10-year-old-child, 5-year-old-child, and 1-year-old-child models were selected. Investigations were made for different situations and orientations. Field strengths induced by the external 10 mG (1micronT) field were estimated for different variations. In the situation of external field was in front of the body, the maximum value was found. When the external field was positioned parallel to major axis, the minimum value was obtained. For example, for 10-year-old child model, at 10 kHz, when the magnetic field was parallel to length axis induced electrical field, ($E_{sub\ rms}$) was 1.923 mV/m. When the magnetic field was parallel to the intermediate axis of body, its value was 2.176 mV/m and it was parallel to the minor axis of body, obtained value was 3.93 mV/m.

DTIC

Electromagnetic Fields; Magnetic Fields; Exposure

20030019349 Liaoning Univ., Science and Research Section, China

Further Study of Spectrum from Stomach Cancer Serum Emission

Xiaozhou, Li; Huiqiang, Jin; Ming, Lei; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409705; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

By using laser-induced Raman spectrum technology, we researched the spectrum characteristic of normal human, atrophic gastritis and stomach cancer. Three sharp peaks (A, B and C) can intensity of peak C excited by 488.0nm is higher than excited by 514.5nm in spectrum of stomach cancer whereas lower in other cases. We utilized it as a criterion and got an accuracy of 80.77% in stomach cancer detection. Results showed that it is available of detection of stomach cancer and pre-stomach cancer.

DTIC

Raman Spectra; Serums; Blood

20030019351 Osaka Univ., Graduate School of Engineering, Japan

Upper Limb-Hand 3D Display System for Biomimetic Myoelectric Hand Simulator

Jimenez, Gonzalo G.; Ryuhei, Okuno; Akazawa, Kenzo; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T

Report No.(s): AD-A409701; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A graphics system displaying both upper limb posture and opening-closing of a prosthetic hand was developed for realtime operation of our biomimetic myoelectric hand simulator, Posture of the upper limb was determined by 3D position of shoulder, elbow and wrist, which were detected with Optotrack. Finger angle of the hand was given by the simulator, which receive the surface myoelectric signal (EMGs) of both flexor and extensor muscles of the forearm, A non-amputee subject could control smoothly the finger angle by using this display system

DTIC

Simulators; Display Devices; Hand (Anatomy); Prosthetic Devices

20030019352 Democritus Univ. of Thrace, School of Engineering, Komotini, Greece

Improved MRI Reconstruction From Reduced Scans K-Space by Integrating Neural Priors in the Bayesian Restoration

Reczko, M.; Karras, D. A.; Mertzios, B. G.; Graveron-Demilly, D.; vanOrmondt, D.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409541; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this paper is to present the development of a new reconstruction methodology for restoring Magnetic Resonance Images (MRI) from reduced scans in k-space. The proposed approach considers the combined use of Neural Network models and Bayesian restoration, in the problem of MRI image extraction from sparsely sampled k-space, following several different

sampling schemes, including spiral and radial, Effective solutions to this problem are indispensable especially when dealing with MRI of dynamic phenomena since then, rapid sampling in k-space is required, The goal in such a case is to make measurement time smaller by reducing scanning trajectories as much as possible, In this way, however, underdetermined equations are introduced and poor image reconstruction follows, It is suggested here that significant improvements could be achieved, concerning quality of the extracted image, by judiciously applying Neural Network and Bayesian estimation methods to the k-space data, More specifically, it is demonstrated that Neural Network techniques could construct efficient priors and introduce them in the procedure of Bayesian reconstruction, These ANN Priors are independent of specific image properties and probability distributions, They are based on training supervised Multilayer Perceptron (MLP) neural filters to estimate the missing samples of complex k-space and thus, to improve k-space information capacity, Such a neural filter based prior is integrated to the maximum likelihood procedure involved in the Bayesian reconstruction, It is found that the proposed methodology leads to enhanced image extraction results favorably compared to the ones obtained by the traditional Bayesian MRI reconstruction approach as well as by the pure MLP based reconstruction approach.

DTIC

Neural Nets; Bayes Theorem; Magnetic Resonance; Imagery; Image Reconstruction

20030019360 Virginia Univ., Charlottesville, VA USA

Aromatase Overexpression and Breast Cancer Development Annual Report, 1 Aug. 2001-31 Jul. 2002

Yue, Wei; Wang, Jiping; Li, Yuebai; Aug. 2002; 8p; In English

Contract(s)/Grant(s): DAMD17-01-1-0444; DAMD17-01-1-0445

Report No.(s): AD-A410094; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

While the relevance of estrogen to established breast cancer is well documented, the role of estrogen in breast cancer initiation is still unclear. The carcinogenic effect of estrogen is mediated by its genotoxic metabolites. We hypothesized that increases in estradiol concentration in breast tissue will lead to accumulation of genotoxic metabolites and eventually causes breast cancer. to test this hypothesis, we proposed to overexpress aromatase into a benign breast epithelial cell line, MCF-10A and to determine the production of genotoxic metabolites of estrogen and cell transformation. During the first year of funding, we successfully constructed pTRE-arom vector. Using our MCF-7Tet-off cells, we demonstrated that this vector expresses functional aromatase which is tightly controlled by tetracycline. Meanwhile, we attempted to establish MCF-LOATet-off cell line that is required for tetracycline-controlled expression of aromatase. However, MCF-10A seems not suitable for tetracycline-controlled gene expression because it showed very high basal expression of the gene tested (luciferase reporter gene) and tetracycline does not regulate gene expression. Therefore, we used alternative approach to establish a stable line of MCF-10A that expresses high levels of aromatase. We fulfilled the tasks scheduled for the first year of funding. The resultant MCF-10A arom cells are ready for the future studies.

DTIC

Cancer; Estrogens; Gene Expression; Mammary Glands; Epithelium

20030019361 Northern California Inst. for Research and Education, San Francisco, CA USA

A Novel Signaling Perturbation and Ribozyme Gene Therapy Procedures to Block Rho-Kinase (ROK) Activations and Breast Tumor Metastasis Annual Report, 1 Sep. 2001-31 Aug. 2002

Bourguignon, Lily Y.; Sep. 2002; 77p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9291

Report No.(s): AD-A410099; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In breast tumor cells (e.g. Met-i and SP-t cell lines), the Rho-Kinase (ROK) is detected as a 160kDa protein. We have demonstrated that ROK phosphorylates the cytoplasmic domain of CD44 A HYALURONAN (HA) receptor and up-regulates the interaction between CD44 and the cytoskeletal protein, ankyrin during HA/CD44-regulated breast tumor cell migration. Most recently, we have found that CD44 and Rho-Kinase (ROK) are also physically associated as a complex in breast tumor cells. Biochemical analyses show that the C-terminal pleckstrin homology (PH) domain is the primary ROK binding region for CD44. Most importantly, HA binding to cells promotes RhoA-mediated ROK activity which, in turn, increases phosphorylation of three different inositol 1, 4, 5-trisphosphate receptors (IP3Rs) IN PARTICULAR, SUBTYPE I (IP3R1), and to a lesser extent subtype 2 (IP3R2) and subtype 3 (IP3R3) all known as IP3-gated Ca²⁺ channels. The phosphorylated IP3R1 (but not IP3R2 or IP3R3) is enhanced in its binding to IP3 which subsequently stimulates IP3-mediated Ca²⁺ flux and breast tumor cell migration. We have also constructed two dominant-negative ROK cDNA constructs which encode for the Rho-binding (RB) domain and the pleckstrin homology (PH) domain. Our data indicate that transfection of breast tumor cells with ROK's RB or PHcDNA significantly blocks HA and CD44-induced Ca²⁺ signaling and breast tumor cell migration. Taken together, we believe that ROK

plays a pivotal role in CD44-cytoskeleton interaction and IP3R-mediated Ca²⁺ signaling during HA-mediated breast tumor progression.

DTIC

Biochemistry; Cells (Biology); Mammary Glands; Metastasis; Perturbation; Oncogenes; Tumors

20030019363 CWA G.m.b.H., Aachen, Germany

Scalar Fuzzy Logic: A New Mathematic Model for Approximate Reasoning

Mlynski, M. F.; Ameling, W.; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410156; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Atrial and ventricular tachycardia are typically treated with Implantable Cardioverter Defibrillators (ICDs). Current dual-chamber ICDs have over 200 parameters, which have to be set all properly to ensure an accurate ICD programming. Since this is a time-consuming procedure, an expert-system to calculate a complete set of ICD parameters based on the given clinical patient-data was developed, where the expert knowledge was acquired and implemented into a knowledge base in cooperation with cardiologist physicians.

DTIC

Expert Systems; Implantation; Fuzzy Systems

20030019464 Chinese Academy of Geological Sciences, Inst. of Physics and Chemistry, Beijing, China

Freezing Curve Based Monitoring to Quickly Evaluate the Viability of the Biological Materials Subject to Freezing and Rewarming

Liu, Jing; Zhou, Yi-Xin; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409723; X5-X5; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A new technique based on freezing curve monitoring to quickly evaluate the viability of the biological materials subject to freezing or rewarming was established. A practical integrated device was fabricated which is simple in structure and cheap in price. Preliminary freezing experiments on the fresh fish blood demonstrated that minor changes in a biological material due to freezing or warming injury may result in significant deviation in its freezing curve compared with that of the intact biomaterials. Three thermal indexes to quantify the damage degree of the biomaterials were pointed out. This method also opens many opportunities for the evaluation of biological material defect in diverse life science fields.

DTIC

Freezing; Defects; Blood

20030019467 California Univ., Irvine, CA USA

Coil Design for Functional Magnetic Stimulation of the Inspiratory Muscles

Hsiano, Ian N.; Zhu, Ercheng; Lin, Vernon; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409727; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this study was to design a new magnetic coil (MC) for effective functional magnetic stimulation (FMS) of inspiratory muscles in human subjects. Part 1 of the study emphasized on the technical procedure of the coil design, and part 2 demonstrated the efficacy of the resulted coil in producing inspiratory functions. Part 2 is reported in another paper titled "Racetrack magnetic coil for functional magnetic stimulation of the inspiratory muscles -toward magnetic assisted ventilation". The primary goal for the new MC was to maximize nerve activation from T1 to T6 spinal nerve roots, and minimize activation of other nerves and muscles. Through the process of coil design, a racetrack shaped MC was conceptualized and produced.

DTIC

Magnetic Coils; Stimulation; Human Beings

20030019469 National Inst. for Longevity Sciences, Aichi, Japan

Evaluation of a Canopy System and a Simple Calorimeter for Resting Metabolism Using a Respiratory Simulator

Ichinoseki, N.; Yoshimura, T.; Nambu, M.; Tamura, T.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also

ADM001351 for entire conference on cd-rom. T

Report No.(s): AD-A409729; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The evaluation of energy expenditure is of great importance, not only during health promotion, but also during recovery from disease. The measurement of oxygen uptake is the most reliable method for measuring energy expenditure, but, for estimating resting metabolism, there is still a need for sophisticated equipment. We have developed and evaluated a simple calorimeter and compared it with the flow-through (Canopy) system. A respiratory simulator was used to evaluate oxygen uptake at different flow rates. A known concentration of mixed gases flows into the system via the respiratory simulator and the oxygen concentrations and flow rates were compared. The results indicate that large errors in the measurement of oxygen uptake occurred at low flow rates, but these errors were about 5% under estimated values in the simple calorimeter. The measurement error at low flow rates is about 10% in the Canopy system. From these results, we concluded that the simple calorimeter can be used to measure oxygen uptake under resting conditions; however, the Canopy system would be unsuitable for measurement in a subject with small ventilation, such as an elderly patient. Great attention is needed when these oxygen measurement systems are applied to patients with very low flow rates.

DTIC

Oxygen Consumption; Calorimeters

20030019470 Zhejiang Univ., China

The Measurement and Research of Surface Potentials of Human Tooth in vitro

Zhang, J. L.; Zheng, Y. Y.; Su, J. M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409731; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Previous studies have shown that there are surface potentials in the separate tooth sections and a whole tooth in vivo. To confirm the existence of the surface potentials in extracted tooth and research the development of the potentials, the surface potentials between mid-spots of enamel crown's buccal side and tooth root were measured with electrochemical methods. The effects of KCl concentration and acid corrosion were also examined in the present study. All the teeth developed the surface potentials, and when 0.1 mol/L KCl solution was used, the average surface potential was +20.83 +/- 11.47mV. The potentials increased along with the ascending of KCl concentration and after being acid corroded. The results of this study suggested that there are also surface potentials in tooth as a whole tissue in vitro, and the potentials can be affected by the electrolyte surroundings and are developed mostly by the dental crystal structure and established in the outer layer, an electric double layer.

DTIC

Corrosion; Teeth; In Vitro Methods and Tests; Potassium Chlorides; Dentistry

20030019471 Tokyo Medical and Dental Univ., Japan

Computer Simulation of Needle Venepuncture for the Development of Automatic Blood Sampling Systems

Saito, Hirokazu; Togawa, Tatsuo; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409733; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To achieve automatic needle puncturing for automatic blood sampling, we studied peak waveforms of the puncture forces developed during penetration of a blood vessel. Computer simulations of controlled needle puncture were performed using data from experiments on puncturing a rabbit's ear vein. Reproducible results of successive puncturing suggested that this simulation could be applied to the control of needles used for automatic blood sampling.

DTIC

Sampling; Blood

20030019472 Wroclaw Univ., Poland

Generating Classifier for the Acute Abdominal Pain Diagnosis Problem

Wozniak, Michal; Kurzynski, Marek; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409735; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The inductive learning algorithms are the very attractive methods generating hierarchical classifiers, They generate the hypothesis of the target concept on the base of the set of labeled examples. This paper presents some of the rule generation methods, their usefulness for the rule-base classifier and their quality of classification for the medical decision problem.

DTIC

Pain; Decision Support Systems; Algorithms; Classifications

20030019473 Ecole Polytechnique, Montreal, Quebec Canada

New Stimulation Strategy to Improve the Bladder Function in Paraplegics: Chronic Experiments in Dogs

Schneider, E.; Abdel-Karim, A. M.; Sawan, M.; Elhilali, M. M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409736; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

New neural electrical stimulation strategy, intended to recover the bladder functions, is proposed. Restoring urinary functions allows voluntary bladder voiding, and reduces or even suppresses hyperreflexia. The preliminary stimulation system is composed of subcutaneous implantable stimulators (an implant) and an external device. The implant includes the selective stimulation for bladder voiding, in addition to a new permanent stimulation technique to reduce (or cancel) the bladder hyperreflexia and so cures other related diseases. Permanent stimulation is a low frequency, low amplitude and all day long stimulation that needs to be batten powered. On the other hand, selective stimulation is a bi-frequency, punctual, precise and at a higher amplitude stimulation that is well controlled and powered from the outside. Eight prototypes of the stimulator have been used in an experimental evaluation in dogs to characterize the reliability and functionality of the new implant in a real application environment. Preliminary results of the study show that the proposed stimulation system and the stimulation strategy provide significant improvement for bladder hyperreflexia curing while it confirmed the efficiency of the selective stimulation by means of high frequency blockage.

DTIC

Urology; Stimulation

20030019474 Ecole Nationale Supérieure des Telecommunications, Image Info Processing Dept., Brest, France

Dynamical Segmentation of the Left Ventricle in Echocardiographic Image Sequences

Bosnjak, A.; Burdin, V.; Torrealbu, V.; Montilla, G.; Solaiman, B.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409737; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents a new methodology for the analysis of echocardiographic image sequences. The echocardiographic medical exam is a frequent practice in the cardiology clinic, and generally there is bi-dimensional echocardiographic equipment. We have developed a new processing chain that will allow a medical diagnosis issued from a 3D reconstruction of the ultrasonic images. The project is divided into several 3D modules: Acquisition, Filtering, Segmentation, Reconstruction, and visualization. Inside of the processing chain, the segmentation module of ultrasonic images has always been a problem. In this paper, we propose two different methods for the 3D segmentation. A model of 3D Snakes and a front propagation model that allow an accurate segmentation and reconstruction of the internal wall of the ventricle. From these segmentation methods, some important medical parameters are computed : ejection fraction, cardiac index, ventricle volume, etc.

DTIC

Echocardiography; Cardiac Ventricles; Cardiology; Segments

20030019475 Aalborg Univ., Center for Sensory-motor Interaction, Aalborg, Denmark

Wavelet Packet Analysis for Angular Data Extraction from Muscle Afferent Cuff Electrode Signals

Sepulveda, F.; Buskgaard, A.; Fjorback, M. V.; Huber, J. B.; Jensen, K.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409738; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Rehabilitation devices can greatly benefit from the use of natural sensors. Thus, we have extended on our efforts to extract angular information from muscle afferent nerves by means of cuff electrodes. In this study we applied wavelet analysis to electroneurographic (ENC) data from rabbits. In order to estimate ankle flexion/extension angles, we recorded ENC signals from the left Tibial and Peroneal nerves, both during FES and under passive motion. Several processing methods were used for extraction of angular data and were compared with the wavelet analysis. An artificial neural network (ANN) was used with the analyzed features to improve on the accuracy of the angular predictions. The network has so far been tested for local generalization

only. The ANN was found to work better with the wavelet features than with previously explored rectified and bin integrated (RBN) signals. Best results were obtained by using ANN inputs that consisted of both the output from a single wavelet packet node and the RBN signal: the mean angle prediction error was 1.2 degrees. Exciting as this result is, we must keep in mind that due to the local generalization scope of this study, angle predictions have yet to be assessed regarding inter-rabbit variability.

DTIC

Neural Nets; Information Retrieval; Predictions

20030019477 Politecnico di Turin, Dipt. di Elettronica, Turin Italy

An Experimental and Model Based Investigation of the Potential and Limitations of Surface EMG Spectral Analysis for Assessment of Motor Unit Recruitment Strategy

Farina, D.; Merletti, R.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409741; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Characteristic frequencies of surface EMG power spectrum have been used in the past as indicative of motor unit (MU) recruitment, since they are rather insensitive to changes of MU firing rates and thus they should remain constant when only rate coding is used to modulate muscle force. However, this speculation has not been yet validated by simulated and experimental data. In this paper, a model of surface EMG signal generation and detection is used to simulate EMG signals detected during linearly increasing force contractions. Different MU control strategies (corresponding to different ways for force generation by recruitment mid rate coding) are simulated. A number of simulations are performed to study the effect of random distribution of MUs in the muscles cross-section upon the surface EMG. The results are compared with those obtained analyzing the EMG signals detected experimentally during linearly increasing force contractions of the biceps brachii muscle in 10 subjects. Results show that the volume conductor properties may act as confounding factors which may mask any relationship between characteristic spectral frequencies mid conduction velocity as a size principle parameter. It is concluded that more advanced signal processing techniques which aim at the analysis of single MU activity are required for the surface EMG based assessment of central nervous system control strategy.

DTIC

Spectrum Analysis; Electromyography; Maximum Usable Frequency; Signal Detection; Statistical Distributions

20030019478 Case Western Reserve Univ., Detroit, MI USA

Influence of Bone Remodeling Inhibition on the Development of Experimental Stress Fractures *Annual Report, 1 Sep. 2001-31 Aug. 2002*

Boyd, Robert D.; Schaffler, Mitchell B.; Sep. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-98-1-8515

Report No.(s): AD-A409742; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Stress fractures result from repetitive loading and have been regarded as a mechanical fatigue-driven process. However, a number of studies indicate that increased remodeling precedes the occurrence of bone microdamage and stress fractures, suggesting a central role for bone remodeling in the pathogenesis of stress fractures. Our ongoing experiments test the hypothesis by pharmacological inhibition of bone remodeling will slow the subsequent accumulation of microdamage, diminishing the severity of the stress fracture. We are using a bisphosphonate (BIS) in the rabbit tibial stress fracture model, to test the hypothesis that reactive remodeling within the cortex drives the development of stress fractures. Results to date indicate that BIS antiresorptive therapy reduces the intensity of the stress fracture response, as indicated by (99m) Technetium bone scans, with the uptake of (99m)Technetium reduced by approximately 50 percent in treated animals as compared to saline-treated controls. However, BIS treatment attenuated, but did not completely prevent the stress fracture response. These data are consistent with the hypothesis that bone remodeling contributes to the pathogenesis of stress fracture. The implication of this suppression on the later accumulation of bone microcracks and the evolution of final stress fracture are unknown are currently under investigation.

DTIC

Bones; Fractures (Materials); Stress Analysis

20030019479 Aalborg Univ., Center for Sensory-motor Interaction, Aalborg, Denmark

A Spike Triggered Averaging Technique for High Resolution Assessment of Single Motor Unit Conduction Velocity Changes During Fatiguing Voluntary Contractions

Farina, D.; Arendt-Nielsen, L.; Merletti, R.; Graven-Nielsen, T.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey.

See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409743; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper we propose an improved spike triggered averaging technique for the assessment of control properties and conduction velocity (CV) of single motor units (MUs) during voluntary sub-maximal muscle contractions. The method is based on the detection of multi-channel surface EMG signals (with linear electrode arrays) and intramuscular recorded single MU action potentials (MUAPs). Intramuscular electrodes are inserted taking into account the MU structural properties (innervation zone and tendon locations, length of the fibers), assessed by the linear array surface EMG detection. A technique for intramuscular EMG signal decomposition is used to identify single MUAP trains. The MUAPs obtained from the intramuscular EMG decomposition algorithm are used to trigger and average the multi-channel EMG signals. CV of single averaged surface MUAPs is estimated by the use of advanced signal processing methods based on multi-channel recordings which allow to consistently reduce the variance of CV estimates with respect to traditional two channel delay estimators. The number of averaged potentials can thus be reduced, improving temporal resolution. The technique proposed is tested with recordings from the tibialis anterior muscle of 11 volunteers. It is shown that the method allows the assessment of CV changes (fatigue) of single MUs as small as 0.1 m/s with a limited number of averages (temporal resolution of 1-2 seconds), leading to a consistent improvement with respect to traditional surface EMG spike triggered averaging techniques. The method has potential usefulness in a number of basic and applied research fields.

DTIC

Electromyography; Actuators; Contraction; Linear Arrays

20030019480 Johns Hopkins Univ., Baltimore, MD USA

Phased Array Coils for High Resolution Prostate MR Imaging

Yung, Andrew C.; Oner, A. Y.; Serfaty, Jean-Michel; Feleney, Mark; Yang, Xioaming; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409744; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

MR imaging of the prostate can be greatly improved by using a phased array that combines the signals from individual receiver coils to form a composite image. Endourethral coils and a dual-coil endorectal probe were constructed and combined with a surface coil in a phased array system. Various phased array configurations were tested with *in vivo* canine experiments, which resulted in high-resolution images that clearly showed the anatomy of the prostate and surrounding structures such as the neurovascular bundles. The endourethral coils were useful in imaging the anterior portion of the prostate, while the endorectal coils provided high SNR in the posterior region of the prostate.

DTIC

Phased Arrays; Imaging Techniques; Photomapping

20030019481 Pennsylvania Univ., Medical Image Processing Group, Philadelphia, PA USA

Development of a Computer Decision Support System for Women with BRCA1 or BRCA2 Mutations *Annual Report, 15 Jul. 2001-14 Jul 2002*

Armstrong, Katrina; Aug. 2002; 67p; In English

Contract(s)/Grant(s): DAMD17-98-1-8234

Report No.(s): AD-A409745; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

"Development of a Computer Decision System for Women with BRCA1 or BRCA2 Mutations is a project uses a decision support system to provide individualized information about the expected benefits of alternative cancer risk reduction strategies for women with either a BRCA1 or BRCA2 mutation. The educational booklet and decision support system that were previously developed, are presently being used in the randomized control trial (RCT). Currently, eligible women are being identified through out the Philadelphia and surround areas for enrollment in the RCT. This year we focused our attention on developing strategies to locate eligible women in order to increase enrollment in the RCT. Strategies include: contacting women who have been tested prior to the start of the RCT, placing advertisements in local newspapers to target high-risk women, and collaborating with various organizations. These strategies have resulted in a major increase in enrollment this year. Through these recruitment strategies, we are confident that we will reach our goal RCT enrollment by next year.

DTIC

Cancer; Decision Support Systems; Mutations; Genes

20030019482 Rehabilitation Inst. of Chicago, Chicago, IL USA

Reflex Responses to Ligament Loading: Implications for Knee Joint Stability

Dhaher, Y. Y.; Tsoumanis, A. D.; Rymer, W. Z.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409746; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To assess the neuromuscular reflex responses to loading of knee ligaments, we applied an abducting positional deflection to the fully extended knee using a servomotor, and recorded EMG activity in preactivated quadriceps and hamstrings muscles with surface electrodes. To establish that the reflex response elicited by the perturbation was not simply a form of muscle stretch response, a tendon tap was applied to the muscles at the same setting and the reflex responses recorded from the same subject. Contrary to the typical muscle stretch reflex, which is of short duration and has a short latency (28-35 msec for knee muscles), the abduction response was characterized by long latency responses with an initial EMG peak followed by sustained muscle activity throughout the duration of the step perturbation. The latency of the abduction response was at least twice the latency of the tap reflex suggesting a different (possibly ligamentous) origin (60-85 msec for knee muscles). This reflex was consistent throughout the set of trials performed at the same speed and amplitude of perturbation. Our investigation showed that the sustained activity of the abduction reflex is dependent on the amplitude of the perturbing stimulus. Furthermore, the knee muscle contractions elicited were sometimes selective, depending on the magnitude of the angular perturbation.

DTIC

Ligaments; Reflexes; Knee (Anatomy); Activity (Biology); Tendons

20030019484 Medical Coll. of Wisconsin, Milwaukee, WI USA

Upper Extremity Motion Assessment in Adult Ischemic Stroke Patients: A 3-D Kinematic Model

Bogart, J. Van; McGuire, J.; Harris, G. F.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409748; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

As part of a larger evaluative study of the effects of botulinum toxin type A (BTA) in ischemic stroke patients, a kinematic model of the trunk and upper extremities (UE) has been developed. The 3-D model provides a comprehensive method of assessing UE motion during performance tasks including exercises in reaching, grasping, and releasing. The 17-marker system tracks UE motion at a rate of 120 SPS with 7 infrared CCD cameras. The biomechanical model developed for the system allows expression of torso, shoulder, elbow, and wrist motion in terms of Euler expressions. Concurrent EMG data is used to confirm periods of co-contraction and spasticity during planned movement. Preliminary trials with the system indicate sufficient fidelity for continued clinical trials.

DTIC

Kinematics; Motion; Biodynamics

20030019485 Vanderbilt Univ., Medical Center, Nashville, TN USA

Development of a Tunable, Monochromatic X-ray Device with the Addition of a Beamline for Protein Crystallography at the Vanderbilt MFEL Facility Final Report, 1 Jul. 1999-14 Nov. 2002

Carroll, Frank; Dec. 20, 2002; 9p; In English; Original contains color images

Contract(s)/Grant(s): N00014-99-1-0904

Report No.(s): AD-A409749; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A new, compact, "tabletop" laser synchrotron X-ray device has been developed. It produces pulsed, tunable, monochromatic X-rays in 8-10 ps bursts. These X-rays emanate from the unit in a conebeam geometry from an effective focal spot of 50 microns. The X-rays produced are tunable from 12-50 keV with each "shot" delivering 10^{10} photons. The unit utilizes a linear accelerator running in the single pulse mode and a tabletop terawatt laser integrated in such a way, that the X-rays are produced using the phenomenon of inverse Compton scattering. This device is used in a shirtsleeves environment, without the need for a shielded vault. The electron beam and laser beam are counterpropagated in a head-on collision yielding the tunable X-ray photons. The prototype unit has been designed, built and commissioned at the W.M. Keck Free Electron Laser Facility at Vanderbilt University, where it is now used for imaging animals, phantoms, and tissue specimens. A 1.5-meter long protein crystallography beam line has been designed and built for elucidation of 3-dimensional structures of protein crystals. This beam line is to be mated to an even smaller second-generation machine in a proteomics laboratory at the same MFEL facility.

DTIC

X Rays; Free Electron Lasers; Crystallography

20030019486 Chinese Academy of Geological Sciences, Inst. of Physics and Chemistry, Beijing, China

Temperature Sensor Array System for Thermal Diagnostics on Human Disease

Liu, Jing; Zhou, Yi X.; Deng, Zhong S.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409752; X5-X5; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A technique using a plane temperature sensor array to dynamically image the transient temperature response of the human skin subject to intentionally applied heating or cooling was proposed. A human disease diagnostic system with satisfactory accuracy and rapid response speed was constructed. Preliminary experiments show the potential clinical application of this device, which is simple to fabricate and thus cheap in price. Further theoretical analysis shows that the surface heat flux may serve as a better thermal index for disease diagnostics than the commonly used surface temperature, due to that it included all the thermal contributions from any abnormal tissues underneath the skin. An approach was proposed to measure the skin surface heat flux using the currently constructed temperature sensor array system.

DTIC

Heat Transfer; Body Temperature; Thermodynamic Properties; Diagnosis

20030019491 Pennsylvania Univ., Medical Image Processing Group, Philadelphia, PA USA

Assisting Survivors in Meeting Challenges at End of Treatment: A Problem-Solving Approach Annual Report, 15 Jul. 2001-15 Jul 2002

Palmer, Steven C.; Aug. 2002; 5p; In English

Contract(s)/Grant(s): DAMD17-01-1-0599

Report No.(s): AD-A409801; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Cancer survivorship begins at diagnosis and continues beyond treatment. Although attention has been paid to psychosocial issues at diagnosis and active treatment, less has been to the end of active treatment when survivors face rising role expectations, fears of relapse, and the need to confront appearance and relationship change. This project focuses on increasing coping skills among breast cancer survivors at the end of active treatment. We will implement a skills-focused, problem-solving intervention (PSI), and evaluate effects relative to routine care. The PSI is brief, non-stigmatizing, and disseminated a single, four-hour group intervention. It focuses on building skills for problem definition, alternative generation, decision making, and solution implementation and evaluation. It also incorporates telephone follow-up at two- and four-weeks after the intervention to allow patients to discuss difficulties and receive additional instruction. This enhances the initial contact without increasing burden, allowing continued intervention with a geographically dispersed population.

DTIC

Cancer; Mammary Glands; Patients

20030019495 Tokyo Inst. of Tech., Tokyo Japan

Cellular Sensing Devices for Assessing Chemicals

Aizawa, M.; Kamei, K.; Haruyama, T.; Kobatake, E.; Oct. 25, 2001; 3p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409961; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Several types of cellular biosensors have been developed for assessing chemicals in which the cell responses to chemicals are transduced to the sensor outputs in various manners. The cell layer is fixed in the vicinity of the signal transducer. As an example assessment of immunomodulating chemicals has been performed with a cellular biosensor based on electrochemical determination of the inducible nitrogen oxide synthase (iNOS) expression in a macrophage-like cell.

DTIC

Chemicals; Bioassay; Cells (Biology); Macrophages; Bioinstrumentation

20030019496 Georgia Inst. of Tech., Atlanta, GA USA

Application of an Adaptive Control Grid Interpolation Technique to Morphological Vascular Reconstruction: A Component of a Comprehensive Surgical Planning and Evaluation Tool

Frakes, David H.; Conrad, Christopher P.; Healy, Timothy M.; Monaco, Joseph W.; Smith, Mark J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409948; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The total cavopulmonary connection (TCPC) is a palliative surgical repair performed on children with a single ventricle (SV) physiology. Much of the power produced by the resultant single ventricle pump is consumed in the systemic circulation. Consequently the minimization of power loss in the TCPC is imperative for optimal surgical outcome. As a component of a comprehensive surgical planning and evaluation tool we have developed a method of vascular morphology reconstruction based on adaptive control grid interpolation to function as a precursor to computational fluid dynamics (CFD) analysis aimed at quantifying power loss. Our technique combines positive aspects of optical flow-based and block-based motion estimation algorithms to accurately reconstruct vascular geometries with a minimal degree of computational complexity. Subsequent CFD simulations offer the pressure and velocity information necessary, to quantify power loss in the TCPC on a pre and post-operative basis. Collectively these steps form a powerful tool for both surgical planning and evaluation aimed at producing optimal TCPC configurations for successful surgical outcomes. Both reconstruction and CFD components of the technique will be discussed.

DTIC

Cardiovascular System; Computational Fluid Dynamics; Morphology; Computerized Simulation; Adaptive Control; Interpolation

20030019687 Burnham Inst., La Jolla, CA USA

Antibody Microchips to Study Metastasis Annual Report

Zhang, Yan; Jul. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-01-1-0173

Report No.(s): AD-A409806; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The hypothesis of my project is the behavior of an invasive tumor cell is largely determined by a collection of proteins on the surface of metastasis cell. I proposed to employ phage display single-chain variable fragment antibody library, mass spectrometry and antibody chip methodologies to study the molecular mechanisms of metastasis in breast carcinoma MDA-MB-435 cell line. During the first year of this grant, I have constructed a phage display scFv antibody library to the plasma membrane proteins of this cell line. I panned the library on intact cells to enrich population of phage-scFvs that are composed of antibodies to cell surface proteins of MDA-MB-435 cell, 5.6-fold, 14-fold and 20-fold enrichment was obtained as compared with background binding when three rounds subsequent pannings were performed. The specificity of 705 individual phage clones was tested by an ELISA (Enzyme Linked ImmunoSorbent Assay) assay. Forty-six of seven hundred and five phage clones showed 2.5-fold greater specificity to MDA-MB-435 cells as compared with normal mammary epithelial cells. Ten of these clones bind to MDA-MB-435 tumor cells in flow cytometry assays. These clones are being sub-cloned in preparation for expression as soluble scFv antibodies. The recombinant scFvs will be used to identify the target antigens.

DTIC

Antibodies; Metastasis; Tumors; Mammary Glands; Chips (Electronics)

20030019688 Baylor Coll. of Medicine, Houston, TX USA

Linking Sister Chromatid Cohesion to Apoptosis and Aneuploidy in the Development of Breast Cancer Annual Report

Pati, Debananda; Jul. 2002; 37p; In English

Contract(s)/Grant(s): DAMD17-01-1-0142

Report No.(s): AD-A409807; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of the study is to identify the effector molecules that act as a link between cell proliferation, cell survival and chromosomes stability. We have hypothesized that chromosomal segregation and apoptotic pathways are linked and have a role in the development of aneuploidy in breast tumors. Rad21 is one of the major cohesin subunits that holds sister chromatids together until anaphase, when proteolytic cleavage by separase, allows chromosomal separation. We show that cleavage of human Rad21 (hRad21) also occurs during apoptosis. Induction of apoptosis in multiple human cell lines results in the early generation of 64 kDa and 60 kDa carboxy terminal hRad21 cleavage products. We biochemically mapped a apoptotic cleavage site at residue Asp (D)279 of hRad2 1. This apoptotic cleavage site is distinct from mitotic cleavage sites previously described. hRad2 1 is a nuclear protein, however, the cleaved 64 kDa carboxy-terminal product is translocated to the cytoplasm early in apoptosis before chromatin condensation and nuclear fragmentation. Overexpression of the 64 kDa cleavage product results in apoptosis in MCF-7 breast cancer cells. Given the role of hRad2 1 in chromosome cohesion, the cleaved C-terminal product and its translocation to the cytoplasm may act as a nuclear signal for apoptosis. Deregulation of Rad21 cleavage may play a role in breast cancer pathogenesis.

DTIC

Cancer; Apoptosis; Mammary Glands

20030019689 Medical Univ. of South Carolina, Charleston, SC USA

The Role of the Insulin-Like Growth Factor (IGF) Binding Proteins (IGFBPs) in IGF-Mediated Tumorigenicity *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Harbeson, Caroline E.; Rosenzweig, Steven A.; Jul. 2002; 18p; In English

Contract(s)/Grant(s): DAMD17-01-1-0392

Report No.(s): AD-A409808; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The insulin-like growth factor (IGF) system has been shown to play an important role in the progression of a number of cancers, including breast cancer. IGF-1 binds with high affinity to a family of proteins known as the IGF binding proteins (IGFBPs), which act as natural inhibitors of IGF-1 through sequestration from the IGF-1 receptor. The purpose of this proposal is the development of IGF antagonists based on the structure of the IGFBPs. Knowledge of the mechanism of IGFBP action is currently unclear, therefore we have taken a photoaffinity labeling approach to identify the IGF binding domains on the IGFBPs.

DTIC

Cancer; Mammary Glands

20030019690 Georgetown Univ., Washington, DC USA

Breast Cancer Metastasis and the Balance of the Serine Protease Matriptase and Its Inhibition KSPI-1 *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Johnson, Michael D.; Jul. 2002; 14p; In English

Contract(s)/Grant(s): DADM17-00-1-0264

Report No.(s): AD-A409809; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study set out to evaluate the biological consequences of a shift in the ratio of the serine protease matriptase relative to its cognate inhibitor HAI-1. The goal of this work is to generate data that we believe will assist in evaluating whether the matriptase HAI-1 system plays a role in breast cancer invasion and metastasis. In order to alter protease / inhibitor ratios we proposed to use a tetracycline regulable expression system to either increase matriptase levels by overexpression or reduce HAI-1 levels by expression of a ribozyme targeted to the HAI-1 mRNA. We have shown that at least in MCF-7 cells, increased expression of Matriptase does not have any impact on any of the properties of the cells that we have examined. This leads us to conclude that these cells either make enough Matriptase already, and additional enzyme is irrelevant, that sufficient HAI-1 is made by the cells to inhibit the activity of the extra Matriptase, or that Matriptase is irrelevant to these processes in these cells. Ongoing studies should allow us to distinguish between these possibilities.

DTIC

Metastasis; Cancer; Mammary Glands

20030019691 Dartmouth Coll., Hanover, NH USA

Role of BRCA1 in Estrogen Receptor Expression in Breast Cancer *Annual Report*

Doherty, Kirsten A.; Jan. 2003; 21p; In English

Contract(s)/Grant(s): DAMD17-99-1-9166

Report No.(s): AD-A409810; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall goal of the research supported by this award was to investigate the correlation between BRCA1-mutated breast cancers and the Estrogen Receptor (ER)-negative phenotype. Although most sporadic breast cancers are ER-positive, studies have consistently shown that the vast majority of BRCA1-linked breast cancers are ER-negative (1-3). In sporadic cancers lacking ER expression, decreased expression of ER mRNA has been noted, without genomic DNA mutations in the ER gene (4-8). Two possible mechanisms by which breast cancers arising in the absence of functional BRCA1 are more likely than not to be ER-negative have been investigated. The first (Task I) was to evaluate the degree of DNA methylation in the region of the ER promoter in BRCA1-linked breast cancers. Methylation of CpGs within the ER promoter has been implicated as an operative mechanism of repressed expression in some cell lines and tumor specimens. The second approach (Task II) was to utilize ER promoter constructs in transient transfection experiments to determine whether expression of BRCA1 affected transcriptional activity at this promoter.

DTIC

Estrogens; Cancer; Mammary Glands

20030019695 Universidad Politecnica de Valencia, Lab. Integrado de Bioingenieria, Valencia, Spain

Effect of Calcium-Activated Chloride Current Blockade on the Delayed Afterdepolarizations. *Simulation Study*

Gomis-Tena, J.; Saiz, J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire

conference on CD-ROM

Report No.(s): AD-A409881; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

High intracellular calcium conditions cause a calcium-activated transient inward current (I_{Ti}) that can provoke oscillations in membrane potential called delayed afterdepolarizations (DAD). The current I_{Ti} comprises of the sodium-calcium exchange current (I_{NaCa}) and the calcium activated chloride current (I_{ClCa}) Lindblad, Murphey, Clark and Ciles developed a mathematical model (LMCC model) of the rabbit atrial AP, In this study, a modified AP LMCC model that includes I_{ClCa} is used to evaluate the contribution of I_{ClCa} to develop DADs, Our results suggest that although I_{NaCa} is the main component of I_{Ti} (65%), I_{ClCa} may play a significant role in DAD generation, Even more, the I_{ClCa} blockade could inhibit the DAD propagation and trigger activity associated to high Ca^{2+} condition, in atrial tissue,

DTIC

Calcium; Chlorides; Cells (Biology); Calcium Chlorides; Actuators

20030019697 Neuro Pace, Inc., Los Angeles, CA USA

Line Length: An Efficient Feature for Seizure Onset Detection

Esteller, R.; Echaz, J.; Tchong, T.; Litt, B.; Pless, B.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference CD-ROM

Report No.(s): AD-A409883; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A signal feature with low computational burden is presented as an efficient tool for seizure onset detection. The feature was evaluated over a total of 1, 215 hours of intracranial EEG signal from 10 patients. Results confirmed this feature as being useful for seizure onset detection yielding an average delay of 4.1 seconds, 0.051 false positives per hour, and one false negative on a subclinical seizure out of 111 seizures analyzed of which 23 were subclinical.

DTIC

Detection; Epilepsy; Electroencephalography

20030019698 Zhejiang Univ., Dept. of Physiology, China

A Model of Gap Junction Conductance and Ventricular Tachyarrhythmia

Wu, X. D.; Shen, Y. L.; Bao, J. L.; Cao, C. M.; Xu, W. H.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409884; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Cardiac gap junctions (CJs) form low resistance pathways along which the electrical impulse flows rapidly and repeatedly between all the cells of the myocardium, enabling coordinated contraction of the heart, In many heart diseases, electrical coupling through GJ channels between cardiomyocytes is down regulated, We set up a mathematical model of a chain of myocardial fibers to study how changing the coupling affects the activity of autorhythmic myocytes, While uncoupling blocked the propagation of excitation from autorhythmic Myocytes to surrounding quiescent but excitable cells, different degrees of uncoupling increased the automaticity of the cells, Our modeling data suggests that the number of autorhythmic cells plays a key role in the excitation of autorhythmic cells and the conduction of impulses, We conclude that the degree of uncoupling between cardiomyocytes, induced by pathological processes, may generate ectopic foci, tachyarrhythmias being the outcome,

DTIC

Semiconductor Junctions; Myocardium; Arrhythmia; Mathematical Models; Coupling

20030019699 Centro de Investigacion y de Estudios Avanzados, Dept. Electrica Computacion, Mexico City, Mexico

Design and Construction of an Intestinal Noises Acquisition System

Chong, J. E.; Leija, L.; Guillemain, F.; Louis, V.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference CD-ROM

Report No.(s): AD-A409885; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This work shows the development of a tool useful in the characterization of intestinal noises (INN), this with the aim to identify certain pathologies of the digestive system in the nearby future. The proposed system has 8 audio transducers (7 for reception from INN and 1 for environmental noises (ENN)). Signals are detected through a circuit that conditions them and then they are digitalized, filtered (eliminating ENN), compacted and finally stored for its further analysis.

DTIC

Data Acquisition; Intestines; Digestive System; Effective Perceived Noise Levels

20030019700 LifeSpex, Inc., Bothell, WA USA

Preliminary Experimental Results from Multi-Center Clinical Trials for Detection of Cervical Precancerous Lesions Using the Cerviscan(TM) System: A Novel Full-Field Evoked Tissue Fluorescence Based Imaging Instrument

Dattamajumdar, A. K.; Wells, D.; Parnell, J.; Lewis, J. T.; Ganguly, D.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference CD-ROM

Report No.(s): AD-A409887; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Cervical cancer is an important cause of death in women worldwide. Women are currently screened for cervical cancer using Pap smear-an imperfect technology with poor sensitivity and specificity. Furthermore, 5-10% of the Pap smear studies result in uncertain findings called ASCUS, These patients are subjected to repeat Pap smears to determine women who need further examination by colposcopy. LifeSpex, Inc., is developing the Cerviscan(TM) system-a novel, full-field multi-spectral tissue fluorescence imaging system that is designed to detect cervical precancerous lesions (i.e. SIL) in real-time, We report preliminary results from a multi-center trial for evaluating the performance of Cerviscan(TM) system. A study population of 67 subjects, in three clinical sites in the US and Canada, each underwent three procedures: (a) repeat liquid-based Pap smear, (b) Cerviscan exam, and (c) colposcopy directed biopsy exam (gold standard). Fifty-two patients for whom data from all three exams were available (i.e. 78% of the patients enrolled) are included in this preliminary analysis. A multivariate classification algorithm has been trained using data from 228 regions (82 SIL, 146 NonSIL) in 42 women. Results are reported on an independent test set of 70 regions (25 SIL, 45 NonSIL) in 10 women. The Cerviscan(TM) system correctly identified 21/25 SIL and 42/45 NonSIL regions, giving a sensitivity of 84% and specificity of 93.3%. The Cerviscan(TM) system correctly resolved 5/7 'ASCUS+LoSIL' calls made by repeat liquid-based cytology. The Cerviscan(TM) system detects precancerous lesions with higher accuracy than repeat liquid-based Pap smear and locates lesion in real-time.

DTIC

Screening; Data Acquisition; Experimentation; Cancer; Cytology; Females; Reproductive Systems

20030019701 Rehabilitation Inst. of Chicago, Chicago, IL USA

Sites of Failure in Muscle Fatigue

Zhang, Li-Qun; Rymer, William Z.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference CD-ROM

Report No.(s): AD-A409888; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The sites of failure in muscle fatigue were investigated by applying controlled tapping to a muscle tendon before and after fatigue of the muscle. The resulting reflex responses were evaluated to assess muscle activation (using the EMG signal for activation failure) and joint torque (for contractile failure). An instrumented hammer was used to tap the triceps muscle tendon and record the tapping force, while the triceps EMG signal and reflex joint torque were recorded to provide measures of the reflex responses. Elbow extensor muscle fatigue was induced through repeated voluntary isometric contraction. The subject generated elbow extension torque in a 6 sec on and 4 sec off pattern for 15 minutes. A rest period of ten minutes was used to let the acute fatiguing effects diminish. Identical tendon tapping tests were done before and after fatigue. Tendon reflex gain (calculated from the tapping force input to the reflex torque output) and tapping-induced EMG gain (calculated from the tapping force input to the reflex-mediated EMG output) were used to characterize tendon reflexes. Following fatigue, we recorded substantial reductions in maximal voluntary elbow extension torque, which was more severe in some subjects than in others. It was found that less severe muscle fatigue was associated only with contractile failure, as indicated by reduction in elbow extension torque but not in EMG response to the controlled tendon tapping. More severe fatigue was associated with both activation and contractile failures, as indicated by reductions in both EMG and joint torque responses to the controlled tendon tapping. The controlled tendon tapping minimized the variations in central drive to motor neurons and neural strategy associated with voluntary contractions and evaluation of the induced reflex EMG and joint torque helps us better understand the underlying mechanisms and sites associated with muscle fatigue.

DTIC

Muscles; Activation (Biology); Electromyography; Failure; Fatigue (Biology)

20030019704 Diabetes Technology Society, Foster City, CA USA

Second Annual Diabetes Technology Meeting Final Report

Klonoff, David C.; Dec. 2000; 187p; In English, 31 Oct. - 2 Nov. 2002, Atlanta, GA, USA; Original contains color images
Contract(s)/Grant(s): DAMD17-03-P-0044

Report No.(s): AD-A409892; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The Second Annual Diabetes Technology Meeting on October 31 - November 2, 2002 at the Atlanta Hyatt Regency Hotel was co-sponsored by the Technologies for Metabolic Monitoring Joint Program, Centers for Disease Control and Prevention, NASA, Juvenile Diabetes Research Foundation International, the UC Berkeley Department of Bioengineering, the Georgia Tech/Emory Center for the Engineering of Living Tissues (GTEC), and by "Diabetes Technology & Therapeutics". The Meeting included sessions on: 1) new technology for measuring glucose and other markers of glycemic control; 2) the artificial pancreas; 3) new technology for delivering insulin (and other therapeutic peptides) for diabetes, such as inhaled, oral, or by other new formulations; 4) computers and diabetes; and 5) a live demonstration of continuous glucose monitoring technology. The Meeting included two poster session receptions, in which a total of 99 posters were presented. The Meeting, which began on the evening of October 31, 2002, was preceded on the afternoon of October 31, 2002 by two simultaneous half-day workshops, which were optional supplements to the meeting. These workshops were entitled: "Calibration of Continuous Glucose Sensors" and "Advances in therapy for diabetes -2002". The 2 1/2 days of the meeting and workshops featured presentations by 50 diabetes technology experts.

DTIC

Measure and Integration; Pancreas; Peptides; Insulin; Computer Programs; Glucose; Diabetes Mellitus

20030019705 University of Technology, Key Univ. Research Strength in Health Technologies, Sydney, Australia

A Novel Fuzzy Neural Network Estimator for Predicting Hypoglycaemia in Insulin-Induced Subjects

Ghevondian, N.; Nguyen, H. T.; Colagiuri, S.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference CD-ROM

Report No.(s): AD-A409893; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Predicting the onset of hypoglycaemia can avoid major health complications in Type 1 insulin-dependent-diabetes-mellitus (IDDM) patients. This paper describes the design of a novel fuzzy neural network estimator algorithm (FNNE) for predicting the glycaemia profile and onset of hypoglycaemia in insulin-induced subjects, by modeling the changes in heart rate and skin impedance parameters. Hypoglycaemia was induced briefly in 12 volunteers (group A: 6 non-diabetic subjects and group B: 6 Type 1 IDDM patients) using insulin infusion. Their skin impedances, heart rates and actual blood glucose levels (BCL) were monitored at regular intervals. The FNNE algorithm was trained using all subjects from group A and validated/tested on the remaining subjects from group B. The mean error of estimation of BCL profile for the training data set (group A) was 0,107 (p less than 0,05) and for the validation/test data set (group B) was 0,139 (p less than 0,05). Furthermore, the FNNE algorithm was able to predict the onset of hypoglycaemia episodes in group A and group B with a mean error of 0,071 (p less than 0,03) and 0,176 (p less than 0,05) respectively.

DTIC

Neural Nets; Predictions; Hypoglycemia; Diabetes Mellitus; Fuzzy Systems; Error Analysis

20030019707 Bogazici Univ., Inst. of Biomedical Engineering, Istanbul, Turkey

Atlas Guided Neurosurgery

Aksel, E. B.; Ozkan, M.; Barlas, O.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409944; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Placement of N bars around the head of subject during an MR or a CT imaging session provides physicians, neurosurgeons with an analytical ability for preoperational target position determination in surgery planning. Since axial slices yielded by a system mentioned above has 9 N bar spots, where the actual length between them is known, determination of the position of a point can be calculated by N bar points respect to any pre-selected origin. Even though, X-Ray CT and MRI are both complex, developed imaging modalities, none of them can be defined as perfect because of their limitations. Namely, when MR imaging is fine for soft-tissue filming, which turns it to be a strong candidate for neurosurgeries, where detailed imaging is important, CT is not as good as MRI. On the other hand, MRI is limited due to mostly, chemical shift, field non-uniformity for preoperational target determination, hence CT imaging becomes more appropriate for such a purpose. Our goal is to integrate brain atlases and CT images to overcome the drawbacks mentioned above by developing a tool providing the neurosurgeon with a preoperational target determination method by the atlas and CT image registration capability of the tool.

DTIC

Brain; Surgery; Neurology; Computer Aided Tomography; Magnetic Resonance

20030019708 Middle East Technical Univ., Dept. of Electrical and Electronics Engineering, Ankara, Turkey

Development of a Compression Algorithm Suitable for Exercise ECG Data

Uyar, K.; Ider, Y. Z.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409945; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Huge amount of data recorded during exercise electrocardiography may be stored for further analysis or be transferred to a remote physician through telephone lines. Due to channel limitations, data must be compressed prior to the transfer. In this study, an algorithm suitable for compression of exercise electrocardiography data is proposed. 2-D Discrete Cosine Transformation is applied in the algorithm to make use of the pseudo periodic behavior of the data. To increase the correlation, data is aligned from the R peaks, QRS detection is performed using Fast Dyadic Wavelet Transform. The success rate of the detection algorithm is found to be 99,78%. Uniform scalar quantization is used with zonal coding method in the coding of 2-D Discrete Cosine Transform coefficients. The performance of the compression algorithm is evaluated in terms of compression ratio, reconstruction error and by compafllw, the reports of the ST segment depression test applied before the compression and after the reconstruction to inspect whether vital information is preserved.

DTIC

Algorithms; Compression Ratio; Electrocardiography; Physical Exercise; Data Compression

20030019709 Dartmouth-Hitchcock Medical Center, Dept. of Medicine, Lebanon, NH USA

Cybercare: Combining Healthcare and Cyberspace in the 21st Century

Rosen, J. M.; Simpson, M. K.; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409946; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper, we discuss the origins of the modern hospital-based tertiary, care system. We define how this system was a product of a large-scale medical disaster that prompted the invention of the modern hospital. We will then similarly describe the disaster that prompted the beginning of telemedicine. Following, we review the history of telemedicine and the development of telesurgery, and present the state-of-the-art in telesurgery, and other advanced telemedicine technologies. We will then define cyber through a discussion of cybernetics and cyberspace. We present the concept of the digital physician and a cybercare vision of a new healthcare system. We will then predict what type of large-scale medical disaster would prompt the creation of a cybercare healthcare system. Finally, we discuss the challenges to be faced in the 21st century.

DTIC

Cybernetics; Telemedicine; Public Health; Technologies

20030019710 Pakistan Univ. of Engineering and Technology, Dept. of Biomedical Engineering, Karachi, Pakistan

Classification of Electrocardiogram Using SOM, LVQ and Beat Detection Methods in Localization of Cardiac Arrhythmias

Baig, M. H.; Rasool, A.; Bhatti, M. I.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409947; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The work investigates a set of efficient methods to extract important features from the ECG data applicable in the localization of cardiac arrhythmia. The work involves the segmentation of the ECG signal and the extraction of important features like QRS and ST segments. Further classification follows the learning process where the SOM (Self Organizing Maps) units organize in such a way that similar map sequences of the ECG data are represented in particular areas of the SOM. Eventual unsupervised learning (UL) time traces are achieved during the training and forwarded to the LVQ (Learning Vector Quantization). Here a set of supervised learning (SL) is followed by a smart beat detection system that further enhances the signal performance and correct localization for arrhythmia detection.

DTIC

Arrhythmia; Detection; Electrocardiography; Vector Quantization; Heart Rate

20030019711 New South Wales Univ., School of Biomedical Engineering, Sydney, Australia

Home Telecare for Chronic Disease Management

Celler, B. G.; Lovell, N. H.; Basilakis, J.; Magrabi, F.; Mathie, M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409950; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We review the development of an Internet-enabled home clinical workstation for the management of chronic disease, and the implementation of a clinical trial to test the functionality, usability and effectiveness of the system in both a city and a remote count% setting. The Home Telecare System integrates with established primary care services to provide a new paradigm of active disease management through the daily collection of clinical data and assessment of functional health status, and the provision of feedback for patient self-management and education. A novel Medications Management module is also implemented to permit on line variation of prescribed medications.

DTIC

Clinical Medicine; Management Systems; Workstations; Diseases

20030019712 New South Wales Univ., School of Biomedical Engineering, Sydney, Australia

Design of an Internet-Enabled Hospital in the Home Information System for Ambulatory Care

Lovell, N. H.; Balakrishnamoorthy, K.; Le, D.; Paleologos, J.; Huynh, K.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409952; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The development of a set of Internet-enabled forms and a relational database management system known as "Hospital in the Home Information System" (HHIS) is discussed. HHIS is an information management and communication system for ambulatory care. Hospital patients who can be treated and cared for in their own homes and do not necessarily have to be based in the hospital are assigned to an ambulatory care program. The ambulatory care program is used to manage post- acute, and acute care at home as an alternative to inpatient care. The HHIS system attempts to bring together both hospital and community based aspects of care to these "hospital in the home" patients. The aim of the project is to develop a user-friendly, database-driven system accessible via the Internet, which will replace the current paper-based system. The system design and technologies used in the implementation of the system are outlined, along with a brief description of the trialing of the system. Ambulatory care, internet, information management, community care.

DTIC

Information Systems; Medical Services; Hospitals; Ambulances; Data Base Management Systems; Housings; Telecommunication

20030019713 Rowan Univ., Glassboro, NJ USA

Dynamic Segmentation of Breast Tissue in Digitized Mammograms

Neyhart, J. T.; Ciocco, M. D.; Polikar, R.; Mandayam, S.; Tseng, M.; Oct. 25, 2001; 5p; In English; Papers from the Annual International Conf. (23rd) of the IEEE Engineering in Medicine and Biology Society, held in Istanbul, Turkey, on 25-28 Oct 2001. Turkey. See also ADM001351 for entire conference on CD-ROM.

Report No.(s): AD-A409953; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The percentage of radio-dense tissue in a mammogram has been used as a marker for determining breast cancer risk. In this paper, we present an image segmentation technique for identifying tissue and non-tissue regions of a digitized X-ray image. This procedure constitutes a vital step prior to subsequent processing for estimating the amount of radiodense tissue. The process involves the generation of a segmentation mask developed by using discrete wavelet transform techniques. Initial results have been promising, demonstrating the feasibility of the approach.

DTIC

Diagnosis; Mammary Glands; Cancer; Computer Aided Mapping; Imaging Techniques; Wavelet Analysis

20030019714 Ecole Nationale Supérieure des Telecommunications, Image Info Processing Dept., Brest, France

Collaborative Medical Reasoning in Telemedicine

Quintero, J.; Abraham, M.; Aguilera, A.; Villegas, H.; Montilla, G.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409954; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During medical practice, doctors use different aspects of reasoning for diagnosis and treatment. There is a particular process when several doctors are involved in taking a medical decision. In this paper we present an overview of different constraints in the process of conventional decision making and collaborative medical reasoning. General notions for an assisted decision cooperation System are introduced, bearing in mind general medical practices; without neglecting the physician's role.

DTIC

Medical Services; Telemedicine; Diagnosis

20030019715 Salford Univ., UK

Intelligent Classification of Electrolaryngograph Signals

Ritchings, R. T.; McGillion, M.; Moore, C. J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409955; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes a prototype system for the intelligent classification of electrolaryngograph (EGG) signals in order to provide an objective assessment of voice quality in patients at different stages of recovery after treatment for larynx cancer. The system extracts salient short-term and long-term time-domain and frequency-domain parameters from EGG signals taken from male patients steadily phonating the vowel /i/. The quality of these voices was also independently assessed by a Speech and Language Therapist (SALT) according to their 7-point ranking of subjective voice quality. These data were used to train and test a Multi-layer Perceptron (MLP) neural network to classify EGG signals in terms of voice quality. Several MLP configurations were investigated using various combinations of these signal parameters, and the best results were obtained using a combination of short-term and long-term parameters, for which an accuracy of 92% was achieved. It is envisaged that this system could be used as a valuable aid to the SALT during clinical evaluation of voice quality.

DTIC

Data Processing; Larynx; Prototypes; Classifications; Smart Structures

20030019716 Karolinska Inst., Stockholm Sweden

A 3D-Model for Computer Simulation of Atrial Electrophysiology

Fredby, Magnus; Elmqvist, Hakan; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409956; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The presented implementation is a three-dimensional isotropic monodomain reaction-diffusion model with a realistic geometry coupled with the atrial ion model proposed by Nygren et al. The partial differential equations are solved by a Galerkin finite element method in space and a forward Euler approximation in time. Simulations yields the expected results and the computational performance of the model is good considering the size of the problem.

DTIC

Computerized Simulation; Electrophysiology; Three Dimensional Models

20030019749 Flinders Univ., School of Informatics and Engineering, Adelaide, Australia

Removing Power Line Noise From Recorded EMG

Mewett, David T.; Nazeran, Homer; Reynolds, Karen J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409957; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Three methods for offline removal of power line interference (hum) from electromyograms (EMGs) were compared using both simulated and recorded EMG signals. The first method was a simple recursive digital notch filter. In the second method (Regression-Subtraction), the amplitude and phase of the interference were estimated by regressing sine and cosine functions onto a 'quiet period' before the start of the muscular contraction. A sinusoid with this frequency, magnitude and phase was then subtracted from the entire length of the signal. In the third method (Spectrum Interpolation), it was assumed that the magnitude of the original component of the signal at the frequency of the interference can be approximated by interpolating between the adjacent frequency bins in the power spectrum. While Regression-Subtraction was found to give the highest SNR for the output

signal under ideal conditions, Spectrum Interpolation was found to be comparable if the phase of the interference was not constant and superior if the interference contained strong harmonic components.

DTIC

Digital Filters; Electromyography; Frequencies; Hum; Power Lines; Sine Waves

20030019750 Alabama Univ., Birmingham, AL USA

Restitution of Action Potential Duration at the Purkinje-ventricular Interface

Huelsing, D. J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409958; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Regional differences in the restitution of action potential duration may be arrhythmogenic. Though such a difference exists at the Purkinje-ventricular interface, restitution kinetics have not yet been defined between coupled Purkinje and ventricular cells. Thus, the purpose of this study was to determine the effects of coupling on restitution in Purkinje and ventricular cells. DiFrancesco-Noble and Luo-Rudy dynamic membrane equations were used to describe the ionic currents for Purkinje and ventricular cells, respectively. During homogeneous coupling (e.g., Purkinje to Purkinje cell or ventricular to ventricular cell), the restitution kinetics of well-coupled cells were intermediate to the intrinsic restitution kinetics of each cells. However, during heterogeneous coupling between a Purkinje and a ventricular cell, the restitution kinetics of the coupled cells were not simply a weighted average of the intrinsic kinetics. These results suggest that restitution is strongly affected by cell-to-cell coupling. Because Purkinje and ventricular cells have intrinsic differences in restitution that are differentially altered by many pharmacological agents, these results have implications for proarrhythmic effects of some antiarrhythmic drugs.

DTIC

Heart; Cells (Biology); Coupling; Cerebral Cortex; Heterogeneity

20030019751 National Taiwan Univ., Dept. of Electrical Engineering, Taipei, Taiwan, Province of China

More Accurate Estimators of Noise Level and TEOAE/Noise in TEOAE Tests

Yang, Li-Ping; Young, Shuenn-Tsong; Kuo, Te-Son; Oct. 25, 2001; 3p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409959; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This study proposed new estimators to estimate the noise level and TEOAE/ noise, which are important indicators of the reliability of the recorded TEOAEs. Fifteen normal ears were tested to evaluate the performance. Results showed that the standard deviations of the proposed estimators were smaller than those of typical estimators.

DTIC

Signal Processing; Hearing; Noise Intensity

20030019753 Technical Univ. of Lodz, Lodz, Poland

Advanced Thermal Image Processing for Medical and Biological Applications

Wiecek, B.; Danych, R.; Zwolenik, Z.; Jung, A.; Zuber, J.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409962; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, new image processing tools are presented for conversion thermal and visual images, mainly for application in medicine and biology. A novel method for area and distance evaluation based on statistical differencing is discussed. In order to increase the measurements accuracy, the interpolation and subpixel bitmap processing are chosen.

DTIC

Image Processing; Thermal Radiation

20030019754 Technical Univ. of Lodz, Lodz, Poland

Computer System for Multispectral Image Acquisition and Processing

Wiecek, B.; Zwolenik, Z.; Danych, R.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409963; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, multi-input computer system for image acquisition and processing is presented. This system is equipped with 2-wavelength thermal channel and any 4 other one, which can be used to capture visual, X-ray, ultrasound images, etc. Novel image processing tools are described, mainly for geometrical and 3D transformations.

DTIC

Image Processing; Computer Programs

20030019760 National Inst. for Longevity Sciences, Aichi, Japan

Animal-Shaped Toys as Therapeutic Tools for Patients with Severe Dementia

Nakajima, K.; Nakamura, K.; Yonemitsu, S.; Oikawa, D.; Ito, A.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409951; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An animal-shaped toy was provided as a therapeutic tool to patients with severe dementia during a therapeutic program and after dinner. The occupational therapist delivered three animal shaped toys a gorilla, a tiger and a dog during the therapeutic program. These toys performed amusing actions. The occupational therapist observed the activities of the patients and classified them into six categories (no reaction, close observation, talking, clapping, patting the toy, taking care of the toy). The total duration of activities during the period of the therapeutic program was recorded. Most of the patients were interested in the toys, and they looked much happier and less agitated. They became accustomed to the toy dog day by day. The animal-shaped toy is a useful tool for occupational therapy.

DTIC

Therapy; Animals; Mental Health

20030019761 Manitoba Univ., Dept. of Electrical Engineering, Winnipeg, Manitoba Canada

Respiratory Onset Detection Using Variance Fractal Dimension

Yap, Yee L.; Moussavi, Zahra; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Papers from the 23rd Annual International conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409886; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Recently a non-invasive acoustical method has been developed to detect respiratory phases without airflow measurement, in which the average power of tracheal breath sounds is used to detect the onset of breaths. We improved the accuracy of the breath onsets detection by applying variance fractal dimension D_{σ} . For the sake of a comparison, the same set of data as in 1 was used. Data included tracheal breath sound recorded simultaneously with airflow from nine healthy subjects. Variance fractal dimension was used to detect the onset of breaths directly from the time domain tracheal sound signals. Result shows that onsets can be detected by the peaks of the variance fractal dimension, with an accuracy of 40 +/- 9 ms. Comparing to the accuracy reported in the previous method (41.5 +/- 34.7 ms), this study slightly improves the average error but also is more robust in term of standard deviation. It also provides an alternative approach to analyze breath sound signals in time domain. The result increases the reliability of acoustical phase detection algorithm and paves the way for further analysis such as actual amount of airflow estimation. respiratory sounds, variance fractal dimension, breath onsets, signal complexity

DTIC

Fractals; Respiratory System; Phase Detectors; Acoustics; Detection; Flow Measurement; Signal Detection

20030019848 Mount Sinai School of Medicine, New York, NY USA

Psychological Distress, Cognitive Bias and Breast Cancer Surveillance Behavior in Women Tested for BRCA 1/2 Mutation Annual Report, 1 Jul. 2002-1 Jul 2002

Erblich, Joel; Bovbjerg, Dana H.; Aug. 2002; 44p; In English

Contract(s)/Grant(s): DAMD17-99-1-9305

Report No.(s): AD-A409853; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research project examines psychological distress and processing of information associated with breast cancer risk. Understanding the types and magnitude of women's distress and impaired processing of cancer-related information is critical because cancer-related distress has been associated with poorer compliance with screening behaviors, and impaired processing of cancer information may decrease women's knowledge and understanding of (and hence, compliance with) recommended screening guidelines. These concerns may be particularly salient among women who attend genetic counseling, as they receive complex, and oftentimes-distressing information about their risk for the disease. to date, our findings indicate that women with family histories of breast cancer may be so preoccupied with their risks for developing breast cancer that they exhibit impaired

processing of cancer-related information, which may lead to poorer informed choices about their health care. We also found that these women underestimate their risks of developing other more common diseases, such as cardiovascular disease, and this may be exacerbated by biased media coverage of breast cancer. Our research has also demonstrated that distress about breast cancer is related to significantly poorer knowledge of information presented during genetic counseling.

DTIC

Stress (Psychology); Mammary Glands; Cancer; Psychological Effects; Education

20030019856 Cleveland Clinic Foundation, Dept. of Physical Medicine and Rehabilitation, Cleveland, OH USA

Analysis of Large Array Surface Myoelectric Potentials for the Low Back Muscles

Reger, Steven I.; Sahgal, Vinod; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409867; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An algorithm was developed and tested for the ability to differentiate between the spatial distribution of large arrays of acute and normal recordings of surface electromyographic (EMG) data from subjects with and without low back pain (LBP). The surface EMG data from 62 channels were statistically analyzed and the spatial distribution of the root mean square (RMS) values were used in a multivariate quadratic discriminant model to classify the healthy and acute LBP subjects. The surface EMG distribution from the low back of 161 healthy and 44 acute LBP subjects were collected in three minimum stress postural positions including standing, 20 degrees of lumbar flexion and standing with arms extended forward holding 1.36 kg (3 lbs.) of weight in each hand. The best results obtained from the flexion group of experiments correctly reclassified 95.50/o (42 of 44) of the acute subjects and 99.40/o (160 of 161) of the healthy. The success rate of this reclassification were found to be superior to reported patient classifications based on smaller set of electrode pairs using fewer subjects. The results indicated a potential of the model for clinical patient classification.

DTIC

Muscles; Electromyography

20030019859 Texas Univ., M. D. Anderson Cancer Center, Houston, TX USA

Differential Processing of Cyclin E Variants in Normal Versus Tumor Cells and Their Role in Breast Cancer Oncogenesis Annual Report, 1 Sep. 2001-31 Aug. 2002

McGahren, Mollianne J.; Keyomarsi, Khandan; Sep. 2002; 12p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9214

Report No.(s): AD-A410125; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cyclin E is a positive regulator, which controls the transition of the G1 to S phase of the cell cycle. When associated with CDK2, it is responsible for cells passing through the restriction point, which is the barrier between G1 and S. This commits the cell to complete one round of cell division. Previous findings by this laboratory have found that overexpression of cyclin E and the presence of lower molecular weight isoforms (LMW) are found more often in breast tumors and cancer cell lines when compared to normal tissues and cells. Also, tumor cells, but not normal cells have the mechanisms to proteolytically cleave the full length cyclin E into these LMW forms. An altered cyclin E may contribute to the deregulation of the G1 to S checkpoint and lead to tumorigenesis. Our laboratory has also identified through mutational and biochemical analysis, the region of cyclin E that is proteolytically cleaved to generate the LMW forms.

DTIC

Cancer; Mammary Glands; Tumors; Cells (Biology)

20030019861 John P. Robarts Research Inst., London, Ontario Canada

Prediction of Malignancy in Breast Tumors Using Diffusion Weighted Magnetic Resonance Imaging Annual Report, 1 Jul. 1999-30 Jun. 2002

Gareau, Paula; Rutt, Brian K.; Jul. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-99-1-9227

Report No.(s): AD-A410127; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this research is to develop a non-invasive predictor of malignancy in breast tumors using novel magnetic resonance imaging (MRI) techniques. The hypothesis is that the spatial distribution of microvasculature around a breast lesion is specific for malignancy and can be reliably measured by a completely non-invasive MRI method. This hypothesis is being tested by: 1) The design and construction of ultra-high gradient coils for MRI. 2) The implementation of advanced MRI pulse sequences

for mapping of microvascular parameters 3) The correlation of MRI-derived vascular parameters (diffusion and perfusion) with histological parameters (tumor grade and microvessel density) in an animal model of human breast cancer.

DTIC

Cancer; Mammary Glands; Cardiovascular System; Imaging Techniques

20030019862 Universidade Federal do Rio de Janeiro, Biomedical Engineering Program, Brazil

Detection of First and Second Cardiac Sounds Based on Time Frequency Analysis

Santos, M. A.; Souza, M. N.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A410128; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Determining the exact timing of cardiac events, represented by the first (S1) and second (S2) sounds, from the PCC signals (phonocardiogram), represents a great challenge, specially in pathological cases. A system that allows this kind of detection could be used to synchronize several important biomedical devices and diagnosis techniques, such as intraaortic balloons (IABP) and synchronous images of Ultrasound, Magnetic Resonance and Computerized Tomography. This work presents a wavelet-based technique for S1 and S2 detection in PCC signals, that is able to perform a good detection in both normal and abnormal cases. It will be shown the criterion of choosing the most suitable wavelet from a set of classical ones, as well as the principles of the final detection method. The results in the analysis of 756 cardiac cycles, from 19 subjects, including normal and abnormal ones present an error ratio of 0.8%, point out to the efficiency of the proposed method.

DTIC

Cardiovascular System; Computer Aided Tomography; Detection; Phonocardiography; Wavelet Analysis

20030019864 Universidade Federal do Rio de Janeiro, Biomedical Engineering Program, Brazil

Study of the Electrical Impedance Scanning

Latge, C. K.; Souza, M. N.; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A410131; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Electrical Transimpedance Scanning is a new modality of image based on the differences in electrical properties of tissues. It is an extremely promising technique to complement other conventional image examinations. Areas presenting abnormalities and/or malignant neoplasia evidence exhibit conductive changes that cause an impedance variation between cancerous and health tissues. Since there are very few commercial devices available that use the new Electrical Transimpedance Scanning technology, this paper describes the design of a prototype using this technique aiming to contribute somehow in the evaluation of the parameters involved.

DTIC

Electrical Impedance; Tissues (Biology); Abnormalities; Prototypes

20030019865 National Taiwan Univ., Dept. of Electrical Engineering, Taipei, Taiwan, Province of China

A Pump Control Index for Reducing Suction and Backflow Effect Caused by the Portable Centrifugal Blood Pump

Lin, Y. H.; Chou, N. K.; Chen, Y. Y.; Jan, G. J.; Oct. 25, 2002; 3p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A410133; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this experiment, the Taita No. 1 centrifugal blood pump was implanted on the calf. The blood pump was driven by constant voltage with the open-loop control method. The pump inflow flow and pump outflow pressure were recorded and analyzed synchronously. According to the status of aortic valve and mitral valve, the cardiac cycle was divided into four stages. The flow in each stage was calculated and an optimal pump control index was obtained. The index suggests an optimal applied voltage of pump for reducing suction and backflow effect. Keywords- blood pump control, suction, backflow, LYAD

DTIC

Centrifugal Pumps; Heart Valves; Blood Pumps; Heart Function

20030019866 Keio Univ., Faculty of Science and Technology, Yokohama, Japan

Cell Nucleus Segmentation of Skin Tumor Using Image Processing

Tanaka, Toshiyuki; Joke, Tomoo; Oka, Teruaki; Oct. 25, 2001; 5p; In English; Original contains color illustrations; Papers from

23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A410134; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Automation and quantification of diagnosis of tumor cell images have been studied for these three decades in the field of medical imaging technology. Many techniques of image processing were proposed to solve problems such as nucleus segmentation and classification. But these studies have mainly focused on epithelial tumors. Nonepithelial skin tumors such as dermatofibroma (DF) and dermatofibrosarcoma protuberans (DFSP) have not been enough studied. DF is benign tumorous disease and DFSP is mid-grade malignant tumor. Recently, it is necessary that criterion of classification between DF and DFSP is quantitatively specified. In this paper a system for segmenting cell nuclei of DF and DFSP is proposed. Nuclei regions are objectively segmented and surrounded using edges of strength by the system. Segmentation of arbitrary shaped nuclear regions and weakly stained nuclear region is made. A dynamic thresholding method with combining Laplacian histogram with Ohtsu's method is used for segmentation. Segmentation test was done using real tissue cell images of DF and DFSP to evaluate validity of this system. Shape characteristics such as grade of similarity, to circle were also computed from the segmented regions to assure that some differences between DF and DFSP is expressed its distribution. Keywords - Segmentation, skin tumor, cell nucleus, dynamic threshold, Laplacian histogram

DTIC

Neoplasms; Medical Services; Cancer; Cells (Biology); Skin (Anatomy); Chromosomes; Tumors

20030019880 Georgetown Univ., Medical Center, Washington, DC USA

Cell Surface Molecules Driving Breast Cancer/Endothelial Interactions *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Al-Attar, Ali; Jul. 2002; 20p; In English

Contract(s)/Grant(s): DAMD17-99-1-9187

Report No.(s): AD-A409628; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fibroblast growth factor-binding protein 1 (FGF-BP1) is a secreted heparin-binding protein that can bind and solubilize members of the fibroblast growth factor (FGF) family. FGF-2 is immobilized on heparan sulfate proteoglycans (HSPGs) in the extracellular matrix and can be released from this storage and activated by degradation of the HSPG or by binding a soluble chaperone molecule that transports it to its cell-surface tyrosine kinase receptor. FGF-BP1 was proposed to serve as such a carrier protein and has been demonstrated to act as an angiogenic switch in models of malignant progression of cancer. Two recombinant FGF-BP1 proteins were produced in prokaryotic and eukaryotic expression systems, and demonstrated to bind several members of the FGF family in a dose-dependent, reversible manner. Furthermore, FGF-2 binding to FGF-BP1 and to heparan sulfate was found to be mutually exclusive. FGF-BP1 did not interfere with FGF-2 binding to its tyrosine kinase receptor (FGFR1) in a cell-free system, and the biologic effects of FGF-2 were enhanced by the addition of exogenous FGF-BP1 in models of growth and angiogenesis. Finally, HIV-1 Tat protein was found to inhibit FGF-2 binding to FGF-BP1 but not to its receptor, suggesting that HIV-1 Tat might function as an FGF binding protein.

DTIC

Cancer; Mammary Glands; Proteins

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AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20030018847 Amirkabir Univ., Dept. of Biomedical Engineering, Tehran, Iran (Islamic Republic of)

Laser-Doppler Blood-Flowmetry Modeling by Monte Carlo Method

Asadpour, V.; Miranbeigi, M. H.; Towhidkhah, F.; Khosroshahi, M. E.; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410151; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Laser Doppler Flowmetry (LDF) is a noninvasive method to assess tissue blood flow. Previously published works have proposed a mathematical model for LDF and showed that there is a relationship between first moment of power spectrum and the velocity of moving blood cells (MBC's). Also researchers have studied this method by mathematical analyses in various aspects. In this paper a new model for LDF based on Monte Carlo method is proposed. We have shown that this new model is more flexible

and provides a better agreement with the experimental results. For example this model represents the nonlinear relationship between the first moment of power spectrum and the blood cells velocity which is not seen in previous models.

DTIC

Monte Carlo Method; Fluid Flow; Blood Cells; Blood Flow

20030018853 Arizona State Univ., Dept. of Chemical and Bioengineering, Tempe, AZ USA

A Non-Homogeneous Binomial Model for Thalamic Oscillations

Wang, T.; Muthuswamy, J.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. T

Report No.(s): AD-A410161; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The thalamic ventral posterior lateral neurons (VPL) respond to somatosensory stimulation with a burst of action potentials followed by a periodic oscillation at the spindle frequency This study aims to build a statistical model to quantify the multi-unit behavior and explain putative underlying mechanisms, Multi-unit data, comprising 4 or 5 different neurons, were collected from anesthetized adult rats (n=2) by positioning a microelectrode in the ventral posterior lateral (VPL) nuclei of the thalamus, Using an observation window of 1 ms and assuming that neuronal firing is uncorrelated within this window, the firing rate of the neurons can be successfully modeled by using a non-homogeneous binomial model with $N=1$ (with 99,5% confidence), Using maximum likelihood estimator (MLE) of the parameter p , statistically consistent prediction of the parameters of non-homogeneous binomial model was made using a minimum of 50 stimulus-response pairs, The inter-stimulus interval histograms of the individual neuronal firing indicate a possible stochastic resonance behavior that will model the spindles in thalamus, Our model offers a statistically elegant description of oscillations in neuronal action potential data and can in general, be used to track changes in the neuronal dynamics with function or dysfunction

DTIC

Statistical Distributions; Thalamus; Oscillations; Maximum Likelihood Estimates; Sensory Perception

20030018867 Flinders Univ., School and Informatics and Engineering, Adelaide, Australia

Computer-Based Clinical Instrumentation for Processing and Analysis of Mechanically Evoked Electromyographic Signals in the Upper Limb

Nazeran, Homer; Jaberzadeh, Shapour; Bidhendi, Essie; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A410064; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A computer-based clinical instrument was developed to simultaneously acquire, process, display, quantify and correlate electromyographic (EMG) activity, resistive torque, range of motion (ROM), and pain responses evoked by mechanical stimuli (i.e. passive elbow extensions) in humans. This integrated multichannel system was designed around AMLAB analog modules and software objects called ICAMs. Each channel consisted of a time- and frequency-domain block, a torque and angle measurement block, an experiment number counter block and a data storage and retrieval block. The captured data in each channel was used to display and quantify: raw EMG, rectified EMG, smoothed rectified EMG, root-mean-squared EMG, fast Fourier transformed (FFT) EMG, and normalized power spectrum density (NPSD) of EMG. Torque and angle signals representing elbow extension measured by a KIN-COM dynamometer during neural tension testing, as well as signals from an electronic pain threshold marker were interfaced to an AMLAB workstation and presented in one integrated display. Calibration was achieved by using low-level square and sine waves. Weight compensation was implemented by developing a special interface between the AMLAB and the KIN-COM dynamometer. Although this system was designed to specifically study the patterns and nature of evoked motor responses in Carpal Tunnel Syndrome (CTS) patients, it could equally well be modified to allow acquisition, processing and analysis of EMG signals in other studies and applications. In this paper, we describe an integrated system to simultaneously study and analyze the mechanically evoked electromyographic, torque and ROM signals and correlate various levels of pain to these signals.

DTIC

Electromyography; Signal Processing; Arm (Anatomy); Computer Techniques; Signs and Symptoms

20030018923 NASA Johnson Space Center, Houston, TX USA

Use of a Slick-Plate as a Contingency Exercise Surface for the Treadmill With Vibration Isolation System

Loehr, James A., Wyle Labs., Inc., USA; Lee, Stuart M. C., Wyle Labs., Inc., USA; Schneider, Suzanne M., NASA Johnson Space Center, USA; February 2003; 28p; In English

Report No.(s): NASA/TM-2003-210789; NAS 1.15:210789; S-899; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The treadmill with vibration isolation system (TVIS) was developed to counteract cardiovascular, musculoskeletal, and neurovestibular deconditioning during long-duration missions to the International Space Station (ISS). However, recent hardware failures have necessitated the development of a short-term, temporary contingency exercise countermeasure for TVIS until nominal operations could be restored. The purpose of our evaluation was twofold: 1) to examine whether a slick-plate/contingency exercise surface (CES) could be used as a walking/running surface and could elicit a heart rate (HR) greater than or equal to 70% HR maximum and 2) to determine the optimal hardware configuration, in microgravity, to simulate running/walking in a 1-g environment. One subject (male) participated in the slick surface evaluation and two subjects (one male, one female) participated in the microgravity evaluation of the slick surface configuration. During the slick surface evaluation, the subject was suspended in a parachute harness and bungee cord configuration to offset the subject's body weight. Using another bungee cord configuration, we added a vertical load back to the subject, who was then asked to run for 20 minutes on the slick surface. The microgravity evaluation simulated the ISS TVIS, and we evaluated two different slick surfaces (Teflon surface and an aluminum surface coated with Tuftram) for use as a CES. We evaluated each surface with the subject walking and running, with and without a handrail, and while wearing either socks or nylon booties over shoes. In the slick surface evaluation, the subject ran for 20 minutes and reached a maximum HR of 170 bpm. In the microgravity evaluation, the subjects chose the aluminum plate coated with Tuftram as the CES, while wearing a pair of nylon booties over running shoes and using a handrail, as the optimal hardware configuration.

Author

Treadmills; Vibration Isolators; Walking; Physical Exercise; Cardiovascular System; Musculoskeletal System

20030018937 Politecnico di Milano, Milan, Italy

Time Frequency Analysis and Spatial Filtering in the Evaluation of Beta ERS After Finger Movement

Bianchi, A. M.; Foffani, G.; Cerutfi, S.; Babiloni, C.; Rossini, P. M.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409583; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Different methods are compared for the evaluation of the event related synchronization (ERS) in the beta rhythm corresponding to finger movements. In addition to the standard procedure usually employed, the realistic Surface Laplacian (SL) is here introduced to improve the spatial localization of the phenomenon, while a Wavelet Packet (WP) decomposition approach is intended to better detect the time dependent characteristics. The parameters of interest (ERS amplitude and latency) were statistically analyzed through Analysis of Variance (ANOVA) and Scheffe's test. The WP filtering results are well comparable with the traditional filtering procedure. On the other hand, the realistic SL considerably improves the spatial localization and the consistency of the estimation (decreased variance) of the ERS amplitude,

DTIC

Electrocardiography; Fingers; Synchronism; Analysis of Variance; Wavelet Analysis

20030019016 Illinois Univ., Dept. of Bioengineering, Chicago, IL USA

A Simulation and Experimental Study on Equivalent Dipole Layer Imaging of Brain Electric Sources

Lian, J.; Yao, D.; Wu, D.; He, B.; Feb. 19, 2003; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409656; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A simulation and experimental study has been conducted on equivalent dipole layer imaging (EDLI) of brain electric sources from EEC. Using the three-sphere inhomogeneous head model, the performance of the EDLI was rigorously evaluated for a variety of brain source configurations under different noise levels. The present simulation results demonstrate the excellent performance of the EDLI in mapping and imaging the underlying cortical sources with much enhanced spatial resolution, as compared to the scalp potentials. Human experiments were further conducted to examine the feasibility of EDLI. Pattern reversal visual evoked potentials (VEP) were recorded from 94 electrodes and the brain electric sources at P100 were estimated. The VEP experiments demonstrate that the present EDLI can eliminate the misleading far field in the scalp potential map, localize and map the underlying cortical sources induced by the visual stimuli.

DTIC

Brain; Electric Power; Pattern Recognition; Vision; Laser Damage; Electroencephalography; Radiation Hazards

20030019018 McGill Univ., Dept. of Biomedical Engineering, Montreal, Quebec Canada

Modulation of Spastic Ankle Stiffness Dynamics with Voluntary Contraction in Spinal Cord Injury

Mirbagheri, M. M.; Barbeau, H.; Kearney, R. E.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409658; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A parallel-cascade system identification technique was used to examine the intrinsic and reflex contributions to overall ankle stiffness in normal (control) and spastic spinal cord injured (SCI) subjects as a function of voluntary contraction level. Intrinsic dynamics were modeled as a linear 2nd-order system relating intrinsic torque to joint position. Reflex dynamics were described by a linear 3rd-order system relating half-wave rectified velocity and reflex-torque. Intrinsic stiffness was similar in magnitude in both groups and increased with voluntary contraction at similar rates. In contrast reflex stiffness dynamics behaved differently in the two groups: (1) reflex stiffness gain was significantly greater in SCI than control subjects at all contraction levels (2) the modulation of reflex gain with voluntary contraction was abnormal and (3) the reflex frequency parameter was lower in SCIs and decreased with contraction level while it increased in controls. These differences were significant across a wide range of contraction levels with the gain difference being largest at low levels of contraction and the frequency difference being largest at high levels of contraction.

DTIC

Stiffness; Reflexes; Contraction; Spinal Cord; Joints (Anatomy); Injuries; Leg (Anatomy)

20030019035 Hong Kong Polytechnic, Jockey Club Rehabilitation Engineering Center, Kowloon, Hong Kong

Comparison of Upper Limb Joint Forces During Straight Line and Turning Wheelchair Maneuvers

Lam, W. N.; Mak, A.; Tam, W. C.; Cooper, R. A.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409687; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this study was to explore the joint kinetics of upper extremities during wheelchair maneuvers. A high incidence of musculoskeletal injuries has been reported due to the overuse and high repetitive motion of wrist, elbow and shoulder during wheelchair propulsion. Studies have been conducted with the use of a dynamometer or treadmill to simulate propulsion on level or inclined surface. However, during indoor maneuvering, turning is unavoidable. Three unimpaired subjects were recruited to perform three types of wheelchair maneuvers: straight line propulsion, turning left and turning right for ninety degrees with their comfortable speed. Using the SMARTwheel(s) and the motion analysis system (Vicon 370, Oxford), joint loadings were determined. The results showed that during turning, the side that held the wheel steady had greater peak joint reaction forces than that of the side which pushed the wheel forward. The results also indicated that the peak joint reaction forces during turning are larger than forces encountered during straight-line propulsion. In straight line propulsion, larger joint forces were found on the dominant side. However, larger joint loadings were found on the non-dominant arm holding the wheel during turning than the dominant side when the dominant hand was holding the wheel during turning. Similar results were also observed for the arms pushing the wheel forward during turning i.e. the non-dominant arm tended to exert larger efforts compared to the dominant arm.

DTIC

Loads (Forces); Joints (Anatomy); Maneuvers; Limbs (Anatomy); Wheelchairs

20030019060 New Brunswick Univ., Inst. of Biomedical Engineering, Fredericton, New Brunswick Canada

Steady-State and Dynamic Myoelectric Signal Compression Using Embedded Zero-Tree Wavelets

Norris, J. A.; Englehart, K.; Lovely, D.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A410098; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Within the field on biomedical engineering, the majority of compression research has focused on encoding medical images, electrocardiograms, and electroencephalograms. Although long-term myoelectric signal (MES) acquisition is important for neuro-muscular system analysis and telemedicine applications, very few studies have been published on MES compression. This research investigates static and dynamic MES compression using the embedded zero-tree wavelet (EZW) compression algorithm and compares its performance to a standard wavelet compression technique.

DTIC

Electroencephalography; Steady State; Telemedicine; Fault Trees; Wavelet Analysis

20030019117 Naval Medical Research Inst., Dept. of Otolaryngology, San Diego, CA USA

Exercise Induced Motion Intolerance: Role in Operational Environments

Gottshall, Kim R., Naval Medical Research Inst., USA; Moore, Robert J., Army Management Staff Coll., USA; Hoffer, Michael E., Marine Corps, USA; Weisskopf, Peter, Marine Corps, USA; Kopke, Richard D., Marine Corps, USA; Wester, Derin, Wester (Derin), USA; Balaban, Carey, Balaban (Carey), USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 41-1 - 41-6; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Exercise induced motion intolerance is a newly recognized disorder. This condition has a profound impact on military individuals in operational environments. Individuals present with a variety of symptoms including: headache, nausea, vertigo, and disequilibrium, which occur after exercise. The symptoms generally worsen with time and can significantly impact patients' daily routines since, often, only minimal exertion produces symptoms. We present a cohort of fifteen patients with exercise-induced motion intolerance. We detail the diagnostic work-up in this group of individuals including differentiating this disorder from common motion sickness and other vestibular pathologies. All of the individuals responded to customized vestibular rehabilitation including vigorous physical exertion with head motion. Since this disorder is poorly recognized and responds well to treatment we hope to provide guidelines that will allow practitioners to manage this disorder. Information from this abstract has bearing involving mechanisms and predisposing factors involved in motion sickness for individuals in operational environments and on a variety of military vehicles.

Author

Physical Exercise; Motion Sickness; Clinical Medicine; Diagnosis; Head Movement

20030019122 Institute for Human Factors TNO, Soesterberg, Netherlands

Motion Sickness When Driving With a Head-Slaved Camera System

Oving, A. B., Institute for Human Factors TNO, Netherlands; vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; Schaap, E., Royal Netherlands Navy, Netherlands; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 46-1 - 46-7; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

In a field experiment, we examined motion sickness incidence when driving with a head-slaved camera system. More specifically, we looked at the contribution to motion sickness of visual feedback on head roll and of stereoscopic view with the head-slaved camera system. The system was capable of motion in all three rotational degrees-of-freedom (DOFs). In the experiment, twelve subjects drove a car around a closed circuit in four different viewing conditions. In two conditions, no feedback on head roll was present by disabling the roll DOF of the camera platform (i.e., resulting in a 2 DOF system), and either mono view or stereo view was used. In the other two conditions, visual feedback on head roll was present (i.e., a 3 DOF system), and again either mono view or stereo view was used. As a baseline, subjects also drove with direct view, either with an unrestricted field-of-view (FOV) or with FOV-restricting goggles. The 2 DOF conditions were tested on a separate day from the 3 DOF conditions, and a direct view condition always preceded a condition with the head-slaved camera system. Upon completion of the driving task in each condition, the subjects filled in the motion sickness questionnaire (MSQ). Simulator sickness questionnaire (SSQ) total scores were derived from the MSQ. Results showed a significant difference between the 2 DOF and 3 DOF conditions (average SSQ total scores of 17.7 and 8.4, respectively). No significant differences between mono and stereo conditions were observed. These results indicate that motion sickness incidence with our head-slaved camera system can be reduced considerably by adding a roll component to the system.

Author

Motion Sickness; Head Movement; Helmet Mounted Displays; Tanks (Combat Vehicles)

20030019296 Tokyo Univ., Center for Collaborative Research, Japan

Evaluation of Infrared Images by Using a Human Thermal Model

Kakuta, N.; Yokoyama, S.; Suzuki, T.; Saito, T.; Mabuchi, K.; Oct. 25, 2001; 5p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM
Report No.(s): AD-A409578; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In order to evaluate IR images obtained under various thermal environmental conditions, we proposed a human thermal model that can be used for converting IR images into those under a standard condition. The developed model was based on a numerical calculation of bio-heat transfer equations that express heat transfer phenomena within the human body and a mathematical model of the thermoregulation system. A comparison of an IR image which was converted under the standard condition (30C) with the

original one at 30C indicated that the method using our model was effective to eliminate the influence of the thermal environmental condition.

DTIC

Thermodynamic Properties; Infrared Imagery; Skin (Anatomy)

20030019309 Waikato Univ., Hamilton New Zealand

Studies of the Coefficient of Variation of the Magnitude of EEG Signals

Round, W. H.; Sleigh, J. W.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409965; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An analysis of the variation in magnitude of EEG signals in various frequency bands of anesthetized patients and normal sleeping volunteers was carried out. The coefficient of variation (CoV), i.e. the standard deviation/ mean, within 10 second epochs was found to be quite constant throughout the whole of the EEG recordings and was typically about 0.46. This was found to be the case for both the patients and the volunteers.

DTIC

Electroencephalography; Time Measurement; Patients; Frequencies

20030019316 Army Research Inst. of Environmental Medicine, Natick, MA USA

Psychological Aspects of Military Performance in Hot Environments

Johnson, Richard F.; Kobrick, John L.; Jan. 2001; 26p; In English

Report No.(s): AD-A409995; USARIEM-MISC-98-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The military needs to understand how mental performance, psychomotor performance, and subjective responses vary with severity of heat stress. Understanding this relationship is important because heat stress can significantly impair military performance and because psychological changes often precede the onset of critical physiological changes. Establishing well-defined relationships between climatic conditions and psychological performance has been difficult. Thermal stress researchers have attempted to identify psychological breaking points in performance, but the environmental conditions employed to simulate the natural world (combinations of temperature, humidity, wind speed, and exposure time) do not lend themselves to systematic, real-world organization. Therefore, it is difficult to make broad generalizations about the effects of heat stress on psychological performance. Nevertheless, there is general agreement that (1) the upper limit of heat exposure for unimpaired psychomotor performance is 90 degrees F WBGT; (2) the upper limit of heat exposure for unimpaired mental performance is 85 degrees F WBGT if the service member is required to perform the task for 2 hours or longer; at less than 1 hour on the task, individuals can perform proficiently at higher ambient temperatures approaching 1090 WBGT; and (3) continuous repetitive tasks with relatively low arousal value tend to be the most affected. Psychological performance during ambient heat exposure is compounded for military personnel because they are often encumbered by mission-essential clothing and equipment, including, for example, chemical protective clothing or medications such as nerve-agent antidotes, or both. Realistic military training in hot environments followed by persistent practice of military tasks in hot environments will attenuate otherwise severe impairments in performance.

DTIC

Heat Tolerance; Ambient Temperature; Wind Velocity; Climatology

20030019353 NASA Johnson Space Center, Houston, TX USA

Cox Proportional Hazards Models for Modeling the Time to Onset of Decompression Sickness in Hypobaric Environments

Thompson, Laura A., Houston Univ.-Clear Lake, USA; Chhikara, Raj S., Houston Univ.-Clear Lake, USA; Conkin, Johnny, NASA Johnson Space Center, USA; March 2003; 50p; In English

Contract(s)/Grant(s): NAS9-1083

Report No.(s): NASA/TP-2003-210791; S-890; NAS 1.60:210791; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we fit Cox proportional hazards models to a subset of data from the Hypobaric Decompression Sickness Databank. The data bank contains records on the time to decompression sickness (DCS) and venous gas emboli (VGE) for over 130,000 person-exposures to high altitude in chamber tests. The subset we use contains 1,321 records, with 87% censoring, and has the most recent experimental tests on DCS made available from Johnson Space Center. We build on previous analyses of this data set by considering more expanded models and more detailed model assessments specific to the Cox model. Our model - which

is stratified on the quartiles of the final ambient pressure at altitude - includes the final ambient pressure at altitude as a nonlinear continuous predictor, the computed tissue partial pressure of nitrogen at altitude, and whether exercise was done at altitude. We conduct various assessments of our model, many of which are recently developed in the statistical literature, and conclude where the model needs improvement. We consider the addition of frailties to the stratified Cox model, but found that no significant gain was attained above a model that does not include frailties. Finally, we validate some of the models that we fit.

Author

Decompression Sickness; Extravehicular Activity; Data Bases; Partial Pressure; High Altitude Tests; Hazards

20030019696 Defence Research and Development Canada, Ottawa, Ontario Canada

Cooling Options for Shipboard Personnel Operating in Hot Environments

McLeilan, Tom M.; Oct. 2002; 29p; In English; Original contains color images

Report No.(s): AD-A409882; DRDC-TR-2002-185; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

DRDC Toronto was asked by the Director of Maritime Health Services to provide information and guidance about the use of cooling vests for shipboard personnel exposed to hot environments. A review of the literature suggested that three options might be available; liquid- or air-cooled systems; phase change material cooling vests; and, extremity cooling. The Steele Vest, which uses water and corn starch as the phase change material, is currently in use by the US Navy. Laboratory studies have shown that the use of this vest will effectively double tolerance times during light exercise in hot environments (in excess of 40C). Extremity cooling through the immersion of the hands and forearm in cool buckets of 10C or 20C water is currently recommended for use by the UK Royal Navy. As long as 20-30 minute rest periods can be scheduled each hour this is as effective as the use of continuous cooling with the Steele Vest. The use of a liquid-cooled suit with a battery-operated pump has been shown to reduce the heat strain of boiler room personnel. The use of an ice vest or alternative phase change material cooling vest would be most effective for personnel performing light exercise such as cage operators involved in the movement of food and equipment, personnel manning the 50-calibre machine guns, brow staff, and firefighters standing in the hangar lobby. The use of forearm and hand immersion in buckets of cool water may provide a better alternative for boarding parties than the cooling vest. Rotation of personnel could be implemented to allow forearm and hand immersion to occur every 30 minutes for a 20-30 minute period. Liquid-cooled suits should be considered as an option for engine stokers. Other factors such as maintaining proper hydration and a high level of cardiovascular fitness during long operations at sea are also critical for enhancing performance in the heat.

DTIC

Protective Clothing; Liquid Cooling; Heat Tolerance; Physiology

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20030019078 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France

Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures *Desorientation Spatiale dans les Vehicules Militaires: Causes, Consequences et Remed*

Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003; 488p; In English; In French, 15-17 Apr. 2002, La Coruna, Spain; Also announced as 20030019079 through 20030019124; CD-ROM contains full text document in PDF format

Report No.(s): RTO-MP-086; AC/323(HFM-085)TP/42; ISBN 92-837-0028-7; Copyright; Avail: CASI; C01, CD-ROM; A21, Hardcopy; A04, Microfiche; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement

Spatial disorientation (SD), a condition in which the operator fails to sense correctly the position, motion or attitude of the vehicle or of him/herself, continues to be a cause of aircraft accidents, with accident rates that, unlike the overall rate, have not fallen over the past 15 years. The Symposium was convened to review current knowledge of the causes of SD and preventative measures, applicable to air, land and maritime environments. Thirty two oral and 14 poster presentations covered the following topics: Causal mechanisms; Operational and psychophysiological consequences of SD; Incidence of SD in air, land and maritime environments; SD training programmes and training devices; Cognitive and sensory aids for the maintenance of spatial orientation, with an emphasis on the use of tactile cues.

Author

Disorientation; Situational Awareness; Military Vehicles; Conferences; Pilot Performance; Pilots; Physiological Effects; Pilot Training

20030019079 Royal Air Force, Centre for Aviation Medicine, Henlow, UK

Technical Evaluation Report

Benson, Alan J., Royal Air Force, UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. T1 - T7; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The 'Call for Papers' issued in June 2001 solicited unclassified contributions on the following topics: 1) Lessons learned from over 40 years of SD studies in the aeronautical environment (Mechanisms involved, Predisposition to SD, Role of cognitive factors). 2) How non-mishap SD may negatively impact crew performance and mission effectiveness (Air environments, Land environments, Sea environments). 3) Potential predisposition to SD using various head-out devices, NVG, HUD, HMD etc. (Day/night missions, Over water, Influence of visual conditions). 4) Effects of artificial visual environments (Virtual environment immersion, Enhanced and/or synthetic vision systems in vehicle manoeuvring and weapon delivery). 5) Spatial disorientation in new vehicular environments (Results of testing supermanoeuvrable aircraft, uninhabited vehicles etc., Display and control issues). 6) Underwater disorientation (Helicopter ditching at sea, SEALS operations, Submarines). 7) Traditional and innovative SD countermeasures for triservice warfighters (Training devices and protocols, Onboard equipment, Cognitive and sensorimotor aids, Visual and auditory symbology, Peripheral visual information, Tactile displays). 8) Standardisation of SD issues (Data Collection, Training methodologies, Equipment characteristics) Forty-eight of the abstracts submitted were chosen for inclusion in the programme of the Symposium that was held in an appropriately sized and well equipped theatre of El Palacio de Congressos, La Coruna, Spain, on April 15-17, 2002. Thirty-four abstracts were selected for oral presentation and 14 for presentation as posters. The oral communications were grouped into six sessions; 1) Recent advances in causal mechanisms. 2) Operational and psychological consequences. 3) SD in land sea and virtual environments. 4) SD training programs. 5) SD countermeasures and training tools. 6) Cognitive and sensory aids to (preventing Ed.) SD. The Symposium ended with a free ranging 'Round Table' discussion with contributions from the platform and the audience. At the Symposium, two oral communications and one poster were withdrawn.

Derived from text

Disorientation; Situational Awareness; Conferences; Papers

20030019080 Royal Air Force, Centre for Aviation Medicine, Henlow, UK

Spatial Disorientation: A Perspective

Benson, Alan J., Royal Air Force, UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. KN-1 - KN-8; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

I am honored to have been invited to give the keynote address to this symposium on spatial disorientation. Spatial disorientation (S.D.) is not a new problem in aviation and over the last 50 years it has been addressed on numerous occasions within the NATO community. Yet despite the increased understanding of the varied aetiology of S.D. and improvement in the display of information to the pilot to facilitate correct spatial orientation (S.O.), accidents, primarily attributable to S.D., continue to occur. Indeed, in the last decade the proportion of human error accidents in which S.D. was considered to be a primary or contributory cause of the mishaps has increased. This would appear to be due, at least in part, to the introduction of new technology, in particular night vision goggles, that has allowed flight operations in environmental conditions which previously were not possible. In the presentations to follow there will be descriptions of new technologies and training techniques that should aid the maintenance of spatial orientation (S.O.) in flight and reduce the frequency of S.D. incidents and orientation error accidents. But these benefits are likely to be tempered by new challenges arising from flight in high performance agile aircraft and unattended aerial vehicles - UAVs. The human factors and aeromedical community also need to be cognisant of S.D. in virtual reality environments as well as in those piloting UAVs. I would like to put this contemporary work in perspective - an historical perspective. I am, however, humbly aware that I will be a victim of perspectivism - that is knowledge of a subject is inevitably partial and is limited by the individual perspective from which it is viewed. My perspective has been acquired from the work I have done on SD and aspects of vestibular function since I joined the RAF Institute of Aviation Medicine in 1956. I have also been influenced by many of the people with whom I have worked, notably Fred Guedry - the doyen researcher in this field, who at the age of 80 is still active as is evidenced by the presence of his name on two of the papers being presented at this symposium.

Author

Disorientation; Situational Awareness; Conferences; Histories

20030019081 Institute for Human Factors TNO, Soesterberg, Netherlands

The Cause of Spatial Disorientation

Bos, Jelte E., Institute for Human Factors TNO, Netherlands; Bles, Willem, Institute for Human Factors TNO, Netherlands;

Hosman, Ruud J. A. W., Institute for Human Factors TNO, Netherlands; Groen, Eric L., Institute for Human Factors TNO, Netherlands; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 1-1 - 1-13; In English; Also announced as 20030019078

Contract(s)/Grant(s): F61775-01-W-E077; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

We here present a model including visual-vestibular interactions describing the basic properties of the human spatial orientation system. It hence also explains and describes spatial disorientation. The model indicates that spatial orientation should at least be characterized by four variables: linear acceleration and velocity, angular velocity, and attitude. Perception of the latter is part of the subjective vertical. Due to visual-vestibular interactions at different levels, these variables are partly independent, and may therefore behave differently. This is demonstrated by two examples concerning a takeoff. A moderate takeoff is simulated by means of a Stewart platform, a high G-load takeoff, like the catapult launch on an aircraft carrier, by a centrifuge. Model predictions are shown and concisely discussed, with further reference to previous papers on this matter. This elaboration, and the notice that we normally (in case of self propelled motion) need a sense of self motion for self control of body motion, leads us to the following conclusion: the main cause of spatial disorientation is the indistinguishability of accelerations due to motion (i.e. inertial accelerations) and those due to gravity. This problem is further enhanced by a limited range of (near) perfection of our visual and vestibular sensors. Unfortunately, the high performance military flight environment is definitely out of that range.

Author

Disorientation; Situational Awareness; Models

20030019082 State Scientific Research Testing Inst. of Military Medicine, Physiology Dept., Moscow, Russia

The Peculiarities of Spatial Orientation of Person in Conditions of G-Influences

Valentinovich, Boukhtiarov Igor, State Scientific Research Testing Inst. of Military Medicine, Russia; Alexandrovich, Vorobjov Oleg, State Scientific Research Testing Inst. of Military Medicine, Russia; Nikolayevich, Khomenko Mikhail, State Scientific Research Testing Inst. of Military Medicine, Russia; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 2-1 - 2-6; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Six test subjects were subjected to lateral (+G(sub y)) and longitudinal-lateral (+Gz/+Gy) accelerations in a centrifuge with a rotation radius of 6.55 m. During rotation, test subjects were instructed to indicate the position of subjective visual vertical. Results of this study demonstrated that during exposure to +G(sub y) and +G(sub z)/+G(sub y) accelerations, the direction of the indicated subjective vertical approached the direction of the resultant acceleration vector when the lateral component increased. This observed effect decreases with an increase of the longitudinal component of the acceleration. It was suggested that exposure to (i.e. 'pulling') high lateral acceleration (up to 2-3 G(sub y)) in highly maneuverable aircraft can hinder spatial orientation of a pilot due to this persistent illusory spatial position as reported above. Our analysis showed that the process of spatial orientation under the conditions of G-load influence becomes more difficult and it is depending on the compromise between visual and vestibular-proprioceptive inputs. On account of this finding, it may be proposed that under conditions of G-load influence, pilots that rely primarily on visual perception may be exposed to higher risk of spatial disorientation.

Author

Disorientation; Situational Awareness; Proprioception; Visual Perception; Physiological Acceleration

20030019083 Naval Medical Research Inst., Dept. of Otolaryngology, San Diego, CA USA

The Role of "Extra-Vestibular" Inputs in Maintaining Spatial Orientation in Military Vehicles

Hoffer, Michael E., Naval Medical Research Inst., USA; Gottshall, Kim, Army Management Staff Coll., USA; Weisskopf, Peter, Naval Medical Research Inst., USA; Moore, Robert J., Army Management Staff Coll., USA; Kopke, Richard D., Marine Corps, USA; Wester, Derin, Wester (Derin), USA; Balaban, Carey, Balaban (Carey), USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 3-1 - 3-7; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

An individual's sense of spatial orientation is commonly attributed to be derived from visual, vestibular, and proprioceptive inputs. Spatial disorientation is often ascribed to arise from a conflict between one or all of these three systems. However, relying on this well studied view of spatial perception has not totally explained motion intolerance and spatial disorientation. It is likely that more than these three systems are involved in spatial orientation. This paper examines how cues obtained from posture, respiration, and blood flow contribute to spatial orientation. Disordered regulation of any of these factors can be identified in land based tests and allows us to study pre-disposing factors to motion sickness. In addition, examining these factors in motion environments allows us to study the mechanisms involved in motion intolerance. Postural studies were obtained in a cohort of individuals experiencing motion sickness in a variety of military environments. A definite pattern of altered postural control on

land was demonstrated in over seventy percent of these individuals. The predictive value of this test and refinement of the test for increased accuracy as a pre-screening method are examined in this report. A second cohort of individuals was examined while underway in a USA Navy ship. Respiratory and postural measurements were performed on 3 motion sick and three non-motion sick individuals within 24 hours of going to sea as well as 48 hours after the first measurement. Initial postural and respiratory adaptations were compared to ship motion and the strategies of individuals without motion sickness were compared to the strategies of the motion sick individuals. Adaptive patterns were examined in each group and found to be complete within 48 hours. The implications of these findings are examined in developing strategies to deal with spatial disorientation in a number of military settings. Technology is examined that might help us to better test individuals for adaptive strategies and train them so that spatial disorientation is not an issue in a planned operational event.

Author

Disorientation; Situational Awareness; Cues; Posture; Blood Flow; Respiration

20030019084 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

G-Transition Induced Loss of Orientation and Reduced G Threshold

Cheung, Bob, Defence and Civil Inst. of Environmental Medicine, Canada; Ercoline, Bill, Veridian Engineering, Inc., USA; Metz, Paul, Department of the Air Force, USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 4-1 - 4-8; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

It has been suggested that the psychophysical and physiological responses to the interplay of rotation and acceleration stresses may result in spatial disorientation (SD) (18, 4). The purpose of this presentation is to review past and current evidence on the possible relationship between disorientation and acceleration stress. Accident scenarios and a number of in-flight observations will be presented together with some theoretical postulates on the mechanisms involved. Our investigation suggests that execution of a series of rapid roll maneuvers prior to or following G transition may lead to loss of attitude awareness. This loss of attitude awareness can be attributed to perceptual confusion during roll maneuvers and the normal response of the vestibular apparatus to the rotary accelerative force acting on the semicircular canals. In addition, G threshold can also be significantly reduced immediately after prolonged rotation. This phenomenon is supported by past and current scientific evidence that the vestibular system exerts an influence on cardiovascular control. The next generation of high agility aircraft has enhanced maneuverability, which will expose pilots to a combination of translational and extraordinary angular accelerations. An understanding of the interaction between SD and acceleration stress is crucial to establish future research initiatives that will lead to appropriate countermeasures.

Author

Disorientation; Situational Awareness; Aircraft Maneuvers; Acceleration Stresses (Physiology)

20030019085 Universite de la Mediterranee, Lab. "Mouvement et Perception", Marseille, France

Head Position Control and Target Localization Performance in Changing Gravito-Inertial Field

Bourdin, C., Universite de la Mediterranee, France; Prieur, J.-M., Universite de la Mediterranee, France; Sares, F., Universite de la Mediterranee, France; Gauthier, G. M., Universite de la Mediterranee, France; Menu, J.-P., Institut de Medicine Navale, France; Montmayeur, A., Institut de Medicine Navale, France; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 5-1 - 5-9; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

A subject seated in a modern vehicle (i.e., aircraft) and performing motor tasks may be submitted to inertial forces (Coriolis and centrifugal forces). These forces are sources of spatial disorientation, leading to perturbations of sensori-motor behavior. The coding of the position of the head, which carries visual and vestibular sensors, is of particular interest with regards to this problem. We have investigated the influence of the position of the head on the accuracy of pointing movements towards visual memorized targets performed in a modified gravito-inertial field in 10 subjects seated 70cm off-center on a platform rotating at 120 deg/s. Subjects' head was either strongly immobilized in a vertical position (aligned with gravity vector) or completely free to move. Subjects were required to point as accurately as possible flashed visual targets presented in total darkness, before (PRE-rotation), during (PER-rotation) and after rotation of the platform (POST-rotation). Position of the head in the head free condition was recorded with an electromagnetic movement sensor (Polhemus Fastrack), whereas pointing accuracy as well as kinematics of the movements were recorded with an infrared position sensor device (Hamamatsu Motion Monitoring System). Whatever the position of the head (head free or head restrained), rotation of the platform induced errors in pointing towards flashed visual targets in the direction of the new imposed forces (to the right in our experiment). However, the errors were greater when the subject's head was free to move than when maintained in a vertical position. Results obtained in the head free condition show a strong correlation between the angular position of the head during rotation and the increased errors in pointing movements. Our data

demonstrate that a change in the position of the head during rotation of the platform may have a strong effect on the accuracy of goal-directed behaviours. Reaching at a visual target requires transformation of visual information about target position with respect to the line of sight, into a frame of reference suitable for the planning of hand movement (body-centred reference frame). Our data suggest that coding of the position of the head during centrifugation may be inaccurate, leading to errors in localizing the real position of the presented target relative to the body. Our experiment confirms that modification of the position of the head during centrifugation may be a source of disorientation. It seems that fixation of the head in a given position may reduce the emergence of spatial disorientation. Moreover, recent data obtained in our laboratory suggest that peripheral visual information may help subjects to stabilize their head in a given position and reduce target localization errors.

Author

Disorientation; Situational Awareness; Gravitational Physiology; Head (Anatomy)

20030019086 Centre de Recherches du Service de Sante des Armees, La Tronche, France

Spatial Disorientation by Derived Perceptions Generated by Military Systems *Desorientation Spatiale par Derives Perceptives Generees par Certains Systemes Militaires*

Raphel, C., Centre de Recherches du Service de Sante des Armees, France; Cian, C., Centre de Recherches du Service de Sante des Armees, France; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 6-1 - 6-4; In French; Also announced as 20030019078; Copyright; Avail: CASI; A01, Hardcopy; Distribution within the U.S. granted by agreement

The development of new technologies in the weapon systems generate sensory flows that can induce sensory interactions, conflicts and dysfunction. The consequences can be pathological disorders, spatial disorientation or space confusion. Most of these problems has been studied in the field of aviation and concerned large gravito-inertial forces. However, perceptual drifts have been observed for lower gravito-inertial forces generated by anti-aircraft guns. Studies of a visual tracking task have shown that low accelerations, under phenomenological thresholds of the vestibular system, unconsciously affect the spatial perception of a target. Basic studies suggest new explanations of the psychophysiological mechanisms of the vestibular system. Moreover, these data can help understand potential problems of spatial disorientation produced by low sensory stimulation.

Author

Disorientation; Situational Awareness; Optical Tracking; Visual Perception

20030019087 Air Force Research Lab., Biodynamics and Protection Div., Brooks AFB, TX USA

USAF Spatial Disorientation Survey

Matthews, Roger S. J., Air Force Research Lab., USA; Previc, Fred, Northrop Grumman Information Technology, Inc., USA; Bunting, Alex, QinetiQ Ltd., UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 7-1 - 7-13; In English; Also announced as 20030019078; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

A recent review of mishaps by the Air Force Safety Center (AFSC) determined that spatial disorientation (SD) was implicated in 20.2% of the Class A mishaps in the USA Air Force (USAF) between 1991 and 2000, at a cost of \$1.4 billion and 60 lives. However, mishap data only provide limited information about the impact of SD on air operations and, as aircraft losses are relatively infrequent, do not allow detailed analysis of SD by aircraft type. A more thorough understanding of how SD affects aircrew in day-to-day flying would allow appropriate countermeasures to be developed to reduce its impact. A survey was conducted and distributed USAF-wide by flight safety officers. The survey collected data about the incidence of a wide range of SD illusions experienced in the respondents' current aircraft type. Additional information about the most recent SD incident was also collected and analyzed. Data from 2582 completed surveys were analyzed, covering 2.17 million flying hours in 34 currently flown aircraft types. The top three causes of SD for each aircraft stream were: Fast Jet (FJ) - the leans, atmospheric blending of earth and sky, and misjudged position in night formation trail; Multi-Engine (ME) - black-hole approach, sloping horizon, and the leans; Trainer (TR) - the leans, atmospheric blending of earth and sky, and Coriolis illusion; and Rotary-Wing (RW) - undetected drift, misleading altitude cues, and brownout/whiteout. The incidence and severity of SD were related to aircraft stream with FJ and RW pilots being affected most. Overall, 8% of surveyed pilots had experienced a severe episode of SD adversely affecting flight safety. Experienced aircrew, as well as those that had received previous in-flight training, reported more illusions suggesting that these factors helped with recognition of SD in flight. Despite being a regular topic at flight safety briefings, pilots still frequently experience SD sufficient to impair performance. This USAF-wide SD survey identifies problem areas for pilots of different aircraft types, which should allow training and research to be targeted more effectively in future. However, with the advent of helmet-mounted displays, greater use of night vision devices, and increasing aircraft agility/performance, SD related

mishaps will continue to pose a significant threat to aircrew. Innovative technological solutions may be required to prevent an increase in SD related mishaps.

Author

Disorientation; Situational Awareness; Surveys; Flight Safety; Aircraft Pilots

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Preliminary Survey of Spatial Disorientation in UK Military Pilots and Navigators

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The direction of future spatial disorientation (SD) research and training is shaped primarily by the outcome of formal investigation of aircraft accidents and incidents. However, another source of vital information is aircrews' experience of SD that does not result in reported incidents. In order to access these experiences, Project Group 117 of Working Partly (WP) 61, Aircrew Standardization Co-ordinating Committee (ASCC) developed a SD survey postal questionnaire (INFO PUB 61/117/5), with the aim of providing a standard format for data collection and analysis. This paper reports the findings of a preliminary survey of UK aircrew. For the UK survey, a total of 1320 questionnaires were distributed to 5 Naval Air Squadrons, 22 Joint Helicopter Command Units and 7 Royal Air Force stations. Seven hundred and fifty-two questionnaires, comprising responses from 606 pilots and 146 navigators were returned. Analysis was conducted primarily on the pilot data. The most frequently experienced SD episodes were the leans (by 92% of respondents), loss of horizon due to atmospheric conditions (82%), misleading altitude cues (79%), sloping horizon (75%) and SD arising from distraction (65%). When asked to rate the severity of their most recent SD episode, 3.5% (21) categorized their incident as severe ('flight safety was at risk'). In general, the frequency of SD episodes and ratings of severity of the worst ever SD episode were positively related to flying experience (hours-on-type, total hours p less than 0.05). Overall, pilots who had received in-flight SD training reported more episodes of SD than those who had not participated in this training (p less than 0.05). Differences in types of SD experienced were found between aircraft categories, which mainly reflected the use of aids to flying: more episodes of SD during NVG use were reported by rotary-wing pilots compared to fast jet aviators (p less than 0.05). Fast-jet pilots reported more incidences of SD during HUD use than all other aviators (p less than 0.05). This preliminary survey has shown that SD is still a significant hazard of military flying. The relatively high incidence of SD resulting from poor crew co-ordination and distraction highlights the need for situation awareness SD instruction in addition to the more traditional 'illusion' training. The differences in SD experienced between aircraft type suggests that specific airframe SD training may be required. This survey has also shown the role of experience (flying hours) in the recognition of SD, and has highlighted the potentially beneficial effects of in-flight SD demonstration and training. Overall, this study shows that the WP61 postal SD Questionnaire is a useful tool for assessing how SD training and experience may benefit the recognition of situations that may cause SD. However it is difficult to access those situations where aircrew were truly disorientated. Phrasing questions in such a way that differentiates between experiencing an illusion and being disorientated because of the illusion may be beneficial.

Author

Disorientation; Situational Awareness; Aircraft Pilots; Navigators; Surveys

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A Spatial Disorientation Survey of Hellenic Air Force Pilots

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Spatial disorientation (SD) continues to be a largely unyielding problem in military and civilian aviation. SD training remains the sole solution of coping with this effect. In order to have more efficient training, we asked pilots the illusion they have probably had experienced in their flying career, attempting to study the prevalence and incidence rates of illusions and their correlation with specific types of aircraft. An anonymous questionnaire was distributed to pilots of Hellenic Air Force during their annual physical examination at Hellenic Air Force Center of Aviation Medicine, between December 2000 and June 2001. The questionnaire gathered information such as age, type of aircraft flown, flying experience. The pilots were asked to give the number of times they experienced each of the listed illusions. Statistical analysis was performed by using SPSS 8.0. A total of 407 surveys were collected. The mean age of the participants was 31.4 +/- 5.4 years old, and their flying experience 1012 +/- 908 hours. The most common types of aircraft flown were F4 and A7. 140 pilots (34.4%) answered that they had never experienced any kind of illusion.

Among the other 267 pilots, 71 reported that they had experienced 1 illusion (26.6%), 185 (69.3%) had experienced 2-10 different types of illusions and 11 above 10 different types of illusions (4.11%). The top 5 illusions reported were the leans (47.2%) primarily with F4, the Coriolis illusion (39%) primarily with F4, blending of earth and sky (38.2%) primarily with F4 and A7, flight instrument reversal (24.3%) primarily with F4 and sloping clouds or terrain (22.8%) primarily with F16 and A7. When asked to report their most personally critical illusion, 185 pilots responded. They classified the severity of their illusion to flight safety 111 (60%) as minor, 68 (36.75%) as significant and 6 (4.9%) as severe.

Author

Disorientation; Situational Awareness; Aircraft Pilots; Flight Safety; Surveys

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Analysis of Spatial Disorientation Mishaps in the US Navy

McGrath, Braden J., Naval Aerospace Medical Research Lab., USA; Rupert, Angus H., Naval Aerospace Medical Research Lab., USA; Guedry, Frederick E., University of West Florida, USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 10-1 - 10-12; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Spatial disorientation (SD) and subsequent loss of situation awareness (LSA) mishaps for military air forces, commercial aviation, and general aviation have an estimated annual cost in the billions of dollars. SD occurs when the pilot has an incorrect perception of the attitude, altitude, or motion of one's own aircraft relative to the earth or other significant objects. One example of the devastating effects of SD is the following mishap: A US Navy F-14 Tomcat, shortly after take off, crashed into a residential neighborhood destroying several homes and killing the two aircrew and three people on the ground. Causal factors in the mishap included SD and cockpit distraction. The Naval Aerospace Medical Research Laboratory (NAMRL) has developed an SD mishap analysis tool to support US Navy mishap boards in their investigations, to provide insight into the problem of SD in naval aviation, and to train aviators to avoid SD mishaps. The SD mishap analysis tool uses spatial orientation models and computer animation techniques to produce three-dimensional (3-D) computer simulations of SD mishaps. Using mishap data from flight data recorders, eyewitness accounts, radar transcripts, and videotapes, an estimate of the mishap pilot's spatial orientation perception is calculated using spatial orientation models. These spatial orientation models are based on current literature and additional data from centrifuge, aircraft experiments, and aircraft mishaps gathered at NAMRL over the previous 40 years. The estimated perceived pilot orientation, along with computer models of the actual aircraft attitude and altitude, flight data, and actual pilot position, are then used to develop a 3-D computer simulation of the SD mishap under consideration. The current spatial orientation models used in the SD mishap analysis tool are adequate to address many types of mishaps, including mishaps due to the somatogravic illusion. However, the current spatial orientation models do not provide accurate results for some types of SD mishaps. Further research and development is required to enhance the mishap analysis tool to provide accurate descriptions of pilots' perceptions in the full range of US Navy aviation environments. The SD mishap analysis system provides an intuitive tool that permits visualization of a complex problem. In the previous five years, results from these analyses have been used in mishap board reports, Judge Advocate General (JAG) investigations, congressional hearings, and television news reports.

Author

Disorientation; Situational Awareness; Accident Investigation; Navy; Armed Forces (USA)

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Effects of Spatial Disorientation on Cognitive Functions

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Spatial Disorientation is well known by fliers but, generally it is too difficult to overcome. Even if it is managed, a pilot might still be at risk of serious dangers. After simulating Spatial Disorientation in laboratory conditions, any impairment of cognitive functions of the pilots was examined in order to find out whether Spatial Disorientation has any negative effect on cognitive functions. Two groups of, totally 82 pilot candidates who were to have Spatial Disorientation training in Turkish Aeromedical Center, were given WAIS-DSST (Wechsler Adult's Intelligent Scale - Digit Symbol Substitution Test) or LCT (Letter Cancellation Test) to measure the differences of attention and percept after Spatial Disorientation. Both test results show that Spatial Disorientation causes impairment of cognitive functions.

Author

Aircraft Pilots; Armed Forces (Foreign); Turkey; Disorientation; Situational Awareness; Psychological Tests

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Pilot Disorientation, Sensorial Response Measured by Dynamic Posturography in SPAF Pilots

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The objective of the present work has been to study the relationship between subjective sensations of spatial disorientation and modifications in the response of the visual, somatosensorial and vestibular patterns, by CDP (Computerized Dynamic Posturography), after exposing pilots, with flight experience, to diverse profiles of SD in the Gyro GPT II trainer. The study hypothesis was that because of in the maneuvers of SD carried out with trainers, it produces movements that stimulate the visual, somatosensorial and vestibular systems, causing disorientation and motion sickness, it is possible to expect that these stimuli generate momentary changes in the organization and maintenance of balance and that those changes can be registered immediately by CDP after this stimulation. 80 pilots of the Spanish Air Force participated in the study. It was carried out in the of Flight Physiology Unit and in the Otorhinolaryngology (ORL) department of the SPAF Aeromedical Center (CIMA) during the months from June to December of 2001. The sample was selected at random among pilots that came to this Center to participated in the of physiological training programme. The inclusion criteria were to belong to the Spanish Air Force, to be in active and to develop flight duties as fighter or transport pilot. In the first phase the pilots were subjected to diverse types of somatogyral illusions (coriolis, leans, spin) in the Gyro GPT II trainer. After that they answered a questionnaire including the following data: age, weight, height, habits (consumption of alcohol, tobacco), exercise, flight hours, type of aircraft flown, previous episodes of SD and motion sickness. Personal observations about the profiles trained and presence or not of symptoms of SD or motion sickness (nausea, vomiting, sickness, pallor) during the training were also collected in the questionnaire. In the second phase the control of balance of these subjects was evaluated by dynamic posturography in the ORL department. The time between the first and the second phase should not excede more than seven minutes. In order to avoid reducing the effectiveness of the test derived from learning effects, suggested by some authors, and because of theses subjects, for their professional activities, have been previously selected without any balance disorders or pathologies, we didn't carry out a previous PDC in these pilots.

Derived from text

Disorientation; Situational Awareness; Aircraft Pilots; Sensory Perception; Posture

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Motorists Vestibular Disorientation Syndrome Revisited

Gresty, Michael A., Imperial Coll. of Science, Technology and Medicine, UK; Ohlmann, Theophile, Universite Pierre Mendes France, France; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 13-1 - 13-7; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

We present a framework within which to understand the causes of chronic susceptibility to disorientation and how it may be resolved. Motorists Disorientation Syndrome is given as an example disorientation syndrome which may occur without sensory or marked psychological disorder and resembles pilots' disorientation. The syndrome may begin with an episode of disorientation or a sensory impairment and thereafter can cause dysfunctional behaviour. A neglected feature of disorientation is that contextual stimuli such as differential movements of parts of the visual field may support alternative interpretations affecting orientation. These are not necessarily at a conscious level but are still able to induce apprehension or inappropriate behaviour: a susceptibility to subliminal percepts. Once sensitized to the intrinsic ambiguities of a complex environment it becomes difficult to adjust gains and asymmetries or re-establish rules of reference between somaesthetic and vestibular signals. A fundamental problem in establishing rules for interpreting sensory input is circularity of reference between somatic and visual signals and vestibular signals of motion in space. Somatic and visual signals which give relativistic information about motion are referenced to vestibular signals of absolute motion in space for interpretation. Conversely vestibular signals are calibrated by reference to these other sensory input. Should a problem of interpretation arise in this potentially vicious circle the only recourse is to make an exploratory appraisal of the environment in which the natural first choice for perceptual sampling of world events is vision because of it teleceptive and panoramic power. Unfortunately, this tactic creates 'visual dependency' which, in a complex environment, risks creating increased susceptibility tovection illusions and visual vertigo (correspondingly, clinical experience indicates that the longer symptoms remain untreated the more patients suffer visual vertigo). Resolution of this deterioration is by recourse to

cognitive behavioural therapy and desensitization, commencing with dealing with simple stable environments and progressing through levels of increasing instability and ambiguity.

Author

Motor Vehicles; Operators (Personnel); Disorientation

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Disorientation, Dizziness and Postural Imbalance in Race Car Drivers: A Problem in G-Tolerance, Spatial Orientation or Both

Guedry, Frederick E., University of West Florida, USA; Raj, Anil K., University of West Florida, USA; Cowin, Thomas B., University of West Florida, USA; *Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures*; February 2003, pp. 14-1 - 14-14; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

On April 28, 2001, Championship Auto Racing Teams (CART) drivers reported experiences of disorientation, dizziness, nausea and blurred vision during practice trials on the Texas Motor Speedway (TMS). Following the practice trials, there were reports of postural imbalance. As a result, the Firestone Firehawk 600 race scheduled for Sunday April 29 was cancelled, the first time in auto racing history that concerns about driver intolerance to G forces caused a cancellation. The four drivers who did not experience problems had completed less than 20 laps (drive time of 8 min) whereas those reporting symptoms had driven on the track for more than 8 min. Using track data (maximum average speed in qualifying laps, radius of turns, bank angle of turns), we have calculated the magnitudes of 'gravito-inertial forces' experienced by drivers on a number of speedways in the US. This reveals that drivers experience high G, particularly lateral G (Gy) on most speedways. Other tracks, eg., Dover Motor Speedway, also have steep banks and relatively small-radius turns, but have been raced at lower speeds. Some have banked turns that are steeper than the TMS turns. Calculated G-loads were greatest on the TMS, due to 220-250 mph car speeds. However, considering the semi-reclining posture of drivers, Gz on turns was not in a range that would be expected to produce G induced loss of consciousness (G LOC). It is suggested that the pattern of visual, vestibular and proprioceptor stimulation contingent upon driver control actions during repetitive laps on the TMS is responsible for the dizziness, disorientation, blurred vision and nausea experienced by the drivers, and onset of adaptation to these conditions induced the postexposure postural imbalance. Calculation of tri-axial angular and linear accelerations during two imaginary laps on the TMS at speeds and lap times comparable to those reported are used to compare driver's stimulus conditions to conditions that produce spatial disorientation, nausea, and postural imbalance in centrifuge experiments, in military and commercial aviation and in other modes of modern transportation. Avenues of research necessary for advances in dealing with the problems of drivers, aviators, passengers in modern transportation and even 'dizzy' patients are discussed. A multi-national approach is necessary for near-term advances.

Author

Disorientation; Vestibular Nystagmus; Motor Vehicles; Operators (Personnel); Gravitational Physiology

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Disorientation in Helicopter Ditching and Rigid Inflatable Boat Capsizement: Training is Essential to Save Crews

Brooks, C. J., Survival Systems Ltd., Canada; *Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures*; February 2003, pp. 15-1 - 15-13; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

This paper discusses the disorientation problems of escape from a rigid inflatable boat (RIB) that has been capsized. It makes comparisons with executing a ditched helicopter underwater escape and emphasizes the need for realistic training for both RIB and helicopter crafts. Although very poor records are collected on RIB capsizements, each year there is a small but significant loss of life and many close calls. A paper at the Royal Institute of Naval Architects in 1998, reported 13 deaths from an accident involving the Sea Gem in 1965, but gave no further details. The Transportation Safety Board of Canada reported the case of the G.R.1 FRC launched from the Gordon Reid off British Columbia, which grounded and flung the three occupants over the rocks and back into the water. Miraculously, all three survived. Rigid inflatable boats or fast rescue crafts (FRC) are used by every Navy in the world, as well as many other paramilitary and commercial marine organizations. In 1998, it was reported that the US Coast Guard alone operated over 700 FRCs. to date, no one has examined the problem of escape from such a vessel after it has been capsized, although Oakley has examined the pros and cons of wearing head protection while operating small, fast boats (Reference 2). This paper discusses a recent experiment conducted by Survival Systems to examine the problems of underwater escape from a capsized FRC.

Author

Disorientation; Escape (Abandonment); Helicopters; Lifeboats

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Spatial Disorientation: Causes, Consequences and Countermeasures for the USAF

Heinle, Todd E., Air Force Research Lab., USA; Ercoline, William R., Veridian Engineering, Inc., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 18-1 - 18-7; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Spatial disorientation (SD) remains a serious drain on USAF resources and personnel. During the ten-year period of 1990-1999, the USAF experienced 36 SD-related Class A mishaps costing a total of \$557M and the loss of 44 aircrew. SD is the single most common cause of human-related aircraft accidents. The causes of SD are complex and require an understanding of the types of SD, the physiology and psychology of flight, and the way pilots train for the prevention of SD. Research has shown there are three distinct types of SD - unrecognized, recognized and incapacitating. Each type impacts the pilot in a different way, and each should be thoroughly understood by the pilot before he or she experiences them in flight. Results from a study of the Post-Roll Illusion (Type I), the Graveyard Spin Illusion (Type II), and a report from a pilot who experienced the Giant Hand Illusion (Type III) is presented. Spatial orientation training techniques are included. Finally, the USAF's Spatial Disorientation Countermeasures Program, designed to reduce the number of SD mishaps, is also presented. This program emphasizes shared knowledge across all flying communities, including research in the areas of attitude awareness (visual and vestibular), multi-sensory integration (3-D audio and tactile stimulation), and both ground-based training and flight-based demonstrations. Although the phenomenon of spatial disorientation (SD) has been described and documented by many, both researcher and aircrew, since the earliest days of aviation, a complete understanding of the complex mechanisms and interactions has remained elusive. The economic consequences alone of SD are enormous, both in cost of lost aircraft and cost of training new aircrew. This paper will provide examples of different types of SD, the interrelationship of SD to loss of situational awareness (LSA), and a brief summary of the US Air Force Research Laboratory's current SD Countermeasures program.

Author

Disorientation; Situational Awareness; Armed Forces (USA); Pilot Training

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A SD-Demonstration Program for German Navy Tornado Aircrew, First Results

Pongratz, H., Institute of Aviation Medicine, Germany; Brix, B., Institute of Aviation Medicine, Germany; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 19-1 - 19-5; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Distribution within the U.S. granted by agreement

Based on a class 1 aircraft accident of the German Navy in 1997 and a class 1 mishap of the German Air Force (GAF) in 1998 with the loss of all four crewmembers, Division III of the GAF Institute of Aviation Medicine installed a program for Tornado aircrew to demonstrate various SD (spatial disorientation) situations in the Flight Orientation Trainer. Although during these accidents every possible flight information was available to the aircrew, the situation was not perceived as disorienting and dangerous but the focus stayed on the primary task intended or wrong priority chosen.

Author

Aircraft Accidents; Disorientation; Flight Crews; Training Devices; Situational Awareness

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Spatial Disorientation Demonstration in The Netherlands

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In this paper we give an outline of the ground course on spatial disorientation that TNO Human Factors provides for military student aviators of the Royal Netherlands Airforce. During this one-day course a variety of laboratory equipment is used to let students experience and understand different disorienting phenomena and to make them aware of the peculiarities and limits of their sensory systems. With these demonstrations students learn in what situations disorientation, and possibly also symptoms of motion sickness, can be expected and when not. The course also includes an introductory session on the consequences of night vision for situational awareness, which we will describe here. We pay special attention to the motivation and form of the course. Finally we briefly discuss how the flight simulated demonstrator (DISO) of the RNLAf will be employed for demonstrating some

flight-related visual illusions and how we upgraded the cockpit with night vision compatibility for practicing the use of night vision goggles (NVG).

Author

Aircraft Pilots; Disorientation; Situational Awareness; Pilot Performance; Sensorimotor Performance

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Spatial Disorientation Experiments and Training in Polish Air Force Institute of Aviation Medicine

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Spatial disorientation (SD) is a long recognized problem in aviation environment. During flight the spatial disorientation may appear as a result of inadequate perception of the position or attitude of an aircraft in comparison of the co-ordinate system constituted by the Earth surface. It is extremely difficult to say how often spatial disorientation became the reason of military aircraft accidents but in Poland it is calculated at around 8%. There is no ultimate cure for spatial disorientation; the two ways considered most important are pilot training and extensive research leading to better understanding of nature of SD which is little known despite of about forty years of worldwide awareness about this problem. Probably every air force in the world has its own methods for SD prevention and training programs. We think that the most comprehensive approach to this question is the introduction of wide training program using all available equipment and conducting further experiments increasing our knowledge about this very complex problem. In 1998 PAFIAM (Polish Air Force Institute of Aviation Medicine) went out with initiative of conducting the initial course and training counteracting spatial disorientation with Polish military pilots using three simulators. The full-mission flight simulator "Japetus" is the first element of this system of devices to work on spatial disorientation prevention. Another device is lately obtained Gyro-IPT spatial disorientation simulator, the main purpose of which, contrary to "Japetus", is use in spatial orientation demonstration and training. Both previously mentioned devices are lacking of important possibility in terms of presentation of influence of linear acceleration on pilot's vestibular system. To make possibilities of presentation and training more comprehensive we decided to include human carrying centrifuge into spatial disorientation program.

Author

Situational Awareness; Aircraft Pilots; Pilot Performance; Sensorimotor Performance; Aircraft Accidents

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Spatial Disorientation Awareness Instruction Given to Aircrews Serving in the French Armed Forces *Sensibilisation Pratique du Personnel Navigant a la Desorientation Spatiale dans les Armees Francaises*

Gigaut, Didier, Centre d'Essais en Vol, France; Lejeune, Damien, Centre d'Essais en Vol, France; Derain, Patrick, Centre d'Essais en Vol, France; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 22-1 - 22-4; In French; Also announced as 20030019078; Copyright; Avail: CASI; A01, Hardcopy; Distribution within the U.S. granted by agreement

The Flight Personnel (PN) of the armed forces are subjected to physiological constraints related either to the environment or to the performance of the airplane. These constraints and their effect on flight safety are such that it has appeared necessary to give the PNs a basic knowledge on this subject. There is a circular distributed by the ministry that defines the basic medical instructions during flight for the PNs. The theoretical instructions are given during professional training at the school; the practical portion is given at the Laboratory of Medical/physiological Studies 16/330 (LEMP) at the beginning of flight instruction. The LEMP is a unit of the Military Aerial Experiment Center, located at Mont de Marsan southwest of Bordeaux and it is also the Department of Operational Medicine at the Institute of Aerospace Medicine of the Army's Division of Healthcare, the other departments of which are at Bregny sur Orge in the Paris region. The 2-day training course of basic aeromedical instruction at the LEMP includes a theoretical summary and practical demonstrations. The proposed instruction program principally deals with spatial disorientation and hypoxemia. A whole day is devoted to spatial disorientation.

Author

Armed Forces (Foreign); Flight Crews; Education; Disorientation; Situational Awareness; Schools

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Assessment of Motion Devices Used for Spatial Orientation Research and Training

Spenny, Curtis H., Air Force Inst. of Tech., USA; Liebst, Bradley S., Air Force Inst. of Tech., USA; Spatial Disorientation in

Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 23-1 - 23-19; In English; Also announced as 20030019078; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

There are many unresolved issues related to motion-based simulators including: 1) should they even be used, 2) if so, what drive configurations might be preferred and to what aspects of flight should they be applied, 3) what motion cues and artifacts are critical, 4) what drive algorithm or set of drive algorithms best utilizes the motion capabilities of a given configuration to emulate critical aircraft motion cues while producing minimal artifacts, and 5) how can pilot-driven algorithms be made more effective at teaching recovery from the perceptual conflicts of spatial disorientation? None of these questions are answered by this paper. What the paper does contain is a description of the capability of a computer simulation of motion simulators that can be used to help quantitatively address these questions. A sample aircraft maneuver is evaluated for several variants of drive configuration and drive algorithm to illustrate the measures for quantitative comparison of motion systems and the level of effort and input data required to make the comparison. The paper indicates the status of an ongoing effort to develop a modeling tool for use by the spatial orientation and flight simulation communities to gain further understanding of the role of motion simulators.

Author

Algorithms; Computerized Simulation; Situational Awareness; Motion Simulation; Flight Simulation; Flight Training

20030019103 Army Aeromedical Research Lab., Fort Rucker, AL USA

Use of Simulator Spatial Disorientation Awareness Training Scenarios by the US Army and National Guard

Estrada, Arthur, Army Aeromedical Research Lab., USA; Adam, Gina E., Army Aeromedical Research Lab., USA; Leduc, Patricia A., Army Aeromedical Research Lab., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 24-1 - 24-23; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Every year the U.S. Army loses aviation assets due to spatial disorientation (SD). All aircrew members, regardless of flight experience, are vulnerable to SD. Despite academic training and new technologies, SD accident rates are not improving. In 1997, the USA Army Aeromedical Research Laboratory (USAARL) developed a method of simulator training to provide experience with factors leading to potentially disorienting events. Actual SD accident summaries were reviewed and those accidents which could reasonably be replicated in a visual flight simulator were selected for the training scenarios. The published scenarios were distributed and were available for use by units on a voluntary basis for three years. Although touted as excellent by Army aviation leaders, this training is not required at any aviator training level. The primary purpose of the study was to determine the extent to which the USAARL SD awareness scenarios are used and are thought to benefit those receiving the training, and whether there is a desire to make the scenarios mandatory in aviators' annual simulator training requirements. A survey evaluating aviator SD experiences, and knowledge, use and opinions of the scenarios was distributed to U.S. Army/National Guard (NG) aviation units worldwide. The responses were used to produce descriptive statistics to determine relationships between flight experience levels and SD experience, experience levels/duty positions and exposure to SD scenario training, and to ultimately determine the level of acceptance of the USAARL SD awareness scenarios in the U.S. Army/NG. The findings revealed that the National Guard has been more aggressive in its voluntary integration of this training than the active Army. A majority of the sample having experience with the USAARL SD awareness scenarios had a positive opinion of the training indicating that it has 1) better prepared them to recognize factors which make SD more likely, 2) improved decision-making skills, 3) improved overall situational awareness and crew coordination skills, and that 4) all aviators would benefit from the training. With the apparent support for such training, aviation leaders could implement a training program with minimal effort. The research revealed that the majority of U.S. Army/NG aggregate has not been trained using the simulator scenarios. Apparently, without specific guidance and a regulatory requirement, simulator SD awareness training will not be conducted extensively. Without active advocacy, what appears to be an effective means to mitigate the SD hazard will continue to be overlooked, and SD will continue to take its toll on the aviation community.

Author

Aircraft Pilots; Armed Forces (USA); Pilot Training; Simulators; Situational Awareness

20030019104 Headquarters Army Aviation, Middle Wallop, UK

An Internal Validation of the British Army Spatial Disorientation Sortie

Hiatt, Keith L., Headquarters Army Aviation, UK; Braithwaite, Malcolm G., Headquarters Army Aviation, UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 25-1 - 25-13; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Following didactic instruction, most aircrew are able to experience some of the disorienting illusions and limitations of the orientation senses in a variety of ground-based simulation devices such as the Barany chair. In order to reinforce instruction in

spatial disorientation (SD) within the environment in which they operate, British Army Air Corps (AAC) helicopter pilots additionally receive an airborne demonstration of the limitations of their orientation senses during initial pilot training and as a quadrennial requirement post-graduation. The sortie syllabus has been previously described. The objective of the assessment presented herein was to determine whether the SD demonstration sortie was a valid method for training aircrew in SD in the AAC. This paper records the results of an anonymous voluntary questionnaire completed by 265 experienced aviators and aviators in training over a two and a half year period immediately following the sortie. The results were entered into a relational database and evaluated by a disinterested party using standard descriptive statistics. The following conclusions were made: the maneuvers performed in the SD demonstration sortie, and the sortie overall, were extremely effective at demonstrating the limitations of the orientation senses. Furthermore the aviators considered that the sortie greatly enhanced their overall awareness of SD. Thus we may conclude that the sortie satisfies the internal validation process of the Systems Approach to Training.

Author

Disorientation; Flight Training; Flight Crews; Situational Awareness; Sensory Perception; Flight Simulation

20030019105 Defence Science Technology Lab., Air Platforms, Farnborough, UK

From Safety Net to Augmented Cognition: Using Flexible Autonomy Levels for On-Line Cognitive Assistance and Automation

Taylor, Robert M., Defence Science Technology Lab., UK; Brown, Lex, Royal Air Force, UK; Dickson, Blair, QinetiQ Ltd., UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 27-1 - 27-21; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Human factors research into spatial disorientation (SD) and loss of situation awareness (SA) in the fast jet military pilot has led to consideration of systems for monitoring pilot behaviour and psychophysiology and for detection of performance degradation and incapacitation. These could be the basis of real-time countermeasures, such as a "Safety Net" system, assisting or taking over automatic control until the pilot is able to resume full control of the system. This paper looks at technologies developed under the UK MOD "Cognitive Cockpit" project for providing cognitive assistance through adaptive automation and decision support. The paper considers the requirements for monitoring and countermeasures for cancelling SD. It is argued that all three basic types of SD can be cancelled by effective real-time adaptive countermeasures using flexible levels of autonomy governed by pilot agreed plans. Through analysis and cognitive walk-through of a mission story-board, we show how the safety net concept can be extended by cognitive automation to provide augmentation of SA and decision making. Cognitive augmentation can be seen to mitigate the most dangerous form of insidious disorientation, by keeping the pilot in the control loop before SD sets in.

Author

Autonomy; Situational Awareness; Pilot Performance; Disorientation; Pilot Support Systems; Decision Support Systems

20030019106 Swedish Defence Research Establishment, Dept. of Man-System Interaction, Linköping, Sweden

On the Possibility of Counteracting or Reducing G-Induced Spatial Disorientation With Visual Displays

Eriksson, Lars, Swedish Defence Research Establishment, Sweden; vonHofsten, Claes, Uppsala Univ., Sweden; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 28-1 - 28-7; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The possibility of counteracting or reducing g-induced spatial disorientation in fighter aircraft with visual displays is discussed in connection with the "classical" distinction between focal/ambient vision and inside-out/outside-in attitude display concepts. A relatively simple and uncomplicated laboratory method is presented that is utilized for exploring primarily visual flow coupling with spatial orientation. In part building on some experimental results from using the method some schematic implementation examples are illustrated, and some preliminary display design guidelines are also suggested.

Author

Disorientation; Display Devices; Aircraft Pilots; Situational Awareness; Gravitational Effects; Aircraft Instruments

20030019107 Montreal Univ., Inst. de readaptation de Montreal, Quebec Canada

Perception of the Vertical With a Head-Mounted Visual Frame: Implication for the Design of Helmet-Mounted Displays in Aeronautics Perception de la Verticale avec un Cadre Visuel Solidaire de la Tete: Implications pour la Conception des Afficheurs de Casques en Aeronautique

Mars, Franck, Montreal Univ., Canada; Vercher, Jean-Louis, Universite de la Mediterranee, France; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 29-1 - 29-17; In French; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The works presented are intended for determining if including visual references of head movements, a possibility offered by the helmet display devices, can influence the perception of the orientation of a visual object. A preliminary experiment studies the influence of a visual head-centered frame on the subjective vertical, when the head is inclined in the frontal plane. It shows that inclining the head with the visual frame results in modifications made in estimating the vertical in the direction of the incline. These errors cannot be explained by an addition of errors attributable to the visual frame and to the inclination of the head when the effects of the two disturbances are evaluated independently. Moreover, the view of the visual head-centered frame during movement does not reduce the error, which is in contrast with the reduction of errors observed when the visual frame is dissociated from the head. A second experiment compares the subjective vertical and the performance in a task of reorientation of the head when the entire body is inclined. Estimates of the vertical are made in the presence either of a visual head-centered frame, or of an integral frame of the movements of the trunk but dissociated from the head. The results show that a visual head-centered frame modifies the orientation behavior of the head, which contributes to significantly increasing the estimating errors of the vertical generated by the frame. The two studies emphasize the fundamental role of the head-centered universal set in the processing of visual information for the perception of spatial orientation. They suggest that surrounding the altitude indicators with the integrated visual information of the head in the helmet display devices could contribute to spatial disorientation, in particular during night flights.

Author

Helmet Mounted Displays; Visual Perception; Disorientation; Head Movement

20030019108 Air Force Academy, CO USA

Assessment of Pilot Performance Using a Moving Horizon (Inside-Out), a Moving Aircraft (Outside-In), and an Arc-Segmented Attitude Reference Display

Self, Brian P., Air Force Academy, USA; Breun, Maggie, Air Force Academy, USA; Feldt, Brent, Air Force Academy, USA; Perry, Carlene, Air Force Academy, USA; Ercoline, William R., Veridian Engineering, Inc., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 30-1 - 30-7; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Flight symbology offers one of the primary countermeasures that can help prevent and alleviate spatial disorientation. As new helmet-mounted displays (HMDs) are being created, we must develop more effective methods of supplying the pitch and bank information to the pilot. While most flyers have long used the inside-out attitude indicator, or a moving horizon (MH) display, many studies have shown that an outside-in display, or a moving airplane (MP), is more intuitive. However, a recent study at Brooks Air Force Base suggests that a new symbology called the arc-segmented attitude reference display (ASAR) produces even better performance and a faster learning curve than either the MH or MP. If found to be operationally relevant, the ASAR should be considered as a likely candidate for HMD flight symbology. Students in an introductory flight course at the US Air Force Academy were tested on three different display symbologies, the MH, MP, and the ASAR. The displays were presented on a 17-inch color monitor. The experimental sequence was: (1) practice free flight, daytime scene; (2) perturbed flight, nighttime scene; (3) practice unusual attitude recoveries (UARs), nighttime scene; and (4) test UARs, nighttime scene. During the UARs, subjects were instructed to first roll the aircraft to level the wings, then recover to straight and level flight as quickly as possible. Six different parameters were analyzed during the study: RMS (root mean square) error in roll and pitch during perturbed flight; time to initial stick input in roll and pitch during the UARs; time to straight and level flight during the UARs; and finally, the number of roll reversal errors during the test UARs. The subjects had the fastest roll and pitch times to initial stick input when using the ASAR, although this display tended to have slightly poorer subjective ratings. The MP display had a slightly faster time to roll input than the MH, but the pitch inputs were identical. Based on these results, the ASAR display is the most effective at portraying attitude information.

Author

Attitude Indicators; Pilot Performance; Aircraft Pilots; Symbols; Helmet Mounted Displays; Flight Simulation

20030019109 Naval Aerospace Medical Research Lab., Pensacola, FL USA

A Tool to Maintain Spatial Orientation and Situation Awareness for Operators of Manned and Unmanned Aerial Vehicles and other Military Motion Platforms

Rupert, Angus H., Naval Aerospace Medical Research Lab., USA; McGrath, Braden J., Naval Aerospace Medical Research Lab., USA; Griffin, Matt, Flight Test Squadron (0018th), USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 31-1 - 31-15; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The Naval Aerospace Medical Research Laboratory has developed a Tactile Situation Awareness System (TSAS) that intuitively provides spatial orientation, navigation and threat/targeting information to operators of various military platforms. The

TSAS consists of tactile stimulators (tactors) on the torso and limbs of the body that relay processed information from a variety of sensors to the operator. Since 1992, the advantages of TSAS have been demonstrated in several applications including helicopters, fixed-wing, Unmanned Aerial Vehicles (UAVs), High-Altitude High-Opening (HAHO) parachuting, undersea, and land (1-5). Before any piece of hardware becomes part of the military inventory, the user community conducts operational test and evaluation (OPTEVEVAL) and Operational Utility Evaluations (OUE) to identify strengths, weaknesses, and suitability in a wide variety of operational conditions. These tests also serve to develop concepts of operation. In the first section of this paper, we will present some of the data collected during an Operational Assessment (OA) of TSAS conducted by the 18th Flight Test of the USAF at Hurlburt Field. In the second portion, we address some of the strengths and weaknesses of TSAS technologies and the improvements made over the past decade.

Author

Situational Awareness; Aircraft Pilots; Pilotless Aircraft; Man Machine Systems; Pilot Support Systems

20030019110 Naval Aerospace Medical Research Lab., Pensacola, FL USA

Enhanced Situation Awareness in Sea, Air and Land Environments

Chiasson, John, Naval Aerospace Medical Research Lab., USA; McGrath, Braden J., Naval Aerospace Medical Research Lab., USA; Rupert, Angus H., Naval Aerospace Medical Research Lab., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 32-1 - 32-10; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

USA (US) military Special Forces teams currently use 2D visual displays for navigation information in the air, in water, and on the ground. These current displays demand the user's visual attention, which can compromise mission effectiveness, and using visual displays in low light visibility environments can cause fatigue, degrade performance, and compromise a clandestine situation. If navigation equipment that is dependent on visual displays were integrated with a tactile display, the need to use vision for navigation could be minimized. The operator could be more effective if his eyes were used to survey the surroundings rather than continuously monitor a visual display. The Tactile Situation Awareness System for Special Forces (TSAS-SF) was developed to investigate the potential of tactile displays for Special Forces operations. The TSAS-SF will upgrade present 2D visual navigation displays and will provide non-visual, non-audible navigation information to Special Forces personnel by interfacing navigation information with a tactile display. This new capability will provide 2D direction cues to the skin, which will free the user's visual senses for higher priority tasks (e.g. contact identification and classification). Preliminary testing in a High Altitude, High Opening (HAHO) parachute environment and a ground environment, and earlier testing in an underwater environment, have demonstrated that navigation can be performed faster with tactile cues than visual cues, and superior navigational accuracy can be achieved with less mental fatigue on the operator. These results suggest that a tactile display that provides 'eyes free' and 'hands free' air and ground navigation information may provide the opportunity to devote more time to other instruments and tasks when operating in high workload conditions. These effects can increase mission effectiveness. The preliminary results from the air and ground navigation tests justify continued testing and evaluation to extend the capabilities of the tactile display, for use as an operational device for navigation in sea, air and land environments.

Author

Display Devices; Cues; Touch; Situational Awareness; Military Operations; Navigation Aids

20030019111 QinetiQ Ltd., Centre for Human Sciences, Gosport UK

The Use of Tactile Navigation Displays for the Reduction of Disorientation in Maritime Environments

Dobbins, Trevor, QinetiQ Ltd., UK; Samways, Shaun, QinetiQ Ltd., UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 33-1 - 33-6; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The maritime environment can be difficult to navigate in, due to poor visual cues, leading to disorientation and the potential for operational failure. The sense of touch is often overlooked as a mode of information display, but is ideally suited to providing intuitive navigation cues. Tactile cues provide a potential method to overcome these visual limitations and provide an alternative mode of displaying information from the more common visual and audio mediums. The QinetiQ Centre for Human Sciences have developed a Navigation Tactile Interface System (NTIS) that displays navigation cues through the highly intuitive sense of touch. This has been demonstrated in high-speed boats by the setting of the blind world water speed record with the use of the QinetiQ NTIS, and underwater by the US NAMRL Tactile Situation Awareness System which allowed divers to successfully complete a navigation exercises using only tactile cues. Therefore, tactile navigation displays have the potential to reduce disorientation in maritime environments and improve operational performance.

Author

Touch; Navigation Aids; Disorientation; Display Devices; Surface Navigation

20030019112 Headquarters Army Aviation, Middle Wallop, UK

Spatial Disorientation: Towards International Standardization

Braithwaite, Malcolm, Headquarters Army Aviation, UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 34-1 - 34-7; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Spatial Disorientation (SD) remains an important source of attrition in both military flying and general aviation. Several recent symposia and technical meetings have recommended various initiatives to control this hazard such as improvements in training and the standardization of mishap and incident data. In the first area, improved and standardized methodologies of training with appropriate training objectives for aircrew training in SD are intended to produce curricula that will provide international air forces with the ability to ensure that aircrew have a common training base. In the second area, the development of a standardized method of data collection, terminology and reporting for SD related topics would enable a common accident database from which factors involved in the SD accident or incident can be determined. Similarly, a standardized format for data collection from surveys of aircrew experience of SD would be extremely useful for comparative and education purposes. Ultimately, research into SD and the application of training countermeasures can be better coordinated, and more effectively and economically applied. Such enhancements are already being progressed in the military forum through the Air Standardization Coordinating Committee (ASCC). Other international services and organizations (NATO in particular) could readily adopt many, if not all, these initiatives. This paper summarizes the achievements to date and outlines the way in which other organizations can both benefit from the work already achieved, and also contribute to the anticipated improvement in mission effectiveness and flight safety.

Author

Disorientation; International Cooperation; Pilot Training; Standards; Flight Crews

20030019113 Institute of Aviation Medicine, Fuerstenfeldbruck, Germany

Postural Stability in Pilots Under Vestibular Stress: A Comparative Look at Pilot Candidates Versus Experienced Jet-Aircrews

Brix, B., Institute of Aviation Medicine, Germany; Pongratz, H., Institute of Aviation Medicine, Germany; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 35-1 - 35-5; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Distribution within the U.S. granted by agreement

All Air Forces battle the lack of sufficient recruitment of pilot and aircrew candidates. One way to solve the problem is to look into extending the flying career of an individual. German regulations require jet aircrew members - except those in commanders' positions - to stop flying at the age of 41 and leave the Bundeswehr to pursue a civilian career. This means the loss of experienced aircrews not because of medical problems but because of legal requirements. This age restriction of 41 might not be justified any more from a medical point of view. Aeromedical specialists all around the world are looking into the issue of aircrew aging. Orientation in space and postural control are very important for any aircrew. In this study we compared the postural control of experienced pilots versus pilot candidates. We tried to determine possible differences between the age groups to get an indication of the ability to control one's position in space after a strong vestibular stimulus. As a working hypothesis, we assumed that there would be no significant differences between the two groups of test persons. In Div. III of the German Air Force Institute of Aviation Medicine we looked into the postural stability of pilot candidates versus experienced jet pilots after subjecting them to a strong vestibular stress induced by the Flight Orientation Trainer (FOT). The FOT was installed in Fuerstenfeldbruck in 1994. Its fully cardanic gondola with its cockpit is mounted on a 30 ft planetary arm. The Flight Orientation Trainer with its ability to rotate freely in space around all three axes can stimulate the vestibular and otolith organs. Especially coriolis effects can be generated by rapidly changing the rotational plane. The test persons were rotated about their yaw axis at 120/sec or 20 RPM and at the same time on the planetary arm of the FOT at 150/sec or 15 RPM. Each trial lasted exactly 180 sec and ended abruptly with a simultaneous deceleration in both axes, inducing a strong coriolis effect. The time of continuous motion lasted approximately 150 sec. Before entering and after exiting the FOT the test persons were guided to the posturography. The distance from the FOT to the posturography was 25 meters. The time between the end of the FOT run and the start of the posturographic measurement was approximately 90 seconds.

Author

Flight Crews; Age Factor; Posture; Sensory Stimulation; Vestibules; Training Simulators; Physiological Tests

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Visual and Vestibular Determinants of Perceived Eye-Level

Cohen, Malcolm Martin, NASA Ames Research Center, USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 37-1 - 37-8; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Both gravitational and optical sources of stimulation combine to determine the perceived elevations of visual targets. The ways in which these sources of stimulation combine with one another in operational aeronautical environments are critical for pilots to make accurate judgments of the relative altitudes of other aircraft and of their own altitude relative to the terrain. In a recent study, my colleagues and I required eighteen observers to set visual targets at their apparent horizon while they experienced various levels of $G(\text{sub } z)$ in the human centrifuge at NASA-Ames Research Center. The targets were viewed in darkness and also against specific background optical arrays that were oriented at various angles with respect to the vertical; target settings were lowered as G_z was increased; this effect was reduced when the background optical array was visible. Also, target settings were displaced in the direction that the background optical array was pitched. Our results were attributed to the combined influences of otolith-oculomotor mechanisms that underlie the elevator illusion and visual-oculomotor mechanisms (optostatic responses) that underlie the perceptual effects of viewing pitched optical arrays that comprise the background. In this paper, I present a mathematical model that describes the independent and combined effects of $G(\text{sub } z)$ intensity and the orientation and structure of background optical arrays; the model predicts quantitative deviations from normal accurate perceptions of target localization under a variety of conditions. Our earlier experimental results and the mathematical model are described in some detail, and the effects of viewing specific optical arrays under various gravitational-inertial conditions encountered in aeronautical environments are discussed.

Author

Visual Stimuli; Vestibules; Eye (Anatomy); Gravitational Physiology; Visual Perception; Horizon; Targets

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Reducing Negative Effects from Virtual Environments: Implications for Just-In-Time Training

Cohn, Joseph, Naval Air Warfare Center, USA; Muth, Eric, Clemson Univ., USA; Schmorrow, Dylan, Defense Advanced Research Projects Agency, USA; Brendley, Keith, Artis, LLC, USA; Hillson, Roger, Naval Research Lab., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 38-1 - 38-9; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Current U.S. Naval doctrine places increasing emphasis on providing just-in-time training. This means training the deployed sailor when they need the training, wherever they happen to be. This differs from classic training doctrine that calls for placing a completely trained expert in the field. This shift in doctrine is a direct response to reduction in force sizes, necessitating fewer experts and more generalists. Just-in-time training requires the generalists to be somehow brought up to expert standard in the field. One way to fill this requirement is through the use of deployable training systems. In this sense, 'deployable' refers to a system that requires minimal space, demands little if any maintenance, and is easy to set-up. Virtual Environment (VE) training systems, with their inherently small footprint, and fundamental reliance on software rather than hardware solutions, represent a seemingly elegant solution to many of these challenges. However, VE systems bring with them their own unique set of challenges that can negatively impact skill learning during VE exposure, as well as significantly reduce military personnel's ability to perform mission-critical tasks following VE exposure. For instance, a group of side effects collectively known as cybersickness can be especially debilitating to users during VE training. Symptoms range from the distracting, such as eyestrain and blurred vision, to the performance detracting, such as visual motor coordination and balance disturbances. Cybersickness occurs in approximately 80-95% of individuals receiving virtual training, with up to 30% of the trainees opting to terminate training before completing it. VE exposure can also produce aftereffects such as eyestrain, dizziness, and nausea, that can last more than an hour after a training session, and in about 8% of individuals symptoms can last for more than six hours post session. Prolonged exposure to VEs can lead to distinct physiological changes, such as changes in the resting point of accommodation or even recalibration of perception-action couplings following exposure to visual scenes. These issues become even more critical when using VE systems to deliver deployable, just-in-time training. When these simulations are placed aboard ship, the physical ship motion will be completely uncorrelated to the motion being visually represented in the VE. This discordance will most certainly exacerbate any already existing side/after effects. The net result of these effects is an increased likelihood of users receiving less-than-adequate training during VE exposure, and being unfit to perform their duties following VE exposure. It is precisely these compounded effects that current research efforts seek to quantify and to reduce. To this end, two parallel approaches have been pursued. In the first, participants 'flew' a personal computer-based flight simulator in the absence of any physical motion, were exposed to actual ship motion in the absence of any simulator exposure, and flew the flight simulator while deployed aboard

a small ship. Results from this study indicate that even when benign ship motion and benign flight simulated motion are combined, a physiological degradation can occur. The effects of the uncoupled motion appear additive in nature, but do not cause emergent effects greater than the sum of the individual motions. A second effort, currently in progress, explores the notion of subtracting the physical motion from the visually displayed motion to reduce these negative additive effects. Additional engineering and behavioral studies are planned.

Author

Virtual Reality; Training Simulators; Military Operations; Physiological Effects; Education; Real Time Operation

20030019118 Institut de Medecine Aerospatiale, Poland

Spatial Disorientation Caused by Vestibular Organs in Pilots *La Desorientation Spatiale Liee aux Appareils Vestibulaires Chez les Pilotes*

Kaczorowski, Zbigniew, Institut de Medecine Aerospatiale, Poland; Pawlik, Marian, Institut de Medecine Aerospatiale, Poland; Stablewski, Roman, Institut de Medecine Aerospatiale, Poland; Nowicki, Jan, Institut de Medecine Aerospatiale, Poland; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 42-1 - 42-8; In French; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The basic mechanisms were presented in this work of spatial disorientation caused by the imperfection of the vestibular devices in the specific surrounding of the conditions of the spatial disorientation in the 20 pilots observed at the IMA's Oto-laryngological clinic over 30 years, that have revealed unconscious incidents of spatial disorientation during flight. The comparison group was comprised of 50 aeronautical personnel in whom no disorder was observed suggesting the vestibular pathology and incorrections during the flight caused by spatial orientation. In both groups, we conducted ENG tests on a device of the Tonnie-Jaeger firm. In control group no. 1, as in the group no. 2, after analysis of the spontaneous nystagmus, examination of the positional nystagmus and the nystagmus position, we performed the kinetic test, according to the time of the examination, in the form of the test according to Barany, the acceleration/deceleration (A/D) test and the sinusoidal pendular test. We also conducted the quadruple calorific test with the temperature of the water at 44 C and at 27 C. We estimated the results of the latency phase dependency tests phase (Mpkwfocz) and the total number of hits (Siu).

Author

Disorientation; Situational Awareness; Vestibular Nystagmus; Aircraft Pilots; Physiological Tests

20030019119 Naval Aerospace Medical Research Lab., Pensacola, FL USA

Vestibular Stimuli May Degrade Situation Awareness Even When Spatial Disorientation is not Experienced

Lawson, Ben D., Naval Aerospace Medical Research Lab., USA; Smith, Sara A., Naval Aerospace Medical Research Lab., USA; Kennedy, Robert S., RSK Assessments, Inc., USA; Kass, Steven J., University of West Florida, USA; Muth, Eric R., Clemson Univ., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 43-1 - 43-21; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Spatial disorientation (SD) is an important contributor to aviation mishaps. Misleading acceleration stimuli during flight are one of the main causes of SD. SD is associated with a loss of situation awareness (LSA) and the commission of dangerous errors, yet little is known concerning the specific interactions among SD, LSA, and human error. While SD is likely to be an important contributor to LSA and human error, the interaction is complicated because acceleration stimuli to the vestibular organs degrade a person's well-being and performance even when spatial disorientation (SD) is not experienced. This paper points out theoretical gaps in knowledge concerning LSA, SD of vestibular origin, and vestibular effects other than SD. The authors argue for a wider consideration of the ways in which vestibular acceleration stimuli contribute to unsafe conditions for vehicle operators. While vestibular acceleration stimuli can elicit SD, they can also challenge psychomotor performance, visual performance, and certain aspects of cognition. A complete approach to the study of acceleration-induced human error and LSA should assess these various decrements in human functioning simultaneously, so the relative contribution of each decrement to the commission of error can be understood and the interactions among the decrements described.

Author

Situational Awareness; Pilot Performance; Disorientation; Psychological Effects; Auditory Stimuli; Visual Stimuli; Pilot Error

20030019123 Naval Air Systems Command, Crew Systems Dept., Patuxent River, MD USA

Almost Loss of Consciousness: A Factor in Spatial Disorientation?

Shender, Barry S., Naval Air Systems Command, USA; Cammarota, Joseph P., Jr., EDO M. Tech, USA; Ryoo, Han Chool, Drexel Univ., USA; Forster, Estrella M., Naval Air Systems Command, USA; Hrebien, Leonid, Drexel Univ., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 48-1 - 48-13; In English; Also announced as 20030019078; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

During high-performance flight, aircrew exposed to +Gz-stress may exhibit symptoms ranging from light loss (LL) to +Gz-induced Loss of Consciousness (GLOC). If the stress is insufficient to cause GLOC, a syndrome called Almost Loss of Consciousness (ALOC) can occur, which features deficits in motor and cognitive function. It is possible that these types of deficits may influence the nature or extent of spatial disorientation symptoms. In order to produce a definitive description of ALOC symptoms, nine subjects (one female) (Ss) were exposed to a series of repeated short +6, +8, and +10 Gz pulses at the NAVAIR Warminster centrifuge facility, which were lengthened in 0.25s increments until they experienced GLOC. of a total of 161 +Gz pulses, 66 episodes of ALOC were identified. A math task before and during each pulse was used to determine short-term memory loss. Ss were required to press and hold a button spanning the time from initial LL symptoms to full recovery of vision. ECG and near infrared spectroscopy (NIRS) of relative cerebral tissue oxygenation (rSO₂) were also recorded. Data analysis included a description of physical, cognitive, and emotional signs and the timing of their occurrence and resolution, and the timing of the LL from its onset to full recovery. The primary manifestation of ALOC symptoms was a disconnection between the desire to do something and the actual ability to act upon it. This could linger well beyond the end of the +Gz exposure. Physical symptoms included tingling, twitching, uncontrollable hand movements, hearing loss and transient paralysis. Cognitive deficits included confusion, amnesia, delayed recovery, a 'vacant feeling' and difficulty in forming words. Surprise, concern and pleasant feelings were some of the emotional signs. There was a significant increase in the reduction in rSO₂, greater overshoot in rSO₂ (increase in oxygenation above baseline after the +Gz exposure), faster fall in rSO₂ during +Gz-stress and prolonged recovery time associated with ALOC as compared to +Gz exposures without symptoms. Evaluation and comprehension of the range of events associated with these altered states of awareness can provide new insights into the relationship between the effects of +Gz-induced changes in the cerebrovasculature and the resultant changes in behavior on understanding the causes of spatial disorientation. With a more complete picture of the responses of both the vascular and vestibular systems, as well as the resultant behavior changes to environmental stresses, a more comprehensive approach to avoiding aircraft mishaps can be developed.

Author

Disorientation; Acceleration Stresses (Physiology); Aerospace Medicine; Attitude (Inclination); Unconsciousness; Mental Performance; Consciousness

20030019233 Space and Naval Warfare Systems Center, San Diego, CA USA

The Problem of Unshared Information in Group Decision-Making: A Summary of Research and the Implications for Command and Control

Fleming, R. A.; Kaiwi, J. L.; Dec. 2002; 20p; In English

Contract(s)/Grant(s): Proj-R3325

Report No.(s): AD-A409792; SSC/SD-TD-3149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains a detailed review of the literature on the use of unshared and shared information in a group decision-making situation, and two conclusions can be drawn: (1) People are not very effective in communicating unshared information groups tend to focus their discussion on information that is already shared, with the result that little, if any, unshared information moves into the shared environment, and (2) when unshared information does move into the shared environment, participants tend to ignore or discount this information and not factor it into their decision process in an effective manner. The net result is many group decisions are based on incomplete information, i.e., decisions are made without taking into account information that would be available to the group if they were optimally exchanging and integrating unshared information. Consequently, group decisions may be sub-optimal when critical information is held by individuals and not shared. The preponderance of the literature on group decision-making is based on experimental groups working in a face-to-face environment, and the findings have been attributed to a variety of social and cognitive influences. In contrast, much of modern military command and control decision-making is not predicated on face-to-face groups, but on time/place asynchronous collaboration where the decision process is often distributed over time and location. Proposed is a research program called START (Structure, Tag, and Release Templates) that will develop group consensus on critical decision evaluation categories, parameters, and qualifying values.

DTIC

Information Transfer; Decision Making; Group Dynamics; Command and Control

20030019692 Michigan State Univ., Dept. of Management, East Lansing, MI USA

**The Influence of Training and Structure Transitioning On Command and Control Team Performance: A Final Report
Final Report, 1 Apr. 2000-31 Oct. 2002**

Ilgen, Daniel R.; Hollenbeck, John R.; Dec. 31, 2002; 59p; In English

Contract(s)/Grant(s): N00014-00-1-0398

Report No.(s): AD-A409813; 02-01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The work described in this report is part of an ongoing research program looking at the effects of team structure on the effectiveness of decision making teams. Team structures are investigated with respect to their fit to situational demands and to the characteristics of team members. Fit is considered both statically and dynamically. In the latter case, teams performing under one structure encounter situational demands that either are or are not consistent with the structure and, in the latter case, must reconfigure their structure to fit better the situations. During the time period intra-team processes of teamwork and learning also were investigated along with team task performance.

DTIC

Education; Teams; Command and Control

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20030019114 Air Force Research Lab., Wright-Patterson AFB, OH USA

G and Alpha: Centrifuge Occupant Tolerance to Simultaneous High G and High Angular Acceleration

Chelette, Tamara L., Air Force Research Lab., USA; Spenny, Curtis H., Air Force Inst. of Tech., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 36-1 - 36-5; In English; Also announced as 20030019078 Contract(s)/Grant(s): 96-AFIT-02; 99-141HE-01; Copyright; Avail: CASI; A01, Hardcopy; Distribution within the U.S. granted by agreement

The ability of a centrifuge operated as a Dynamic Flight Simulator to meet the response recommendations of the Federal Aviation Administration (FAA) for motion simulators is discussed. The effect on an occupant of angular acceleration artifacts produced by such an enhanced centrifuge is explored. The concern investigated herein is whether these high angular acceleration artifacts are dangerous, disorienting, or distressing. Human response tests have been conducted on the centrifuge at Wright-Patterson AFB to evaluate sensitivity to the artifacts produced by a centrifuge when operated in this rapid response mode. Results indicate the effect to be no more than a mild disturbance over the expected range of G loading and artifact magnitudes found in the next generation of centrifuges. The unique capability of a Dynamic Flight Simulator is that the pilot can be exposed to high fidelity, sustained, elevated-G levels while receiving training in flight procedures and air combat tactics. Such a capability would be expected to provide improved flying performance during the vestibular and tactile misinterpretations common during sustained acceleration.

Author

High Acceleration; Angular Acceleration; Acceleration Tolerance; Centrifuges; Flight Simulators; Motion Simulators; Physiological Tests

20030019120 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

The Effects of Helmet-Mounted Display Symbology on the Opto-Kinetic Cervical Reflex and Frame of Reference

Liggett, Kristen K., Air Force Research Lab., USA; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 44-1 - 44-11; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Spatial disorientation (SD) accidents are a major contributor to the Class A mishap rate in the US Air Force. A recent investigation showed that transitions between visual meteorological conditions (VMC), when pilots use real-world visual cues to fly, to instrument meteorological conditions (IMC), when pilots have to use instruments to fly, were a leading cause of SD. In VMC, the true horizon is the primary visual cue pilots use to orient themselves. In IMC, pilots must rely on a representation of the horizon as their primary visual cue to maintain spatial orientation. Research has shown that when pilots fly in VMC, they tilt their heads in the direction opposite that of aircraft roll in an effort to keep the horizon fixed in their visual field. This implies that pilots use a world frame of reference for determining orientation. However, pilots do not tilt their heads in IMC when viewing the horizon symbol on a head-down, aircraft-referenced attitude indicator. Because pilots must transition between these two

frames of reference when transitioning between VMC and IMC, this may be causing SD. The helmet-mounted display (HMD) is currently being tested as a means of displaying attitude information. The HMD symbology tested portrays a conformal horizon symbol which overlays the true horizon. In VMC, pilots see the true horizon and the conformal horizon symbol simultaneously. In IMC, pilots see only the horizon symbol. It was hypothesized that pilots would tilt their heads in VMC and in IMC (due to the fact that the conformal horizon represents the true horizon). Eleven pilot-subjects completed a VMC and an IMC flight task. Results showed no practical head tilt in either task. This was attributed to the nature of the task. Task demands determine the visual information to which pilots attend. This attention narrowing may influence the strength of the OKCR.

Author

Helmet Mounted Displays; Flight Rules; Pilot Error; Disorientation; Attitude (Inclination); Head Movement

20030019121 Universite de la Mediterranee, Lab. Mouvement et Perception, Marseille, France

Control of Posture, Subjective Vertical, and Body Scheme in Changing Gravitoinertial Field

Sares, Frederic, Universite de la Mediterranee, France; Merhi, Omar, Universite de la Mediterranee, France; Bourdin, Christophe, Universite de la Mediterranee, France; Gauthier, Gabriel, Universite de la Mediterranee, France; Menu, Jean-Pierre, Institut de Medecine Navale, France; Montmayeur, Alain, Institut de Medecine Navale, France; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 45-1 - 45-6; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

Spatial disorientation associated to decrease of sensorimotor performance may result in observers evolving in changing gravitoinertial field as created in aircrafts and other high dynamics modern vehicles. We have investigated the influence of body support orientation on the perception of egocentric and exocentric reference frames in 8 observers standing 80 cm off-center on a platform rotating at 120 deg.s(exp -1). Standing support was either a fixed horizontal board or a swinging pendulum. The perceptive task consisted in adjusting the orientation of a visual rod to indicate geocentric (subjective vertical (SV) and horizontal (SH)) and egocentric (head, trunk and platform orientations) references. Subjects' head and trunk, as well as rod orientations, were recorded with electromagnetic sensors (Polhemus Fastrack). The platform was equipped with sensors providing heel and toe vertical and lateral forces from both feet. Platform motion (when allowed to rotated in the swinging pendulum condition) was recorded with a potentiometer. We analyzed body postural reactions and compared veridical and perceived orientations in the two body support conditions. In the horizontal platform condition, to compensate the mechanical constraints caused by the centrifugal force, subjects leaned toward the axis of rotation adopting a hyperbolic body shape. Head was aligned with the gravitoinertial force. SH was not sensed as orthogonal to the SV. Foot pressure (vertical and lateral components) was higher under the outer than under the inner foot. In the swinging pendulum condition, SV and body were aligned with the gravitoinertial vector. SH and SV were orthogonal. Foot pressure was the same under both feet. In both conditions, head and body orientations were overestimated. The data suggest that, as the gravitoinertial vector evolves, the vestibular system induces compensatory postural adjustments. The hyperbolic body shape is thought to be due to body multisegmental coordination. Other postural adjustments, thought to be neither of vestibular nor of visual origin, occur to keep the projection of the combined forces in the body support area. Although observers provided erroneous cognitive answers, they maintained postural balance in both conditions suggesting sensorimotor control to be independent of posture related cognitive processes.

Author

Sensorimotor Performance; Disorientation; Attitude (Inclination); Posture; Human Body

20030019124 Institute for Human Factors TNO, Soesterberg, Netherlands

Tactile Torso Display as Countermeasure to Reduce Night Vision Goggles Induced Drift

vanErp, Jan B. F., Institute for Human Factors TNO, Netherlands; Veltman, J. A., Institute for Human Factors TNO, Netherlands; vanVeen, H. A. H. C., Institute for Human Factors TNO, Netherlands; Oving, A. B., Institute for Human Factors TNO, Netherlands; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 49-1 - 49-8; In English; Also announced as 20030019078; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The degraded visual information when hovering with Night Vision Goggles may induce drift that is not noticed by the pilot. We tested the possibilities of counteracting these effects by using a tactile torso display. The display consisted of 64 vibro-tactile elements and presented information on the desired direction of motion only (simple version), or also included information on the current motion direction (complex version). The participants flew in a fixed-base helicopter simulator with either full vision or with simulated night vision goggles. The results showed performance improvement for both tactile display variants compared to hovering without a tactile display. This improvement was present in the NVG conditions (mean reduction of the position error of 22% in the horizontal direction and of 41% in the vertical direction), but also in the full vision condition (mean reductions of 32 and 63%, respectively). Also, performance with a tactile display is less affected by the introduction of a secondary (cognitive)

task than performance without a tactile display. The complex variant of the tactile torso display tends to be less effective than the simple variant. We hypothesize that this effect may be due to what we call 'tactile clutter'. This simulator study proves the potential of intuitive tactile torso displays in reducing drift during hover. The display is so effective that it even results in performance improvement in full vision conditions. Also, the results prove that tactile displays can be applied in fast man-in-the-loop tasks. Finally, advanced tactile displays that are able to present more complex stimuli open up new possibilities of information presentation, but may also introduce tactile clutter.

Author

Night Vision; Display Devices; Position Errors; Pilot Performance; Torso

20030019334 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Response of the Wayne State Thorax Model With Fabric Vest to a 9-mm Bullet Final Report, 1 Oct. 2000-30 Sep. 2001

Raftenberg, Martin N.; Jan. 2003; 96p; In English; Original contains color images

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A409941; ARL-TR-2897; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The 1999 version of the Wayne State Thorax Model, WSTM99, was applied to the finite element (FE) simulation of a 9-mm Remington bullet striking a multi-ply Kevlar (DuPont) vest worn by a human thorax. The bullet impact speed was 425.5 meters per second, and the hit location was the vest material covering the center of the sternum. FE models for the vest and bullet were developed. The computations were performed with the LS-DYNA FE code. Computational results for axial (along the path of the bullet) acceleration were compared with accelerometer measurements from three tests performed at the Armed Forces Institute of Pathology on human thoracic tissue. At the posterior sternum, the computed peak axial acceleration was 5.6 times larger than the measured value in the direction of the bullet's lateral path and 11% smaller than the measured value in the opposite (recoil) direction. At the ligamentum arteriosum, the computed peak axial acceleration exceeded the measured value by factors of 7.9 and 18.1 in the directions along and opposite to the bullet's initial path, respectively. Possible explanations for the discrepancies are offered in terms of features of WSTM99 and of the gauges used in the tests.

DTIC

Simulation; Thorax; Vests; Mathematical Models; Fabrics; Guns (Ordnance)

20030019487 Aoyamagakuin Univ., Tokyo, Japan

The Relationship Between Arm Movement and Walking Stability in Bipedal Walking

Shibukawa, Miki; Sugitani, Kazuhiko; Hong, Renshan; Kasamatsu, Keiko; Suzuki, Satoshi; Ninomija, Satoki P.; Oct. 25, 2001; 8p; In English; Original contains color illustrations; Presented at the Annual Int'l Conference of the 23rd IEEE Engineering in Medicine and Biology Society held in Istanbul, Turkey, on 25-28 Oct. 2001. See also ADM001351 for entire conference on CD-ROM. All DTIC reproductions will be in black and white

Report No.(s): AD-A409793; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Research on bipedal walking is currently underway in a variety of fields. In engineering, robots that can walk in a bipedal manner are now under development, and, in medicine, important data on human walking characteristics are being gathered for use in the clinical analysis of walking for use in rehabilitation programs. The analysis of walking movement has generally focused on the legs rather than the arms, probably due to a perception that the arms do not play an essential role in this movement. However, if a quantitative understanding of arm movement functions can be obtained, this data will prove invaluable in the fields of robotics, sports physiology, and rehabilitation research. This study focuses on the relationship between arm movement and walking stability during bipedal walking. Subjects were 8 healthy, young males without walking disabilities who mounted an electric treadmill and walked in three different modes: unrestrained, with arms strapped to the sides of the body, and with arms swung up 90 degrees. In each of these modes the treadmill was set to three speeds. Subjects walked for two minutes at each speed in each mode (nine different mode-speed combinations). Movement was videotaped from two different positions. Analysis of variance was conducted for each measurement item using the factors of walking posture and speed. Results showed that at high walking speed (5.7 km/hr), the Shoulder Fulcrum Dispersion (SFD) was significantly higher for walking with arms immobilized than for unrestrained walking. This indicates that, at low and medium speeds (2.7 km/hr and 4.2 km/hr, respectively), the effect of restricted arm movements on upper body posture was minimal, whereas, at high speed, its effect on stability was considerable. The use of SFD as an index in this study provided a comparison with the subjective evaluations of the subjects as well as a quantitative understanding of walking stability based on analysis of variance. (five figures, four references)

DTIC

Biometrics; Physiological Effects; Arm (Anatomy); Walking; Gait

20030019702 Consiglio Nazionale delle Ricerche, Center of Biomedical Engineering, Milan, Italy

3D Reconstruction of Anatomical Surfaces from Unorganized Range Data

Tognola, G.; Parazzini, M.; Ravazzani, P.; Svelto, C.; Grandori, F.; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Presented at the Annual Int'l Conference of the IEEE Engineering in Medicine and Biology Society (23rd) held in Istanbul, Turkey on 25-28 Oct. 2001. See also ADM001351 for entire conference on CD-ROM
Report No.(s): AD-A409890; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Three-dimensional range data acquired through digital scanning of anatomical surfaces are used in this study as test material for the validation of an innovative approach for the reconstruction of closed surfaces. Although based on a straightforward theoretical approach, the proposed method exhibits an extreme accuracy in the reconstruction of a variety of target surfaces of different topologies. The method does not require any additional information about the target surface than the raw range data and is robust to noise. A triangular mesh approximates the target surface. Also, a few examples on the possible biomedical applications of the reconstructed surface are provided in this paper. (6 figures, 7 references)

DTIC

Computerized Simulation; Three Dimensional Models; Head (Anatomy); Anatomy; Topology

20030020365 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA

Bioregenerative Life Support Systems for Microgravity

Nevill, Gale E., Jr., Florida Univ., USA; Hessel, Michael I., Florida Univ., USA; Rodriquez, Jose, Florida Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 200-211; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

With long-term manned space missions now technologically feasible, life supports systems for the astronauts need to become self-sustaining and durable. Such a system would require plants to recycle waste water and air. However, in the confined volume of a spacecraft, a unit to grow plants in the least amount of volume would be desirable. This report describes a Variable Geometry Plant Growth Unit (VGPGU), dubbed the "Accordion" for its resemblance to the musical instrument, which is able to stretch and contract and efficiently deliver nutrients to the plants. Although the effects of microgravity cannot be simulated on earth, the design is expected to perform better in microgravity.

Author

Closed Ecological Systems; Microgravity; Vegetation Growth; Spacecraft Environments; Food Production (In Space)

20030020392 Wisconsin Univ., Dept. of Architecture, Milwaukee, WI USA

Domus I and Dymaxion: Two Concept Designs for Lunar Habitats

Moore, Gary T., Wisconsin Univ., USA; Huebner-Mothes, Janis, Wisconsin Univ., USA; Brinlee, Christine M., Wisconsin Univ., USA; Erdmann, David S., Wisconsin Univ., USA; Matheson, Lydia H., Wisconsin Univ., USA; McCambridge, Wayne A., Wisconsin Univ., USA; Schmidt, Steve M., Wisconsin Univ., USA; Wellings, Augustus J., Wisconsin Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 479-489; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Two concept designs for lunar habitat missions were explored and developed. In contrast to other work on lunar habitat designs, the driving force was habitation objectives and habitation performance requirements based on human factors/environment-behavior considerations. Attention was given to site selection and site planning requirements, first lunar outpost requirements, and initial operating configuration design requirements (both quantitative and qualitative). After review of 5 technological options and 12 previously published lunar habitat concept proposals, it was decided to further explore two concepts. The first is a pressurized self-supporting membrane structure (PSSMS) proposed by Chow and Lin, and the second a dymaxion dome structure based on the work of Buckminster Fuller. The master plan, construction sequencing, building system, technical subsystems, and interior configuration of one of the concepts is presented in this paper. Domus I consists of three entrance/EVA modules connected to a rigidized, inflatable torus containing all research laboratories and mission control, and a domed interior of an rigidized, inflatable ellipsoid containing all crew quarters and the crew support facility. (Dymaxion consisted of three hard module research laboratories/EVA chambers, a mission control core, and a two-floor habitation inflatable.) The relative advantages and limitations of the PSSMS concept are briefly reviewed. In summary, the concept seems extremely feasible and deserves most serious exploration by the various lunar program offices at NASA.

Author

Habitats; Domes (Structural Forms); Human Factors Engineering; Lunar Bases

COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.

20030019476 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Comments on Computational Fluid Dynamics (CFD) Code Performance on Scalable Architectures *Final Report, Apr. 1995-Sep. 1999*

Behr, Marek; Pressel, Daniel M.; Sturek, Walter B., Sr; Dec. 2002; 23p; In English; Original contains color images; Prepared in collaboration with Rice Univ., Dept. of Mechanical Engineering and Materials Sciences, Houston, TX
 Report No.(s): AD-A409739; ARL-RP-63; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We comment on the current performance of computational fluid dynamics codes on a variety of scalable computer architectures. The performance figures are derived from both the finite volume and finite element methodologies, and encompass shared, virtual shared, and distributed memory architectures, as exemplified by the SGI Origin series, CM5, and the CRAY T3D/E family, respectively.

DTIC

Architecture (Computers); Computational Fluid Dynamics; Distributed Memory; Virtual Memory Systems; Memory (Computers)

COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20030018874 NASA Ames Research Center, Moffett Field, CA USA

A Genetic Representation for Evolutionary Fault Recovery in Virtex FPGAs

Lohn, Jason, NASA Ames Research Center, USA; Larchev, Greg, NASA Ames Research Center, USA; DeMara, Ronald, University of Central Florida, USA; [2003]; 11p; In English; 5th International Conference on Evolvable Systems, Unknown; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Most evolutionary approaches to fault recovery in FPGAs focus on evolving alternative logic configurations as opposed to evolving the intra-cell routing. Since the majority of transistors in a typical FPGA are dedicated to interconnect, nearly 80% according to one estimate, evolutionary fault-recovery systems should benefit by accommodating routing. In this paper, we propose an evolutionary fault-recovery system employing a genetic representation that takes into account both logic and routing configurations. Experiments were run using a software model of the Xilinx Virtex FPGA. We report that using four Virtex combinational logic blocks, we were able to evolve a 100% accurate quadrature decoder finite state machine in the presence of a stuck-at-zero fault.

Author

Field-Programmable Gate Arrays; Quadratures; Logic Design; Logic Circuits; Transistors

20030018921 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France

Virtual Reality: State of Military Research and Applications in Member Countries *La Realite Virtuelle: L'Etat Actuel des Travaux de Recherche et des Applications Militaires dans les Pays Membres de l'Alliance*

February 2003; 154p; In English; Original contains color illustrations

Report No.(s): RTO-TR-018; AC/323(HFM-021)TP/18; ISBN 92-837-0030-9; Copyright; Avail: CASI; C01, CD-ROM; A08, Hardcopy; A02, Microfiche; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement

Research Study Group 28 (RSG 28) has defined Virtual reality as the experience of being in a synthetic environment and the perceiving and interacting through sensors and effectors, actively and passively, with it and the objects in it, as they were real. VR technology allows the user to perceive and experience sensory contact and interact dynamically with such contact in any or all modalities. The main goals were: to identify human factors issues involved in the use of VR technology for military purposes; to determine the state of knowledge with regard to those issues and to recommend a research agenda that will address critical

questions and enable effective products to be produced to meet the military's needs. In its five year existence RSG 28 has organized three major workshops addressing these goals and published the results in a number of reports, which are part of this document.

Author

Military Technology; Research and Development; Virtual Reality

20030018925 Computer Sciences Corp., Moffett Field, CA USA

NAS Parallel Benchmarks I/O Version 2.4, 2.4

Wong, Parkson, Computer Sciences Corp., USA; VanderWijngaart, Rob F., Computer Sciences Corp., USA; Nov. 19, 2002; 3p; In English

Contract(s)/Grant(s): RTOP 704-40-24; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We describe a benchmark problem, based on the Block-Tridiagonal (BT) problem of the NAS Parallel Benchmarks (NPB), which is used to test the output capabilities of high-performance computing systems, especially parallel systems. We also present a source code implementation of the benchmark, called NPbio2.4-MPI, based on the MPI implementation of NPB, using a variety of ways to write the computed solutions to file.

Author

Computers; Parallel Programming; Parallel Processing (Computers)

20030018928 NASA Ames Research Center, Moffett Field, CA USA

Safe Grid

Chow, Edward T., Jet Propulsion Lab., California Inst. of Tech., USA; Stewart, Helen, NASA Ames Research Center, USA; Jan. 23, 2003; 1p; In English; Information Power GRID (IPG) Workshop, 4-6 Feb. 2003, Palo Alto, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The biggest users of GRID technologies came from the science and technology communities. These consist of government, industry and academia (national and international). The NASA GRID is moving into a higher technology readiness level (TRL) today; and as a joint effort among these leaders within government, academia, and industry, the NASA GRID plans to extend availability to enable scientists and engineers across these geographical boundaries collaborate to solve important problems facing the world in the 21st century. In order to enable NASA programs and missions to use IPG resources for program and mission design, the IPG capabilities needs to be accessible from inside the NASA center networks. However, because different NASA centers maintain different security domains, the GRID penetration across different firewalls is a concern for center security people. This is the reason why some IPG resources are been separated from the NASA center network. Also, because of the center network security and ITAR concerns, the NASA IPG resource owner may not have full control over who can access remotely from outside the NASA center. In order to obtain organizational approval for secured remote access, the IPG infrastructure needs to be adapted to work with the NASA business process. Improvements need to be made before the IPG can be used for NASA program and mission development. The Secured Advanced Federated Environment (SAFE) technology is designed to provide federated security across NASA center and NASA partner's security domains. Instead of one giant center firewall which can be difficult to modify for different GRID applications, the SAFE "micro security domain" provide large number of professionally managed "micro firewalls" that can allow NASA centers to accept remote IPG access without the worry of damaging other center resources. The SAFE policy-driven capability-based federated security mechanism can enable joint organizational and resource owner approved remote access from outside of NASA centers. A SAFE enabled IPG can enable IPG capabilities to be available to NASA mission design teams across different NASA center and partner company firewalls. This paper will first discuss some of the potential security issues for IPG to work across NASA center firewalls. We will then present the SAFE federated security model. Finally we will present the concept of the architecture of a SAFE enabled IPG and how it can benefit NASA mission development.

Author

Security; Domains; Technologies; NASA Programs

20030018977 Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA

Phase I Report on Intelligent Software Decoys: Technical Feasibility and Institutional Issues in the Context of Homeland Security

Michael, James B.; Rowe, Neil C.; Rothstein, Hy S.; Auguston, Mikhail; Drusinsky, Doron; Dec. 10, 2002; 34p; In English Report No.(s): AD-A410039; NPS-CS-03-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project is to explore the technical feasibility and institutional issues associated with applying software-based deception techniques as part of Homeland defense. At present, we refer to the embodiment of software-based deception as intelligent software decoys, although this name may change in the next phase of our research. The key idea that we

are pursuing is that software-based deception can be used to harden software assets against attack. An important novel aspect of our research is that we introduce the concept of conducting counterintelligence and intelligently employing countermeasures in cyberspace via software-based deception. The owners of computing assets may have to deploy intelligent software decoys with such capabilities in order to counter attacks conducted by technology-savvy terrorists and criminals, in addition to information warriors from rogue or enemy nation-states; conventional countermeasures will likely be ineffective against the sophisticated arsenal of cyber weapons at the disposal of such attackers, and any countermeasure will be difficult to deploy without reliable counterintelligence, particularly if the users of countermeasures intend to avoid becoming cyber war criminals. In this report, we summarize our research and its relevance to Homeland security, and briefly discuss our plans for furthering our work under Phase II of the Naval Postgraduate School's Homeland Security Research & Technology Program. The initial results of our work indicate to us that software-based deception could play a pivotal role in protecting the U.S. critical information infrastructure and critical software applications that rely on that infrastructure.

DTIC

Computer Programs; Decoys; Information Management; Computer Information Security

20030019040 Louisiana State Univ., Baton Rouge, LA USA

Information Credibility Assessment and Meta Data Modeling in Integrating Heterogeneous Data Sources *Final Report, Jul. 2000-Jan. 2002*

Chen, Peter P.; Nov. 2002; 37p; In English; Original contains color images

Contract(s)/Grant(s): F30602-00-2-0605; AF Proj. R427

Report No.(s): AD-A409695; AFRL-IF-RS-TR-2002-298; No Copyright; Avail: Defense Technical Information Center (DTIC)

This effort identified several key issues and proposes a framework to solve the problem of credibility and validity assessment of information from various data sources for information fusion. This report outlines some of the important steps in a framework for an information validity assessment. The report also describes some algorithms for conflict resolution. The effort also proposes a prototype of a decision-support system to support the estimation of the composite data values from heterogeneous databases with different validity assessment values. As part of this effort this prototype has been implemented using Java and Oracle DBMS version 8i for helping people to make decisions under conflicting data situations and for information validity assessment based on the proposed meta-data conceptual modeling methodology. Finally, several issues closely related to information credibility assessment such as meta data modeling and reverse-engineering of existing database schemas into conceptual models are examined.

DTIC

Data Management; Data Integration

20030019198 Stanford Univ., Dept. of Pediatrics, Stanford, CA USA

Making Virtual Baby Alive

Korosec, D.; Halamek, L. P.; Zazula, D.; Oct. 25, 2001; 5p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409561; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have designed and implemented a prototype virtual environment for medical training in neonatal resuscitation. The central element of this environment is the dynamic virtual model (avatar) of a new-born child, built using VRML and Java. Physiological variables relevant for training were chosen to be represented through the avatar: heart rate, respiration rate, skin colour and activity level (such as movement and crying). Implementation mechanisms of presenting these vital signs on the virtual baby with animation and sound are described in this paper. We are using time-dependent description of basic events to specify scenarios according to which the condition of a baby is changing. Sets of scenarios are then coupled to actions performed by a student during training. Such approach for all relevant variables had seemed good at first, but it soon became impractical and hard to follow due to separate treatment of variables. Therefore an attempt to create a simplified, easier controllable model with interdependent variables is being under development. This paper reports on current implementation as well as on the explored ideas for the future.

DTIC

Children; Birth; Virtual Reality

20030019483 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Dismounted Infantry Visualization Research: The Dismounted Infantry Simulation (DISim) Final Report, 10 Jan. 1998-1 Apr. 2002

Thomas, Mark A.; Dec. 2002; 22p; In English

Report No.(s): AD-A409747; ARL-TN-193; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is an overview of the Dismounted Infantry Simulation (DISim) Software Test-Bed. DISim is software that allows researchers to test new simulation and visualization algorithms for real-time virtual simulation. Targeted to the simulation needs of the ground warfighter, the algorithms developed using the DISim test-bed are high-resolution real-time effects for simulation, training, and mission rehearsal. C++ based on the Linux operating system, the software uses commercial software for graphics and realistic human figure animation. This report will introduce the DISim, detail its battlefield simulation features, describe the software architecture, and present a brief overview of algorithms developed using it.

DTIC

Computer Programs; Algorithms; Computerized Simulation; Virtual Reality

20030019693 Defence Research and Development Canada, Ottawa, Ontario Canada

DRDC Toronto/HPP Metabolic Measurement Software V2.0: Users' Manual

Keefe, Allan A.; Aug. 2002; 35p; In English

Report No.(s): AD-A409814; DRDC-TM-2002-038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a result of changes in computer technology, an update to the DRDC (D?partement de R?ponse et Dynamique Cellulaire) Toronto/HPP (High-pressure processing) Metabolic Measurement Software was deemed necessary. In addition to making this software compliant with the Windows(TM) 32-bit operating system, several enhancements were made to improve its usability and accuracy of measurements. These include; a wizard' to facilitate test set-up data entry, protection of data loss due to equipment failure, compensation for system lag, graphical display of data, and integration with Microsoft Excel(TM) for data exporting, saving and analysis. This document is a manual to assist the operator in the usage of this software.

DTIC

Computer Programs; Metabolism; Biometrics

20030019852 Defence Research and Development Canada, Ottawa, Ontario Canada

Dual Use Study of Systems and Software Technologies: Defence and IST analysis Report

Wong, Winnie; Stergiopoulos, Stergios; Reid, Robert; Bhartia, Prakash; Nov. 2002; 126p; In English; Original contains color images

Report No.(s): AD-A409862; DRDC-TR-2002-188; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report outlines an unbiased process to assess and prioritize information Technologies (IT), which can be identified as areas of high priority for defense R&D. The proposed process minimizes potential political and industrial biases and allows for the formation of a detailed list of Information Technologies, thus prioritizing and highlighting the IT areas that require attention and R&D funding. The information Technologies ranking method process consists of a two-stage qualitative and quantitative analysis. This two-stage approach introduces strategic and system cost weighting factors to generate a ranked list of the areas of Information Technologies, which is derived from the defense procurement plans of the US and Canadian Forces. This ranking process allows also for the identification of the Dual Use Technologies (i.e. Dual Use Study of Systems and Software Technologies (DUST)) into five main areas, namely: * Software and System Engineering; * Information Management; * Visualization and Imaging; * Modelling and Simulation; * IT aspects in Communication; In summary, the proposed study may be considered as a strategic model' for considering review of Dual-Use Technologies and their associated R&D cost across different market sectors and system applications. In particular, this study is designed to improve the co-ordination, planning and exploitation of dual-use Information Society Technologies (IST), with a view to strengthening Canadian industrial competitiveness in defense as well as civil Information & Communication Technologies (ICT) industry.

DTIC

Computer Programs; Information Systems

20030020320 NASA Langley Research Center, Hampton, VA USA

General Aviation Cockpit Weather Information System Simulation Studies

McAdaragh, Ray, NASA Langley Research Center, USA; Novacek, Paul, Research Triangle Inst., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 257-288; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides information on two experiments on the effectiveness of a cockpit weather information system on a simulated general aviation flight. The presentation covers the simulation hardware configuration, the display device screen layout, a mission scenario, conclusions, and recommendations. The second experiment, with its own scenario and conclusions, is a follow-on experiment.

CASI

Cockpit Weather Information Systems; Display Devices; Flight Simulation

20030020331 NASA Langley Research Center, Hampton, VA USA

Numerical Simulation of Event 191-6 of NASA's Flight Tests

Proctor, Fred H., NASA Langley Research Center, USA; Hamilton, David W., NASA Langley Research Center, USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 510-536; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

In this viewgraph presentation, information is provided on the numerical simulation of a turbulence event encountered by NASA Langley's B-757 while conducting flight tests in areas at high risk for severe turbulence. Specific details on the Terminal Area Simulation System (TASS) show how the simulation is devised. The 100 m simulation was able to observe large-scale features.

CASI

Flight Tests; Simulation; Atmospheric Turbulence

20030020334 AeroTech Research, Inc., Hampton, VA USA

Development and Flight Test of In Situ Turbulence Algorithms

Robinson, Paul A., AeroTech Research, Inc., USA; Proceedings of the Second NASA Aviation Safety Program Weather Accident Prevention Review; January 2003, pp. 571-585; In English; Also announced as 20030020303; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A10, Microfiche

This viewgraph presentation provides an overview of the development and testing of in situ turbulence algorithms developed by AeroTech Research. These efforts were made in support of the development of a turbulence radar detection system designed to improve aircraft safety. Issues considered in the algorithm development included 3-D wind models and turbulence recovery, atmospheric/meteorological diagnostics, distributed load analysis and hazard metrics for radar. The code designed from these algorithms were flights tested aboard a NASA B-757 aircraft. Data analysis from these flight tests are presented.

CASI

Algorithms; Applications Programs (Computers); Atmospheric Turbulence; Data Processing; Airborne Radar; Meteorological Radar

20030020401 Florida State Univ., Dept. of Mathematics, Tallahassee, FL USA

Computational Aeroacoustics: An Overview

Tam, Christopher K. W., Florida State Univ., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. IV1-1 - IV-13; In English; Also announced as 20030020397

Contract(s)/Grant(s): NAG3-2327; NAG3-2102; NAG1-2145; NCC1-01026; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

An overview of recent advances in computational aeroacoustics (CAA) is presented. CAA algorithms must not be dispersive and dissipative. It should propagate waves supported by the Euler equations with the correct group velocities. Computation domains are inevitably finite in size. To avoid the reflection of acoustic and other outgoing waves at the boundaries of the computation domain, it is required that special boundary conditions be imposed at the boundary region. These boundary conditions either absorb all the outgoing waves without reflection or allow the waves to exit smoothly. High-order schemes, invariably, supports spurious short waves. These spurious waves tend to pollute the numerical solution. They must be selectively damped or filtered out. All these issues and relevant computation methods are briefly reviewed. Jet screech tones are known to have caused structural fatigue in military combat aircrafts. Numerical simulation of the jet screech phenomenon is presented as an example of a successful application of CAA.

Author

Aeroacoustics; Boundary Conditions; Computation; Fatigue (Materials)

20030020405 Motoren- und Turbinen-Union G.m.b.H., Aero Engines, Munich, Germany

Resolution Requirements for the Numerical Computation of Tonal Noise in Compressors and Turbines of Aeroengines

Huettl, Thomas, Motoren- und Turbinen-Union G.m.b.H., Germany; Kahl, G., Motoren- und Turbinen-Union G.m.b.H., Germany; Kennepohl, F., Motoren- und Turbinen-Union G.m.b.H., Germany; Heinig, K., Motoren- und Turbinen-Union G.m.b.H., Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 5-1 - 5-12; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The time linearized Euler method Lin3D is applied to two sets of test cases. 2D wave propagation test cases in homogeneous flow are used to quantify numerical dissipation and dispersion of the discretization scheme. The minimum number of mesh diagonals between two wave fronts has been found to be an appropriate measure of the resolution of a wave. Correlations have been found that characterize the dissipation and dispersion behavior of the code and therefore the resolution requirements for a given flow simulation. The transmission and reflection of plane sound waves incident upon a single cascade of finite plates has also been calculated with Lin3D and compared with an analytical method of Koch. The computed ratios of transmitted or reflected to incident pressure wave amplitude agree well with the analytical solution, even for scattered modes.

Author

Numerical Analysis; Noise (Sound); Wave Propagation; Aircraft Engines; Compressors

20030020411 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

Emerging Computational Tools for Flow Acoustics

Blake, William K., Naval Surface Warfare Center, USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. INV2-1 - INV2-10; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

This lecture is a survey of multiple on-going efforts in the United States, largely sponsored by the Office of Naval Research, that are devoted to the development of prediction methods for flow-generated sound. This research is meant to develop methods that are useful in future engineering applications that could involve complex three dimensional geometries, high Reynolds number fluid mechanics, flow-induced vibration, and finite Mach number. This paper will focus specifically on development of tools for the calculation of forcing functions and on efforts to systematically validate them in anechoic wind tunnels. The slides that are discussed herein form a complete description of work as currently undertaken at the David Taylor Model Basin of NSWC-CD and its collegiate organizations.

Author

Software Development Tools; Prediction Analysis Techniques; Acoustic Properties; Fluid Mechanics

20030020414 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Aerodynamik und Stroemungstechnik, Brunswick, Germany

Using RANS Mean Flow Fields in Numerical Aeroacoustics Simulations (CAA)

Lummer, Markus, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Grogger, H. A., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Delfs, J. W., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 16-1 - 16-13; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

One way to perform CAA simulations is to split the flow field in a steady mean flow and turbulent and acoustic fluctuations. The small acoustic fluctuations can then be calculated from linearized Euler equations (LEE). The mean flow can be supplied by the solution of the Reynolds averaged Navier-Stokes (RANS) equations. Since different numerical requirements exist for the numerical grids of RANS and LEE simulations, an interpolation procedure between RANS and LEE grids is necessary. The following paper presents an interpolation procedure between different structured multi-block grids and its application to RANS/CAA simulations of a generic wing section.

Author

Structured Grids (Mathematics); Steady Flow; Navier-Stokes Equation; Flow Distribution; Aeroacoustics; Numerical Analysis

20030020417 National Aerospace Lab., Amsterdam, Netherlands

Computations of Three-Dimensional Unsteady Supersonic Cavity Flow to Study the Effect of Different Downstream Geometries

Soemarwoto, B. I., National Aerospace Lab., Netherlands; Kok, J. C., National Aerospace Lab., Netherlands; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 21-1 - 21-13; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Computations of three-dimensional unsteady supersonic cavity flow are performed for a free-stream Mach number of 1.2. Two cavity geometries are considered: (1) a simple rectangular cavity of length-to-depth (L/D) and length-to-width (L/W) ratios of 4.5, and (2) a cavity with a 45 ramp attached to the downstream wall of the simple rectangular cavity. Two flow models for computing the cavity flowfield are assessed: (a) the Reynolds-Averaged Navier-Stokes (RANS) equations with a k - ω turbulence model for the whole flowfield, and (b) a combination of an inviscid flow model using the Euler equations for the domain outside the boundary layer and the RANS model for the boundary layer. The structures of the flowfields resulting from the different models are observed. The effect of the different downstream geometries is assessed.

Author

Mathematical Models; Computer Programs; Three Dimensional Flow; Supersonic Jet Flow; Unsteady Flow; Mach Number

20030020423 Air Force Research Lab., Bolling Air Force Base, Washington, DC USA

High Frequency Acoustic Suppression: Experimental and Computational Overview

Stanek, Michael J., Air Force Research Lab., Bolling Air Force Base, USA; Ross, John A., Defence Evaluation Research Agency, UK; Wrisdale, Ian, Defence Evaluation Research Agency, UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 29-1 - 29-20; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The recent history of the relatively new field of high frequency acoustic suppression is outlined. Key experiments, actuator developments, and obvious applications are described. Differences between low frequency forcing and high frequency forcing are outlined, and definitions for the two regimes are offered. Preliminary first steps toward numerical simulation of the high frequency acoustic suppression are critiqued and compared to existing experimental evidence. Future research directions are briefly described.

Author

High Frequencies; Noise Reduction; Experimentation; Computation

62

COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.

20030018859 Military Academy, West Point, NY USA

Trial-By-Fire in Information Assurance Education

Welch, Donald; Ragsdale, Daniel; Schepens, Wayne; Jul. 14, 2001; 13p; In English; Original contains color images
Report No.(s): AD-A408300; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the spring of 2001, the USA Military Academy, the United States Air Force Academy, and the Naval Postgraduate School participated in first ever Cyber Defense Exercise. Each school set up identical small networks running a typical suite of services. They then configured the network to be as secure as possible in advance of attacks by a NSA-led Red Team. After almost a week of attacks a winner was declared. This was the best educational experience any of the authors ever participated in and most students felt the same way. Although this exercise required a great deal of resources, the information assurance educational outcome was great. by following the principles of the exercise design we suggest here a less ambitious exercise could become a standard feature of information assurance programs.

DTIC

Education; Computer Information Security

20030018863 NASA Ames Research Center, Moffett Field, CA USA

Interfacing Computer Aided Parallelization and Performance Analysis

Jost, Gabriele, NASA Ames Research Center, USA; Jin, Haoqiang, NASA Ames Research Center, USA; Labarta, Jesus, Technical Univ., Spain; Gimenez, Judit, Technical Univ., Spain; Jun. 02, 2003; 12p; In English; 2003 International Conference of Computational Sciences (ICCS2003), 2-4 Jun. 2003, Melbourne, Australia

Contract(s)/Grant(s): NAS2-14303; NASA Order A-61812-D; DTTS59-99-D-00437; TIC2001-0995-C02-01; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under contracts NAS2-14303; DTTS59-99-D-00437; and NASA Order A-61812-D; Distribution as joint owner in the copyright under contracts NAS2-14303; DTTS59-99-D-00437; and NASA Order A-61812-D

When porting sequential applications to parallel computer architectures, the program developer will typically go through several cycles of source code optimization and performance analysis. We have started a project to develop an environment where the user can jointly navigate through program structure and performance data information in order to make efficient optimization decisions. In a prototype implementation we have interfaced the CAPO computer aided parallelization tool with the Paraver performance analysis tool. We describe both tools and their interface and give an example for how the interface helps within the program development cycle of a benchmark code.

Author

Architecture (Computers); Parallel Computers; Interfaces; Reliability Analysis; Computer Techniques

20030019022 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA

Quorum Distributed Object Integration (QUOIN) Final Report, Jun. 1998-Dec. 2002

Schantz, Richard E.; Loyall, Joseph; Pal, Partha; Atighetchi, Michael; Webber, Franklin; Dec. 2002; 120p; In English; Original contains color images

Contract(s)/Grant(s): F30602-98-C-0187; DARPA ORDER-J098; AF Proj. G116

Report No.(s): AD-A409663; AFRL-IF-RS-TR-2002-305; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Complex computing systems are predominantly networked. As a result, they must operate under increasingly unpredictable and changeable conditions. This problem occurs at multiple levels, ranging from distributed applications that are geographically dispersed to applications that are embedded and componentized. Both types of applications pose similar problems and issues, and lend themselves to similar solutions using strategies, algorithms, and optimizations at various levels of granularity. In particular, they require predictable mission-critical levels of service end-to-end. Adaptive distributed object computing (DOC) middleware is a promising approach to provide these end-to-end services by coordinating lower-level mechanisms that coordinate application- or user-centric tradeoffs.

DTIC

Distributed Processing; Real Time Operation

20030019209 Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA

NAVSUP Hosting Requirements and Service Level Agreements

Gaines, Leonard T.; Jan. 06, 2003; 120p; In English

Report No.(s): AD-A409872; NPS-CS-03-002; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This paper consists of a statement of work (SOW) and its related service level agreements (SLAs) for hosting services. The paper will be used as part of contract negotiations to outsource the hosting functions for NAVSUP owned applications. The SOW contains the hosting requirements that NAVSUP believes are necessary to support the application. NAVSUP will maintain control and responsibility of the application software, but all server and infrastructure hardware as well as system software support (operating system, monitoring software, utilities, and infrastructure software), is the responsibility of the service provider. The SOW details hosting requirements at three levels to allow program managers to select the levels and the corresponding services that best meet their needs. A service level agreement (SLA) is an agreement between a provider of services and a customer that defines a level of performance. This agreement defines in measurable terms the service to be performed, the level of service that is acceptable, and the means to determine if the service is being provided at the agreed upon levels. SLAs define the quality of service, and how it is measured. There are fourteen SLAs defined that support the SOW. This paper provides a starting point for negotiating host services. The intent of this paper is to give the program managers a document that listed hosting services that will provide a high level of support for their application. The SOW and SLA were designed to meet the needs of most applications, but each program manager will have the flexibility to select and modify the services and service levels required to support their specific applications.

DTIC

Computer Programs; Computer Information Security; Data Processing

20030019350 Kestrel Inst., Palo Alto, CA USA

Real-Time Asset Rescheduling With Execution Monitoring and Accurate Asset Tracking Final Report, May 1997-Sep. 2000

Smith, Douglas R.; Fitzpatrick, Stephen; Westfold, Stephen J.; Nov. 2002; 50p; In English

Contract(s)/Grant(s): F30602-97-C-0154; DARPA ORDER-F080; Proj-F080

Report No.(s): AD-A409702; AFRL-IF-RS-TR-2002-297; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Through the use of software transformational synthesis technology, synthesize rescheduling algorithms that reschedule transportation assets using data from automatic identification technology and asset tracking hardware and software. Kestrel

brought to bear its software synthesis technology which allows for the generation of correct-by-construction, high performance schedulers from formal specifications of the problem they are intended to solve. Savi Technology brought to bear its expertise in automatic identification technology and asset tracking hardware and software systems. In this effort Kestrel and Savi co-developed scheduler for Yard Management Systems based on data from the Army's Crane Ammunition Depot.

DTIC

Computer Programs; Tracking (Position)

20030019463 New Mexico Univ., Dept. of Physics and Astronomy, Albuquerque, NM USA

Post Detection Processing and Inverse Problems in Ground Based Imaging *Final Report, 1 Feb. 2000-31 Aug. 2002*

Prasad, S.; Nov. 08, 2002; 26p; In English

Contract(s)/Grant(s): F49620-00-1-0155

Report No.(s): AD-A409722; AFRL-SR-AR-TR-02-0447; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document contains the final report on the research activities supported by the AFOSR Grant No. F49620-00-1-0155 (to be called "the grant" hereafter) in the area of post processing and inverse problems in ground based imaging over the two-year duration of the grant. The principal objective of the grant was to establish an active research program in astronomical imaging and image processing at the Maui High Performance Computing Center (MHPCC). A number of vehicles were proposed to accomplish this objective over the grant period, specifically (i) two workshops a year at MHPCC; (ii) active participation of several distinguished imaging scientists from around the country in those workshops and by collaborative visits to MHPCC and the Univ. of New Mexico (UNM); and (iii) a series of seminars and courses to stimulate, foster, and organize existing resources and research personnel working with Air Force imaging assets particularly on Maui but also at the Starfire Optical Range (SOR), Kirtland AFB.

DTIC

Image Processing; Imaging Techniques; Astronomy

63

CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.

20030018844 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Three-Dimensional Stereo Reconstruction and Sensor Registration With Application to the Development of a Multi-Sensor Database *Final Report*

Oberle, William F.; Haas, Gary A.; Dec. 2002; 43p; In English; Original contains color images

Report No.(s): AD-A410118; ARL-TR-2878; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses efforts undertaken at the U.S. Army Research Laboratory (ARL), which support research in robotic perception. The efforts include collaborative work with the National Institute of Standards and Technology to develop a multi-sensor (laser radar LADAR, navigation and stereoscopic video (stereo) database with ground truth for use by the robotics research community. ARL's efforts are focused on stereo. The report documents procedures for determining the transformations between the cameras of the stereo system and the transformations between the camera system and other sensor, vehicle, and world coordinate systems. Results indicate that the measured stereo and ladar data are susceptible to large errors that affect the accuracy of the calculated transformations.

DTIC

Robotics; Three Dimensional Models; Data Bases; Multisensor Applications

20030018864 NASA Ames Research Center, Moffett Field, CA USA

A Real-Time Rover Executive based On Model-Based Reactive Planning

Bias, M. Bernardine, Carnegie-Mellon Univ., USA; Lemai, Solange, Laboratory for Analysis and Architecture of Systems, France; Muscettola, Nicola, NASA Ames Research Center, USA; [2003]; 7p; In English; The 11th International Conference on Advanced Robotics (ICAR 2003), 30 Jun. - 3 Jul. 2003, Portugal; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper reports on the experimental verification of the ability of IDEA (Intelligent Distributed Execution Architecture) effectively operate at multiple levels of abstraction in an autonomous control system. The basic hypothesis of IDEA is that a large control system can be structured as a collection of interacting control agents, each organized around the same fundamental

structure. Two IDEA agents, a system-level agent and a mission-level agent, are designed and implemented to autonomously control the K9 rover in real-time. The system is evaluated in the scenario where the rover must acquire images from a specified set of locations. The IDEA agents are responsible for enabling the rover to achieve its goals while monitoring the execution and safety of the rover and recovering from dangerous states when necessary. Experiments carried out both in simulation and on the physical rover, produced highly promising results.

Author

Automatic Control; Real Time Operation; Architecture (Computers); Autonomy

20030018896 NASA Ames Research Center, Moffett Field, CA USA

Subauditory Speech Recognition based on EMG/EPG Signals

Jorgensen, Charles, NASA Ames Research Center, USA; Lee, Diana Dee, Science Applications International Corp., USA; Agabon, Shane, NASA Ames Research Center, USA; [2003]; 6p; In English; International Joint Conference on Neural Networks 2003, 20-24 Jul. 2003, Portland, OR, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Sub-vocal electromyogram/electro palatogram (EMG/EPG) signal classification is demonstrated as a method for silent speech recognition. Recorded electrode signals from the larynx and sublingual areas below the jaw are noise filtered and transformed into features using complex dual quad tree wavelet transforms. Feature sets for six sub-vocally pronounced words are trained using a trust region scaled conjugate gradient neural network. Real time signals for previously unseen patterns are classified into categories suitable for primitive control of graphic objects. Feature construction, recognition accuracy and an approach for extension of the technique to a variety of real world application areas are presented.

Author

Neural Nets; Speech Recognition; Wavelet Analysis; Electromyography; Larynx; Conjugate Gradient Method

20030019010 Northwestern Univ., Medical School, Chicago, IL USA

Altering Movement Patterns in Healthy and Brain-Injured Subjects Via Custom Designed Robotic Forces

Patton, J. L.; Mussa-Ivaldi, F. A.; Rymer, W. Z.; Oct. 25, 2001; 5p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images
Report No.(s): AD-A409640; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We investigated robotic methods for teaching movements to hemiparetic subjects using novel techniques for neuro-adaptive control. Eight healthy subjects and twelve hemiparetic stroke subjects were exposed to novel viscous forces during planar movement of the hand towards a visual target. These forces were initially responsible for significant movement errors, but were followed by automatic adaptation. The forces were designed so that unexpected withdrawal would result in a pronounced after-effect, consisting of movement path errors that were opposite in sign to those induced by initial application of the force field. For healthy subjects, the desired movement was a curved sinusoid. For the hemiparetics, we chose a replicated normal trajectory. After-effect trajectories in healthy subjects' were significantly shifted toward the desired trajectory. This after-effect fully washed out following the removal of the forces in the final 50-75 movements, regardless of whether the subjects had visual feedback of their position. After-effects also generalized to movement directions that were not practiced. Hemiparetics showed different types of results. While several of them showed minimal improvement, the remaining hemiparetics showed adaptation with beneficial after-effects. Furthermore, several in this group retained diminished features of these after-effects for the duration of the experiment. This approach may be an effective neurorehabilitation tool because it does not require explicit instructions about the desired movement.

DTIC

Robotics; Medical Science; Robot Control; Man Machine Systems

20030019096 QinetiQ Ltd., Farnborough, UK

Remote Control of Vehicles

Viveash, Jacqueline, QinetiQ Ltd., UK; White, Joanna, QinetiQ Ltd., UK; Boughton, Jenny, QinetiQ Ltd., UK; King, Stuart, QinetiQ Ltd., UK; Kaye, Martin, QinetiQ Ltd., UK; Spatial Disorientation in Military Vehicles: Causes, Consequences and Cures; February 2003, pp. 16-1 - 16-7; In English; Also announced as 20030019078; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The remote guidance of vehicles or tools in inaccessible or hazardous environments is of considerable military interest. The control performance achieved with these systems is dependent on the information received by a human operator. Sensors such as Night Vision Goggles (NVG) mounted on the head, or cameras mounted on the vehicle or tool can be used to provide such

information, and how many sensors and where the sensors are positioned will depend on the task to be performed. Two experiments have been conducted to assess the effects on performance of presenting monocular, stereoscopic, or enhanced stereoscopic (hyperstereoscopic) information to the operator. One experiment used a head-mounted system to investigate the effects of these viewing systems on depth perception under static and dynamic conditions. In the other experiment cameras were mounted on a remotely controlled vehicle to investigate the effects the different viewing systems on vehicle control. Two tasks were used in this second investigation; one was a driving task, the other a manipulation task. The first experiment showed that there was an effect of motion on the results; depth was estimated more accurately under static than under dynamic conditions. Neither stereopsis nor hyperstereopsis had a measurable effect on depth perception. It was concluded that further experimentation should take place using a more appropriate task. The second experiment indicated that remote control performance was task dependent. For the driving task there was no significant difference between the performance measured under monocular and stereoscopic conditions. In the manipulation task the best performance was achieved using stereoscopic presentation techniques, the hyperstereoscopic presentation of information producing a 38% reduction in task completion time over the monocular time. For both tasks, regardless of whether the differences were significant or not, the better performance was always achieved using stereo rather than monocular presentation techniques. Thus it was concluded that there are advantages in using stereo rather than monocular presentation techniques for remote control tasks. In manipulative tasks the performance gain can be as high as 38%. Such an improvement in performance is clearly of importance for tasks such as bomb disposal and in-flight refuelling. In both experiments some subjects complained of eyestrain when using the hyperstereoscopic systems. Further work should be conducted to determine the optimum convergence setting for different tasks, and the amount of disparity easily tolerated by the majority of the population. On this basis of the above results a new apparatus has been designed to evaluate performance when head mounted displays such as night vision goggles (NVG) are used. The head-mounted apparatus consists of pairs of mirrors to reflect the visual scene into each eye of the individual. The outer mirrors will be positioned to produce effective interpupillary distances (IPD) of 2x, 3x or 4x the individuals IPD. The monocular and 1xIPD configurations will also be investigated. Further experiments are planned which will investigate the relationship between eyestrain and hyperstereopsis.

Author

Remote Control; Operators (Personnel); Operator Performance; Visual Perception; Enhanced Vision; Remotely Piloted Vehicles

20030019340 Naval Research Lab., Washington, DC USA

Evaluation and Improvement of a Speaker Verification System in Military Environments

Heide, David A.; Dec. 26, 2002; 23p; In English

Report No.(s): AD-A409777; NRL/FR/5550--02-10047; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. Navy is constantly looking for ways to improve security. One of the possible solutions proposed has been the use of biometrics, defined by the Biometric Consortium as 'automated methods of recognizing a person base on a physiological or behavioral characteristic'. One of the least costly, most convenient, and least invasive methods of biometrics is speaker verification. The Naval Research Laboratory's Voice Systems Section has undergone an extensive study of a commercial speaker verification system in adverse military noise and voice encoding environments. Additional testing was conducted to study the amount of improvement that could be achieved using a noise canceling preprocessor. This report documents the performance results in 10 different military noise environments, six different voice encoding algorithms, and all combinations of the two, with and without noise cancellation. Results show that speaker verification definitely show promise under some conditions. In many cases, a significant improvement in performance was achieved by using a noise cancellation preprocessor. While more testing needs to be done to gauge the level of performance under live conditions, this report shows system integrators where speaker verification could possibly be used.

DTIC

Coding; Speech Recognition; Voice Communication

20030020370 Kansas State Univ., Dept. of Mechanical Engineering, Manhattan, KS USA

Human-Like Robots

Cogley, Allen, Kansas State Univ., USA; Gustafson, David, Kansas State Univ., USA; White, Warren, Kansas State Univ., USA; Dyer, Ruth, Kansas State Univ., USA; Hampton, Tom, Editor, Kansas State Univ., USA; Freise, Jon, Editor, Kansas State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 246-257; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Design Team at Kansas State University has designed and built a prototype of a six-legged walking robot. This robot was designed to successfully navigate extremely rough terrain. Ultimately, the robot will be capable of near total autonomous roving and navigation with goal directed activity and self-preservation skills designed into the controlling software. The prototype is not complete, but the major phases of mechanical design and construction are complete. The electronics have been partially

designed, but need much further development and implementation. The Behavior Language, developed by Rodney B. Brooks at M.I.T. has been chosen to implement the high level control system.

Author

Autonomous Navigation; Prototypes; Robots; Walking

20030020474 NASA Ames Research Center, Moffett Field, CA USA

Machine Learning for Biological Trajectory Classification Applications

Sbalzarini, Ivo F., Eidgenoessische Technische Hochschule, Switzerland; Theriot, Julie, Stanford Univ., USA; Koumoutsakos, Petros, NASA Ames Research Center, USA; Studying Turbulence Using Numerical Simulation Databases - IX: Proceedings of the 2002 Summer Program; December 2002, pp. 305-316; In English; Also announced as 20030020448; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Machine-learning techniques, including clustering algorithms, support vector machines and hidden Markov models, are applied to the task of classifying trajectories of moving keratocyte cells. The different algorithms are compared to each other as well as to expert and non-expert test persons, using concepts from signal-detection theory. The algorithms performed very well as compared to humans, suggesting a robust tool for trajectory classification in biological applications.

Author

Machine Learning; Cluster Analysis; Cells (Biology)

64

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030018841 Lund Univ., Sweden

Block LMS Adaptive Filter With Deterministic Reference Inputs For Event-Related Signals

Olmos, S.; Sornmo, L.; Laguna, P.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A410079; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Adaptive estimation of the linear coefficient vector in truncated expansions is considered for the purpose of modeling noisy, recurrent signals. The block LMS (BLMS) algorithm, being the solution of the steepest descent strategy for minimizing the mean square error in a complete signal occurrence, is shown to be steady-state unbiased and with a lower variance than the LMS algorithm. It is demonstrated that BLMS is equivalent to an exponential averager in the subspace spanned by the truncated set of basis functions. The performance of the BLMS algorithm is studied on an ECG signal and the results show that its performance is superior to that of the LMS algorithm.

DTIC

Adaptive Filters; Signal Processing; Algorithms; Noise (Sound)

20030018845 Rensselaer Polytechnic Inst., Troy, NY USA

Automated p-Version Mesh Generation for Naval Structures Final Report, 1 Jun. 1999-31 Dec. 2002

Shephard, Mark S.; Dec. 29, 2002; 8p; In English; Original contains color images

Contract(s)/Grant(s): N00014-99-1-0725; Proj-A10957

Report No.(s): AD-A410122; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research study considered the technologies needed to realize the promise of optimum rates of convergence of adaptive high-order methods based on hp-discretization. The study focused on the development of the technologies needed to support robust p-version mesh generation of general non-manifold geometric domains of interest to the NAVY. To meet the goal of providing appropriate meshes for p-version finite element analysis for general domains, the authors developed an automatic mesh generation procedure to create curved finite element meshes with sufficient order of geometric approximation based on the order of polynomial used in the finite element basis. Although the initial straight-sided mesh generated by automatic mesh generators has all valid elements, the process of curving the mesh edges and faces to the appropriate model boundaries often yields elements with invalid shapes. Therefore, the developed procedures perform mesh modifications to produce a set of valid curved elements. A key ingredient is the geometric representation of the mesh entities. The standard method of Lagrangian interpolation does not lend itself to effective procedures as the order of the elements increases. Therefore, an alternative geometric form based on Bezier approximating geometry was developed. Many of the physical domains of interest to the Navy are structures dominated by thin

sections for which the desired finite element discretizations employ thin volume elements. For the most effective application of p-version finite elements it is desirable to generate elements in these thin volumes that do not have long diagonals going through the "thick-ness direction." This creates problems for current automatic mesh generators that use only tetrahedra. Therefore, procedures were developed to eliminate, to the greatest possible extent, such diagonals.

DTIC

Mathematical Models; Computational Grids; Curves (Geometry); Marine Technology

20030018900 Royal Melbourne Inst. of Tech., Australia

Wavelets for QRS Detection

Dinh, H. A.; Kumar, D. K.; Pah, N. D.; Burton, P.; Oct. 25, 2001; 6p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images
Report No.(s): AD-A410228; No Copyright; Avail: Defense Technical Information Center (DTIC)

This paper examines the use of wavelets for the detection of QRS complex in ECG. Wavelets provide temporal and spectral information simultaneously and offer flexibility with a choice of wavelet functions with different properties. This research has examined wavelet functions with different properties to determine the effects of wavelet properties such as linearity and time frequency localization on the accuracy of QRS detection. The sum of false negatives and false positives (total error in detection) is the criterion for determining the efficacy of the wavelet function. The paper reports a significant reduction in error in detection of QRS complexes with mean error reduced to 0.75%. This is achieved with the use of Cubic Spline wavelet- a biorthogonal third order wavelet. This paper reports that the use of wavelets reduces the error in detection of QRS complexes and that wavelet functions that support symmetry and compactness provide better results.

DTIC

Electrocardiography; Wavelet Analysis; Detection

20030018926 NASA Ames Research Center, Moffett Field, CA USA

Implicit Approaches for Moving Boundaries in a 3-D Cartesian Method

Murman, Scott M., Eloret Corp., USA; Aftosmis, Michael J., NASA Ames Research Center, USA; Berger, Marsha J., New York Univ., USA; Kwak, Dochan, NASA Ames Research Center, USA; Jan. 09, 2003; 28p; In English; AIAA ASM Conference, Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): F19620-00-0099; DE-FC02-01ER-25472; DE-FG02-00ER-25053; RTOP 704-40-21

Report No.(s): AIAA Paper 2003-1119; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This work considers numerical simulation of three-dimensional flows with time-evolving boundaries. Such problems pose a variety of challenges for numerical schemes, and have received a substantial amount of attention in the recent literature. Since such simulations are unsteady, time-accurate solution of the governing equations is required. In special cases, the body motion can be treated by a uniform rigid motion of the computational domain. For the more general situation of relative-body motion, however, this simplification is unavailable and the simulations require a mechanism for ensuring that the mesh evolves with the moving boundaries. This involves a "remeshing" of the computational domain (either localized or global) at each physical timestep, and places a premium on both the speed and robustness of the remeshing algorithms. This work presents a method which includes unsteady flow simulation, rigid domain motion, and relative body motion using a time-evolving Cartesian grid system in three dimensions.

Author

Cartesian Coordinates; Grid Generation (Mathematics); Three Dimensional Flow; Boundary Conditions; Unsteady Flow; Algorithms

20030018967 Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

The Accuracy of Remapping Irregularly Spaced Velocity Data onto a Regular Grid and the Computation of Vorticity

Cohn, Richard K.; Koochesfahani, M. M.; Aug. 04, 1999; 8p; In English; Prepared in collaboration with Michigan State Univ., Dept. of Mechanical Engineering, East Lansing, MI

Contract(s)/Grant(s): AF Proj. 3058

Report No.(s): AD-A410024; AFRL-PR-ED-TP-FY99-0167; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Velocity data obtained from Molecular Tagging are typically located on an irregularly spaced measurement grid. To take advantage of many standard data processing techniques, the MTV data need to be remapped onto a grid with a uniform spacing. In this work, accuracy and noise issues related to the use of a least-squares-fit to various low order polynomials for the remapping

of these data onto a uniformly spaced grid and the subsequent computation of vorticity from these data are examined. This information has relevance to PIV data processing as well. As noted by Spedding and Rignot (1993), the best estimate of the velocity vector acquired through the use of tracer techniques such as PIV, is at the midpoint of the displacement vector. Thus, unless special care is taken, PIV data are also initially obtained on an irregular grid. As in the results of Fouras and Soria (1998), the error in the re-mapped velocity and the calculated vorticity field is divided into a mean bias error and a random error. In the majority of cases, the mean bias error is a more significant source of error than the more often quoted random error. Results of the simulation show that the best choice for remapping is the use of a least-squares fit to a 2nd order polynomial and the best choice for vorticity calculation is to use a 4th order accurate, central, finite difference applied to uniformly sampled data. The actual value of the error depends upon the data density and the radius used for the selection of velocity measurements to be included in the remapping process. Increasing the data density and reducing the fit radius improve the accuracy.

DTIC

Data Processing; Computation; Computational Grids; Least Squares Method

20030019191 Marquette Univ., Milwaukee, WI USA

Medical Imaging Genesis for Finite Element-Based Mandibular Surgical Planning in the Pediatric-Subject

Zhao, Linping; Patel, P. K.; Widera, G. E.; Han, H.; Harris, G. F.; Oct. 25, 2002; 5p; In English; Original contains color illustrations; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409767; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A CT imaging system has been used to develop a finite element (FE) model of the child-specific mandible. Correspondingly a procedure to generate FE models from digital image data has also been developed. The geometric models are extracted from the CT scan data of children using ANALYZE AVW version 3.0 and then reviewed edited and meshed using the preprocessor of DEFORM 3D version 6.0. By utilizing simplified material model and boundary conditions detailed convergence tests were carried out using ABAQUS/STANDARD version 6.1. Test results show that over 52,592 linear tetrahedral elements or 37,062 degrees of freedom (DOF) are needed to model a child-specific mandible with reasonable accuracy. Results of the test series indicate that the surgical planning system is appropriate for further clinical implementation.

DTIC

Finite Element Method; Medical Equipment; Imagery; Medical Services

20030019703 Utah State Univ., National Center for the Design of Molecular Function, Logan, UT USA

Algorithm for Recognition of Optical Spectra in an Environment Containing Interferants

Wade, B.; Estes, C.; Lloyd, C.; Powers, L.; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409891; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An algorithm for quickly determining the presence of bacteria based on their intrinsic fluorescence signals has been developed. Applications of this algorithm are discussed. The constant threat of bacterial infection affects today's society, since these infections cause sickness and often death. These threats include bio-terrorism/bio-warfare, outbreaks of new and re-emerging diseases, and food and water contamination. Current technologies detect microbes, but are limited in their ability to do so. Most require an outgrowth step, requiring the proper media and time (usually at least one day). In addition, these require sample contact. To overcome these limitations, a prototype instrument has been developed that detects bacteria based on their intrinsic fluorescence properties.

DTIC

Algorithms; Bacterial Diseases; Spectra; Infectious Diseases; Contamination

20030019849 Ohio State Univ., Dept. of Electrical Engineering, Columbus, OH USA

An Auto-Calibration Method for Unattended Ground Sensors

Moses, Randolph L.; Krishnamurthy, Dushyanth; Patterson, Robert; Oct. 2001; 15p; In English

Report No.(s): AD-A409855; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present an algorithm for locating and orienting a set of sensor arrays that have been deployed in a scene at unknown locations and orientation angles. This self-calibration problem is solved using a number of source signals also deployed in the scene. We assume each array can estimate the time-of-arrival and direction-of-arrival (with respect to the array's local orientation coordinates) of every source. From this information we compute the array locations and orientations. We consider four

subproblems, in which the source signals or emission times are either known or unknown. We develop necessary conditions for solving the self-calibration problem and provide a maximum likelihood solution and corresponding location error estimate.

DTIC

Algorithms; Detectors; Arrays; Calibrating

20030019877 Massachusetts Inst. of Tech., International Center for Air Transportation, Cambridge, MA USA

Modeling, Analyzing, and Mitigating Dissonance Between Alerting Systems *Final Report*

Song, Lixia, Massachusetts Inst. of Tech., USA; Kuchar, James K., Massachusetts Inst. of Tech., USA; February 2003; 184p; In English

Contract(s)/Grant(s): NAG2-1425

Report No.(s): MIT-OSP-6891031; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Alerting systems are becoming pervasive in process operations, which may result in the potential for dissonance or conflict in information from different alerting systems that suggests different threat levels and/or actions to resolve hazards. Little is currently available to help in predicting or solving the dissonance problem. This thesis presents a methodology to model and analyze dissonance between alerting systems, providing both a theoretical foundation for understanding dissonance and a practical basis from which specific problems can be addressed. A state-space representation of multiple alerting system operation is generalized that can be tailored across a variety of applications. Based on the representation, two major causes of dissonance are identified: logic differences and sensor error. Additionally, several possible types of dissonance are identified. A mathematical analysis method is developed to identify the conditions for dissonance originating from logic differences. A probabilistic analysis methodology is developed to estimate the probability of dissonance originating from sensor error, and to compare the relative contribution to dissonance of sensor error against the contribution from logic differences. A hybrid model, which describes the dynamic behavior of the process with multiple alerting systems, is developed to identify dangerous dissonance space, from which the process can lead to disaster. Methodologies to avoid or mitigate dissonance are outlined. Two examples are used to demonstrate the application of the methodology. First, a conceptual In-Trail Spacing example is presented. The methodology is applied to identify the conditions for possible dissonance, to identify relative contribution of logic difference and sensor error, and to identify dangerous dissonance space. Several proposed mitigation methods are demonstrated in this example. In the second example, the methodology is applied to address the dissonance problem between two air traffic alert and avoidance systems: the existing Traffic Alert and Collision Avoidance System (TCAS) vs. the proposed Airborne Conflict Management system (ACM). Conditions on ACM resolution maneuvers are identified to avoid dynamic dissonance between TCAS and ACM. Also included in this report is an Appendix written by Lee Winder about recent and continuing work on alerting systems design. The application of Markov Decision Process (MDP) theory to complex alerting problems is discussed and illustrated with an abstract example system.

Author

Air Navigation; Collision Avoidance; Decision Theory; Disasters; Management Systems; Warning Systems; Accident Prevention

20030019882 Cornell Univ., Ithaca, NY USA

Algorithmic Issues in Network Design and in Information Access *Progress Report, for Oct. 2001-Jul. 2002*

Tardos, Eva; Jul. 2002; 7p; In English

Contract(s)/Grant(s): N00014-98-1-0589

Report No.(s): AD-A409842; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

There has been a few main areas of efforts. (1) understanding the tradeoffs between central allocation and the cost of relying on selfish behavior in different games, including a simple model of routing on the Internet, (2) Designing algorithms and mechanisms for optimization problems for selfish users such as scheduling, path selection, and auctions, (3) design of network topology, and server placement. I will review results in each of these three areas separately.

DTIC

Networks; Game Theory; Algorithms

20030020416 Office National d'Etudes et de Recherches Aerospatiales, Dept. of Computational Fluid Dynamics and Aeroacoustics, Chatillon, France

Numerical Prediction of the Unsteady Flow and Radiated Noise from a 3D Lifting Airfoil

Manoha, E., Office National d'Etudes et de Recherches Aerospatiales, France; Redonnet, S., Office National d'Etudes et de Recherches Aerospatiales, France; Delahay, C., Office National d'Etudes et de Recherches Aerospatiales, France; Sagaut, P., Office National d'Etudes et de Recherches Aerospatiales, France; Mary, I., Office National d'Etudes et de Recherches Aerospatiales, France; Khelil, S. Ben, Office National d'Etudes et de Recherches Aerospatiales, France; Guillen, P., Office National d'Etudes et de Recherches Aerospatiales, France; Ageing Mechanisms and Control Symposium; February 2003, Parts

A and B, pp. 18-1 - 18-15; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The numerical prediction of the aerodynamic noise radiated by an isolated airfoil is performed using a Computational AeroAcoustics (CAA) method. This hybrid method combines (i) a simulation of the nearfield unsteady flow and (ii) an acoustic method to estimate the noise radiated in the far field. This process is applied to a symmetrical NACA0012 airfoil with a constant section and a blunted trailing edge (TE), at a Mach number of 0.205 and an angle-of-attack of 5 deg. The Reynolds number based on the airfoil chord is 2.86 millions. The computational domain has a spanwise extent representing 3.3 % of the chord. The nearfield unsteady flow around the airfoil is computed via a compressible three-dimensional Large Eddy Simulation (LES). This flow exhibits a superimposed pressure fluctuation field which presents the qualitative and quantitative features of the TE noise generated by the acoustic scattering of: (1) the turbulent boundary layers convected on both airfoil sides (broad-band noise) and (2) the alternated vortex shedding generated by the TE bluntness (narrow band component). Due to the strong stretching of the LES computational grid, which acts as an acoustic low-pass frequency filter, this acoustic field cannot radiate farther than a half-chord from the body. Consequently, the LES must be relayed by an acoustic propagation method to correctly simulate the farfield noise. The most readily available methods are integral techniques which only need data on a control surface or in a control volume. A former estimation is performed via the Kirchhoff integration of pressure data on a control surface enclosing the airfoil and its wake. The position of this surface is subjected to a careful parametric study. Since very large spanwise integral length scales are observed on this surface, the acoustic field is assumed two-dimensional there, leading to interesting qualitative results but overestimated noise levels. On the other hand, wall pressure spanwise integral length scales reasonably match experimental values, suggesting to use the Ffowcs Williams-Hawkings integration of wall pressure data. This method provides farfield noise levels which agrees well with experimental data. Both methods assume that the mean flow is uniform outside the control surface, which slightly distorts the solution since the actual flow is non-homogeneous. In order to avoid such distortion, one can resort to a numerical method based on discretized linearized Euler equations (LEE) in which the total field is splitted into a mean flow and a perturbation field. The E3P code (Propagation of small perturbations using Euler equations) is currently developed for that purpose. The present paper shows its application to several complex acoustic scattering problems, then it shows how this code could be coupled to LES calculation on a two-dimensional interface.

Author

Unsteady Flow; Mathematical Models; Numerical Analysis; Aerodynamic Noise; Three Dimensional Models; Airfoils; Acoustic Propagation

20030020420 Universiteit Twente, Dept. of Mechanical Engineering, Enschede, Netherlands

Development of Discontinuous Galerkin Method for the Linearized Euler Equations

Blom, Carl P. A., Universiteit Twente, Netherlands; Hagmeijer, Rob, Universiteit Twente, Netherlands; Vedy, Eric, Institute TNO of Applied Physics, Netherlands; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 21-1 - 24-13; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The propagation of sound waves, defined as an oscillatory motion with small amplitude in a compressible fluid, can be described by the linearized Euler equations (LEE), under the assumptions that there is no feedback to the mean-flow and that effects of viscosity and heat conduction can be neglected. In the field of Computational Aeroacoustics (CAA), it is widely recognized that the numerical algorithms applied to solve the governing equations must have sufficiently low numerical dispersion and dissipation in order to accurately simulate the propagation of aeroacoustic information. To this end, higher-order schemes can be used. The Discontinuous Galerkin (DG) method is an ultimately compact finite-element method which can be applied efficiently on unstructured meshes, thus allowing geometrically complex problems to be handled. Higher-order (higher than second-order) accuracy can be obtained relatively easily because of the compactness of the method, at the penalty, however, of an increasing number of unknowns per element. An extensive description of the application of the Discontinuous Galerkin method in the field of CAA is given by Atkins et al. The results presented in the present paper are obtained with the computer code DIGs3D, which is based on a numerical algorithm developed to solve the LEE in three dimensions. For the spatial discretization of the LEE the Quadrature-free Discontinuous Galerkin method has been applied, while the time integration is performed by a four-step, low-storage Runge-Kutta algorithm. At present the algorithm is second-order accurate in both space and time. The numerical algorithm has already been applied to a three-dimensional broadband cavity-noise prediction problem, where it is part of a three-step method. In the three-step method, the first step provides the time-averaged RANS-Solution from which, in the second step, turbulent aeroacoustic source terms for the LEE are obtained. In the third step DIGs3D is used to simulate the propagation of the aeroacoustic disturbances produced by the source field. The work presented in this paper can be regarded as a continuation of the work presented. Two verification problems, the convection of a 2D compact acoustic disturbance and the radiation from a three-dimensional harmonic monopole source, were presented. One of the conclusions drawn in that paper is that acceleration

of the algorithm to relax requirements on computational effort was needed. Here we present results obtained for the first of the two.

Derived from text

Galerkin Method; Linear Equations; Euler Equations of Motion; Aeroacoustics; Computer Programs; Unstructured Grids (Mathematics)

20030020422 Johns Hopkins Univ., USA

Numerical Analysis of Stochastic Dynamical Systems in the Medium-Frequency Range

Ghanem, Roger, Johns Hopkins Univ., USA; Saekar, Abhijit, McGill Univ., Canada; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 27-1 - 27-11; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

A stochastic finite element method (SFEM) has been applied to the mid-frequency vibration analysis of complex structural systems. A frequency domain model reduction strategy is devised using the energy operator approach. The dominant eigen-subspace of the energy operator adapted to a specified frequency band allows the construction of a reduced model using the Ritz-Galerkin procedure. Once an efficient reduced model is constructed, the system parameter uncertainty is performed using SFEM approach. The approach allows significant computational efficiency in performing system parameter uncertainty analysis. The SFEM approach utilized is based on an integration of the Karhunen-Loeve and the Polynomial Chaos expansions with the energy operator methodology. The approach presented avoids the combination of disparate approaches for the mid-frequency vibration analysis such as the statistical energy analysis (SEA), the traditional modal analysis (well-suited for high and low frequency vibration analysis respectively) and thus appears to provide a general framework for mid-frequency vibration analysis. The emphasis in the paper is on investigating the effect of system parameter uncertainty on the dynamical response. Firstly, a simple example involving a coupled uncertain rod system is studied to provide a better understanding of the formulation. Secondly, the examples of a capsule and a shell-plate assembly with random joint parameters are investigated using an existing FEM software.

Author

Numerical Analysis; Stochastic Processes; Dynamical Systems; Frequency Ranges; Systems Analysis

20030020431 Bundeswehr Research Inst. for Materials, Explosives, Fuels and Lubricants, Erding, Germany

Mathematical Pattern Recognition Techniques Applied to Wear Debris Characterisation for Condition Monitoring of Gas Turbine Engines

Ortner, J., Bundeswehr Research Inst. for Materials, Explosives, Fuels and Lubricants, Germany; Czarnecki, J. v., Bundeswehr Research Inst. for Materials, Explosives, Fuels and Lubricants, Germany; Laufer, A., Bundeswehr Research Inst. for Materials, Explosives, Fuels and Lubricants, Germany; Gaulty, P., Bundeswehr Research Inst. for Materials, Explosives, Fuels and Lubricants, Germany; Oley, D., Bundeswehr Research Inst. for Materials, Explosives, Fuels and Lubricants, Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 8-1 - 8-5; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy; Distribution within the U.S. granted by agreement

The automation of wear debris characterisation by SEM / EDX analysis using mathematical pattern recognition techniques offers a reliable identification of particle alloy composition. It is less time consuming than an individual check for the best fitting material. Another advantage is the full automatic generated Word report, which can be easily distributed by LAN or email.

Author

Mathematical Models; Pattern Recognition; Gas Turbine Engines; Debris

65

STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series and analysis; and stochastic processes.

20030019008 Boston Univ., Neuromuscular Research Center, Boston, MA USA

Decomposition of Superimposed Waveforms Using the Cross Time Frequency Transform

Bonato, P.; Erim, Z.; Gonzalez-Cueto, J. A.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409637; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The identification of the timing of the discharges of groups of muscle fibers (motor units) is of utmost importance in research into the strategies employed by the central nervous system in producing muscle force and in the diagnosis of neuromuscular diseases. The process involves the recognition of unique shapes (action potentials) contributed by different motor units at random times throughout a muscle contraction. This paper addresses a specific aspect of the identification process: the decomposition of the compound signal when the action potentials of two or more motor units are superimposed. We propose a cross-time-frequency-based procedure to identify which two (out of a previously identified collection of waveforms) are included in a superposition.

DTIC

Decomposition; Central Nervous System; Muscles

20030019034 Cornell Univ., Ithaca, NY USA

Compute-Intensive Methods and Hybrid Approaches for Combinatorial Problems *Final Report, Mar. 1999-Jul. 2001*

Gomes, Carla; Nov. 2002; 56p; In English

Contract(s)/Grant(s): F30602-99-1-0005; AF Proj. 2304

Report No.(s): AD-A409686; AFRL-IF-RS-TR-2002-299; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Our research program focuses on techniques that lie at the intersection of Artificial Intelligence and Operations Research. In particular, we study computational methods for large-scale combinatorial optimization. Our research combines formal analysis and design of optimization techniques with the study of applications such as planning and scheduling, autonomous distributed agents and combinatorial auctions. Central themes of our work are (1) the integration of concepts from mathematical programming with constraint programming, (2) the study of the impact of structure on problem hardness, and (3) the use of randomization techniques to improve the performance of exact (complete) search methods. This report highlights some of our research projects and accomplishments.

DTIC

Combinatorial Analysis; Mathematical Programming

66

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030019275 Yamanashi Univ., Kofu, Japan

Automated Sleep Stage Scoring by Decision Tree Learning

Hanaoka, Masaaki; Kobayashi, Masaki; Yamazaki, Haruaki; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409924; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper we describe a waveform recognition method that extracts characteristic parameters from waveforms and a method of automated sleep stage scoring using decision tree learning that is in practice regarded as one of the most successful machine learning methods. In our method, first characteristics of EEG (electroencephalograph), EOG (electrooculograph) and EMG (electromyograph) are compared with characteristic features of alpha waves, delta waves, sleep spindles, K-complexes and REMs (Rapid Eye Movement). Then, several parameters that are necessary for sleep stage scoring are extracted. We transform these extracted parameters into a few discrete variables using canonical discriminant analysis and the discretization method based on a random walk, and then a committee that consists of several small decision trees is formed from a small number of training instances. Furthermore final sleep stages are decided by a majority decision of the committee. Our method was applied to the digitized PSG (polysomnograph) chart data, provided by the Japan Society of Sleep Research and we carried out an evaluation experiment. The experiment indicated that our method can quickly execute learning and classification and precisely score sleep stages.

DTIC

Decision Theory; Machine Learning; Sleep; Waveforms

20030019762 Army Engineer Research and Development Center, Cold Regions Research and Engineering Lab., Hanover, NH USA

Ice and Debris Passage for Innovative Lock Designs

Tuthill, Andrew M.; Jan. 2003; 45p; In English; Original contains color images

Report No.(s): AD-A409726; ERDC/CRREL-TR-03-2; No Copyright; Avail: Defense Technical Information Center (DTIC)

Physical and numerical models were used to assess ice and debris passage at navigation locks focusing on key factors such as the configuration of the upper approach, the design of the lock filling and emptying system and the location and design of culvert intakes and outlets. Unconventional ice passage techniques such as manifolds in the miter gates were also evaluated. Physical model results were compared to field observations and a parallel series of tests using the DynaRICE ice-hydraulic numerical model. Ice processes modeled included upper approach ice accumulation during lock filling, drawing ice into the lock chamber and flushing ice out of the lock. Initial ice thickness was found to be the most important parameter affecting ice passage. Physical and numerical model results compared reasonably well proving DynaRICE to be a useful tool for assessing ice passage for new lock designs.

DTIC

Navigation; Ice

70

PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

20030018947 Air Force Research Lab., Edwards AFB, CA USA

Pressure Effects and Surface Cracks in a Rubbery Particulate Composite

Miller, T. C.; Mar. 06, 2001; 6p; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A409603; AFRL-PR-ED-TP-2001-046; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the manufacture, handling, and storage of rubbery particulate composites, cracks develop in the material that threaten structural integrity. Previous fracture tests used edge cracked geometries to simplify analysis. Hopefully, these simple experimental results are applicable to a wide range of crack geometries. However, we can increase our confidence in these testing methods by also testing more realistic crack geometries. In this work, surface cracked specimen experiments supplement previous tests conducted under pressure on single edge notched tension (SENT) specimens'. The testing of these specimens under pressure is an attempt to understand the effects of pressure, and to quantify these effects. The use of dual specimen geometries is focused on ensuring that the SENT specimen data represents a fracture toughness that is geometry independent and that the SENT derived fracture parameters can be used in the analysis of semi-elliptical surface flaws in the structural application.

DTIC

Fracture Strength; Structural Failure; Pressure Effects; Surface Cracks

20030018948 Air Force Research Lab., Edwards AFB, CA USA

Investigating Near Tip Damage and Crack Growth Behavior in a Solid Propellant

Liu, C. T.; Mar. 08, 2001; 14p; In English

Report No.(s): AD-A409604; AFRL-PR-ED-TP-2001-048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives of this report were to investigate the local damage mechanisms near the crack tip in a solid propellant and investigate the effects of local damage on the crack growth behavior under a constant strain rate condition.

DTIC

Crack Propagation; Crack Tips; Degradation

20030018949 Air Force Research Lab., Edwards AFB, CA USA

Monitoring Initiation and Growth of Cracks in a Particulate Composite Material Using Nondestructive Testing Techniques

Liu, C. T.; May 14, 2001; 10p; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A409605; AFRL-PR-ED-VG-2001-118; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of this report was to investigate damage initiation and evolution and crack growth behavior in a highly filled polymeric material.

DTIC

Polymers; Crack Propagation; Crack Initiation; Growth

20030018950 Air Force Research Lab., Edwards AFB, CA USA

Crack Growth Data Collection and Reduction Methodology Survey

Miller, T. C.; Apr. 18, 2001; 8p; In English

Report No.(s): AD-A409606; AFRL-PR-ED-TP-2001-098; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Engineers responsible for predicting solid rocket motor performance and ensuring reliability know that during manufacture, transport, and storage of motors, cracks may appear in the propellant that threaten this reliability. When they discover cracks, engineers use fracture mechanics principles to assess the crack stability. Structural analysis shows the critical loads for the cracked motor, and testing of specimens determines the tendency of the material toward crack growth initiation, as well as subsequent growth rates. The measurement of crack growth rates in propellant is complicated by inhomogeneity of the microstructure and by time-dependent behavior. The local microstructure affects the crack growth, so that growth does not increase uniformly with load. Instead, the crack growth is sporadic, reacting to local stresses and strains in the microstructure; crack growth may even stop at some points during the test. Also, the high ductility of the viscoelastic matrix causes large dimensional changes, resulting in crack tip blunting and damage zones near the crack tip that deviate from the mathematical ideal of an infinitely sharp, well-defined crack. Another source of difficulties is that material properties often vary among specimens because of trouble maintaining uniformity during processing of large rocket grains, resulting in high statistical scatter in measurements compared with other materials.

DTIC

Crack Propagation; Data Acquisition; Performance Prediction; Microstructure; Fracture Mechanics

20030019019 Marquette Univ., Dept. of Biomedical Engineering, Milwaukee, WI USA

Validation of a Multi-Segment Foot and Ankle Kinematic Model for Pediatric Gait

Myers, K. A.; Wang, M.; Marks, R. M.; Harris, G. F.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409659; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper quantifies the system characteristics for a pediatric foot and ankle biomechanical model. While orientated along the Z-axis the static system resolution is computed at $0,32 + 0,29$ mm with 99,9% accuracy. Dynamic resolution and accuracy are $0,43 + 0,39$ mm and 99,8%, respectively. Angular dynamic resolution computes to $0,52 + 3,36$ degrees at 99,6% accuracy. These calculations are comparable to the Milwaukee adult foot and ankle model.

DTIC

Kinematics; Biodynamics; Feet (Anatomy)

20030019027 Michigan Univ., Dept. of Mechanical Engineering, Ann Arbor, MI USA

Mid-Frequency Dynamics of Complex Structural Systems: Assessing the State of the Art and Defining Future Research Directions Final Report, 1 Jun.-30 Nov. 2001

Pierre, Christophe; Castanier, Matthew P.; Nov. 26, 2002; 66p; In English

Contract(s)/Grant(s): F49620-01-1-0413

Report No.(s): AD-A409674; AFRL-SR-AR-TR-02-0444; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

One of the last frontiers of structural dynamics is mid-frequency vibration analysis of complex structures. In the low-frequency range, finite element analysis (FEA) is well established as the standard method. However, as the frequency of vibration increases, the cost of FEA becomes prohibitive due to the necessary refinement of the finite element mesh to capture the shorter wavelength of vibration. Furthermore, the system response becomes sensitive to small parameter variations at higher frequencies, which means that a statistical analysis should be employed to make confident response predictions. In the high-frequency range, statistical energy analysis (SEA) is popular. However, SEA provides only averaged response predictions and cannot capture the resonant behavior in the response that becomes evident as frequency decreases. Thus, there exists a mid-frequency range in which there is no established analysis technique analogous to FEA or SEA. The goal of this research is

to produce a review paper on mid-frequency vibration analysis that will provide a survey of the relevant literature, identify the key technical challenges, formulate an assessment of the state of the art, and propose directions for future research.

DTIC

Vibration; High Frequencies

20030019288 Karlsruhe Univ., Germany

Stretch Activated ION Channels in Myocytes: Parameter Estimation, Simulations and Phenomena

Sachse, F. B.; Riedel, C.; Seemann, G.; Werner, C. D.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference cd-rom.

Report No.(s): AD-A409903; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Mechanosensitive ion channels influence the electrophysiological state of cardiac myocytes. An examination of the mechanisms of mechano-electrical coupling on cellular level by the mechanosensitive ion channels was performed. Simulations with a detailed electrophysiological model were carried out. Static stretch led to an increase of the resting potential and a decrease of the duration of the action potential with increasing sarcomere length. Dynamic stretch delivered a variety of phenomena depending on the duration and amplitude of the stretch. An arrhythmogenic single cell phenomenon, early afterdepolarisation, was observed.

DTIC

Electrophysiology; Cells (Biology)

20030019303 Technische Hogeschool Twente, Enschede, Netherlands

Finite Element Modeling of Intermuscular Interactions and Myofascial Force Transmission

Yucesoy, Can A.; Koopman, Bart F.; Huijting, Peter A.; Grootenboer, Henk J.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409568; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A finite element muscle model to study the principles of intermuscular myofascial force transmission is developed. The results obtained explain force differences at the distal and proximal tendons of muscles that have mechanical interaction. This is in agreement with experimental findings in other recent studies. The strain distributions found along the fiber direction indicate intermuscular myofascial force transmission. A consequence is that active force generated within one muscle may be exerted at the tendon of another muscle.

DTIC

Finite Element Method; Strain Distribution; Face (Anatomy); Muscles

71 ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.

20030018849 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Cramer-Rao Lower Bounds of Angle-of-Arrival Estimates for Acoustic Sensor Arrays Operating in Atmospheric Turbulence

Collier, S. L.; Wilson, D. K.; Oct. 2001; 21p; In English; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ, La

Report No.(s): AD-A410153; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance bounds of acoustic arrays operating in atmospheric turbulence with fluctuations described by a von Karman spectrum have been examined.

DTIC

Acoustic Measurement; Cramer-Rao Bounds; Signal Detectors

20030018871 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Control of Sound Radiation and Reflection With Advanced Smart Acoustic Blankets *Final Report, 1 Oct. 1998-31 Mar. 2002*

Fuller, Chris R.; Nov. 2002; 24p; In English; Original contains color images

Contract(s)/Grant(s): F49620-99-1-0020

Report No.(s): AD-A410055; AFRL-SR-AR-TR-02-0454; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work carried out in this project has successfully demonstrated the potential of advanced smart acoustic blankets for reducing sound transmitted into payload fairings. The smart blanket consists of active tiles embedded in standard acoustic blanket material. The lightweight honeycomb tiles are supported by specially developed active-passive piezoelectric mounts, which implement Thunder elements. The mounts are designed to provide passive isolation of transmitted sound, which is augmented by the application of active inputs in parallel to the mount. SISO uncoupled control approaches were developed in order to facilitate the future use of multiple active tiles. Both feedforward and feedback control approaches applied to a single tile located on a payload fairing like structure provided good reduction of broadband transmitted sound. The feedback approach is especially attractive due to its low complexity and cost effectiveness of hardware. An analytical model of the active tile system applied to a base structure has been developed and used to optimally design the system.

DTIC

Acoustic Properties; Honeycomb Structures; Mathematical Models; SISO (Control Systems); Sound Waves; Reflection; Smart Materials; Blankets

20030018883 Drexel Univ., Dept. of Electrical and Computer Engineering, Philadelphia, PA USA

Advances in Measurements of Ultrasound Fields in the Frequency Range 20-60 MHz

Radulescu, E. G.; Lewin, P. A.; Nowicki, A.; Oct. 25, 2001; 4p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A410008; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A powerful measurement technique suitable for virtually continuous calibration of ultrasonic hydrophone probes in the frequency range 250 kHz - 60 MHz is described and frequency responses of PVDF polymer hydrophones are presented. The validity of the calibration results was examined using independent calibration techniques. The values of sensitivity in V/Pa obtained using a linear swept frequency technique were compared with those which were determined from the measurements employing nonlinear wave propagation. Also, the sensitivity against frequency data obtained here were compared with the data provided by an independent national laboratory. The overall agreement between the calibration results obtained using different techniques mentioned above was within +/-1 dB at the frequencies up to 25 MHz. The uncertainty increased gradually with increasing frequency and was determined to be +/-2.5 dB at 60 MHz. Spatial averaging correction model is being developed to minimize this uncertainty. The near continuous frequency plots in the 40-60 MHz bandwidth were not reported so far and reveal that the ultrasonic hydrophone probes response is largely controlled by their design architecture.

DTIC

Hydrophones; Calibrating

20030018994 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA

Ladar-Acoustic Fused Sensor for Area Denial Application

Kisatsky, Paul; Prado, Gervasio; Brennan, Tom; Oct. 2000; 8p; In English; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001), held in Applied Physics Lab., Johns Hopkins Univ.,

Report No.(s): AD-A409623; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Area Denial concepts, as applied to the next generation of scatterable mines (NGSM), are oriented to the philosophy of greatly reducing the cost and logistics burden of the current family of scatterable mines (FASCAM) while maintaining or improving their effectiveness. by extending the sensing radius of the mines and employing some level of warhead mobility, each mine can protect a larger surrounding area, thus reducing the number of mines required per minefield. ARDEC is currently investigating short range, low cost, ladar-acoustic hybrid sensors, which would be capable of detecting, classifying, tracking, and selecting the optimal firing path to vehicular targets at various ranges from the sensor. In this concept, the strengths and weaknesses of each sensing mode are designed to complement each other, resulting in improved performance of the integrated product. Design

concepts will be described and emphasis will be placed on techniques to detect and track targets despite near ground obstacle and terrain features, which can block line of sight. Experimental results, as available at the time of this paper, will also be presented.

DTIC

Laser Range Finders; Signal Detectors; Optical Radar

20030019065 Miami Univ., Dept. of Biomedical Engineering, Coral Gables, FL USA

Chirp and Click Evoked Auditory Steady State Responses

Hekimoglu, Yuce; Ozdamar, Ozcan; Delgado, Rafael E.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A410106; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this study, Auditory Steady State Responses (ASSR) to 100 microsec clicks and 4 msec cochlear chirps are recorded in adult subjects at repetition rates of 20 to 100Hz in 10 Hz increments, Response characteristics of ASSRs are compared in the frequency domain, Results show that response amplitudes to both stimuli peak in the proximity of 40 Hz and 80 Hz, but chirps generate responses with larger amplitudes at all repetition rates, The responses at 40 Hz repetition rates for both clicks and chirps are larger than the corresponding responses at 80 Hz stimuli in awake adults, The 40 Hz responses, however, show greater variability than the 80 Hz responses depending on the subject's state of consciousness, The predictions of the ASSR waveforms at each repetition rate were then synthesized by superimposing the suitably shifted Middle Latency Response (MLR) waveforms that were recorded during the same session with a stimulus repetition rate of 10 Hz for both click and chirp recordings.

DTIC

Chirp; Steady State; Waveforms; Hearing; Auditory Perception; Stimuli

20030019231 Woods Hole Oceanographic Inst., MA USA

Broadband Acoustic Backscatter and High-Resolution Morphology of Fish: Measurement and Modeling

Reeder, D. B.; Jech, J. M.; Stanton, Timothy K.; Jan. 2002; 56p; In English; Prepared in cooperation with NOAA/NMFS Northeast Fisheries Science Center, Woods Hole, MA

Report No.(s): AD-A409817; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Remote detection and classification of marine organisms require accurate acoustic scattering models that adequately incorporate organism morphology. Broadband acoustic backscattering measurements, advanced high-resolution imaging of fish morphology using CT scans and phase contrast x-rays (in addition to traditional x-rays), and associated scattering modeling using the images have been conducted involving alewife (*Alosa Pseudoharengus*), a swimbladder-bearing fish. A greater-than-octave bandwidth (40-95 kHz), shaped, linearly swept, frequency modulated signal was used to insonify live, individual, adult alewife that were tethered while being rotated in 1- degree increments of orientation angle over all angles in two planes of rotation (lateral and dorsal/ventral). These data, in addition to providing the orientation dependence of the scattering over a continuous band of frequencies, were also used (after pulse compression) to identify the dominant scattering features of the fish (including the skull and swimbladder).

DTIC

Sound Detecting and Ranging; Fishes

20030019362 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Tracking Moving Acoustic Sources With a Network of Sensors Final Report, Oct. 2000-Oct 2001

Kozick, Richard J.; Sadler, Brian M.; Oct. 2002; 48p; In English

Contract(s)/Grant(s): ARL-TR-2750

Report No.(s): AD-A410115; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents issues and algorithms for the problem of source tracking with a network of aeroacoustic sensors. We study fusion of data from sensors that are widely separated, and we give particular attention to the important issues of limited communication bandwidth between sensor nodes, effects of source motion, coherence loss between signals measured at different sensors, signal bandwidth, and noise. We compare the tracking performance of various schemes, including joint (coherent) processing of all sensor data, as well as data-reduction schemes that employ distributed computation and reduced communication bandwidth with a fusion center. Our analysis provides a quantification of the potential gain in source tracking accuracy that is achievable with greater communication bandwidth and joint processing of sensor data. We show that the potential gain in accuracy depends critically on the scenario, as determined by the source motion parameters, signal coherence between sensors, bandwidth of the source signals, and noise level. For scenarios that admit increased accuracy with joint processing, we present a bandwidth-efficient algorithm that involves beamforming at small-aperture sensor arrays combined with time-delay estimation

between widely spaced sensor arrays. The algorithms and their performance are illustrated using measured aeroacoustic data from ground vehicles.

DTIC

Aeroacoustics; Sensors; Algorithms; Data Reduction; Multisensor Fusion

20030020397 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Ageing Mechanisms and Control Symposium, Part A, Developments in Computational Aero- and Hydro-Acoustics Symposium *Les Mecanismes Vieillissants et le Controle, Partie A, Developpements dans le Domaine de l'Aeroacoustique et l'Hydroacoustique Numeriques*

February 2003; 364p; In English; In French, 8-11 Oct. 2001, Manchester, UK; Also announced as 20030020398 through 20030020447; Original contains color illustrations

Report No.(s): RTO-MP-079(I)-Pt-A-B; AC/323(AVT-074/075)TP/50-Pt-A-B; ISBN 92-837-0024-4; Copyright; Avail: CASI; C01, CD-ROM; A16, Hardcopy; A03, Microfiche; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement; Distribution within the U.S. granted by agreement

Part A: The acoustic characteristics of air and sea vehicles are of increasing importance for war-time as well as peace-time operations. The meeting treated the potential of and results obtained with computational aero- and hydro-acoustics. It is a relatively new and rapidly expanding technical discipline with a large potential for (more) accurate prediction of the acoustic characteristics of air and sea vehicles. Examples are: Acoustic signatures. Acoustic fatigue loads and their consequences for the structural integrity. Effects of inboard noise levels and the near-field acoustic environment including low frequency noise on the effective and efficient operation of the vehicle and its systems (human factors). Community noise of air vehicles during peace-time operation. Papers were presented on the following topics. Propulsion & power noise: propellers, fans, jets, power systems. Fluid flow noise: shear layers and vortex shedding/interaction, cavities. Noise propagation. Structural response and acoustic loads suppression. Part B: Financial constraints make it imperative to retain weapon systems for longer periods than originally planned and to operate them in ways not envisioned by the designers. Therefore technologies that extend the useful lives of weapon systems and their components are needed. Twenty four papers from seven NATO nations and one allied nation (Australia) were presented threatening the Monitoring and Management of Gas Turbine Fleets for Extended Life and Reduced Costs. Papers were presented in four major categories: Maintenance and logistics practices, General design practices, Usage data and mission analysis, and Life determination methodologies. These categories provided material of interest to, respectively, the fleet manager, the equipment designer, the fleet operators, and the technical specialists responsible for fundamental technologies. A consensus view emerged that full fleet monitoring is optimal for understanding fleet life. Further, limitations in existing data bases with regard to both content and ability to support appropriate data manipulation were identified as a significant concern. There is need for more research into the failure mechanisms such as crack growth in order to identify and safely use the remaining life in fielded systems. This originated from the work of the former AGARD/PEP WG28.

Author

Acoustic Fatigue; Acoustic Properties; Aging (Metallurgy); Computation; Fatigue (Materials); Gas Turbines; Human Factors Engineering

20030020402 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Aerodynamik und Stroemungstechnik, Technische Akustik, Brunswick, Germany

Simulation of Open- and Ducted-Rotor Noise Using CAA-Multidomain Method

Yin, Jianping, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Delfs, Jan W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 2-2 - 2-15; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The sound field generated by an open rotor and that radiated by the same rotor placed inside a semiinfinite duct is simulated using a Computational Aeroacoustic (CAA) multi-domain method. The linearized Euler equations in cylindrical coordinates are used as governing equations in solving this problem. Both Tam's radiation and PML boundary conditions are used. Comparisons of results by using the two different far-field boundary conditions will be given. A multi-domain Cartesian grid system is used so that the number of grid points can be kept as a minimum. A combination of DRP and a specially optimized cell-centered high order differencing scheme is implemented in the area of two Cartesian grid interfaces. The effect of mean flow including a shear layer on the noise radiation off the ducted rotor is studied.

Author

Aeroacoustics; Aerodynamic Noise; Computational Grids; Differential Equations; Ducts; Rotor Aerodynamics

20030020403 Rolls-Royce Ltd., Derby, UK

A Method for Deriving Tone Noise Information from CFD Calculations on the Aeroengine Fan Stage

Wilson, A. G., Rolls-Royce Ltd., UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 3-1 - 3-17; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

A wavesplitting procedure is proposed by which noise information can be derived from CFD calculations on the aeroengine fan stage. Noise propagation in the ducted regions is compared with well-understood linear behaviour in parallel wall ducts. Deviations from this behaviour are used to highlight important features of the flow solution. These include genuine flow features such as non-linear acoustic interaction as well as dissipation and boundary condition errors deriving from the numerical solution of the equations. Properly applied, the method provides quantitative noise source amplitudes, accounting for (modest) reflections from the boundaries of the CFD domain. At the same time confidence can be gained that the CFD results are accurate for the wavelengths and frequencies being analysed, and that the CFD domain sufficiently covers the region of interest. Examples are given of how the method can be applied to steady and unsteady CFD calculations. Limitations of the method are also discussed.

Author

Computational Fluid Dynamics; Aircraft Engines; Noise Propagation

20030020407 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering, UK

Computational Aero-Acoustic Studies of an Exhaust Diffuser

Jayatunga, C., Loughborough Univ. of Technology, UK; Kroeff, G., Loughborough Univ. of Technology, UK; Carrotte, J. F., Loughborough Univ. of Technology, UK; McGuirk, J. J., Loughborough Univ. of Technology, UK; Petersson, B. A. T., Loughborough Univ. of Technology, UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 9-1 - 9-10; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The present paper describes work underway to develop a computational approach that can adequately simulate both the aerodynamic and acoustic behaviour of a typical exhaust diffuser/volute combination, such as are commonly used in industrial gas turbines for power generation use. An experimental rig was constructed to obtain a detailed understanding of the flow and acoustic properties of the system, and to provide guidance for computational modelling. Two different approaches are described for analysis of this system. The first uses CFD predictions carried out with a time-averaged RANS-based approach and a statistical turbulence model. Examples of the flow-field from this approach are presented. The second approach uses Large Eddy Simulation CFD, on a simplified geometry chosen on the basis of the experimental evidence, to provide information on the unsteady flow behaviour. This information is analysed and used to specify parameters for an acoustic analogy model. The acoustic model is also a simplified representation of the dominant noise source constructed from an experimentally derived viewpoint. The model is based on a ring of dipoles simulating the fluctuating pressure field associated with the unsteady vortex shedding/growth/merging process in the shear layer emerging from the diffuser exit. Spectral analysis of the unsteady velocity field provided by the LES calculation is used to determine amplitude, frequency dependence and phase relationships in the acoustic model. The basis of the model is described and sample outputs from both LES and acoustic model components are used to illustrate its performance.

Author

Acoustic Properties; Aeroacoustics; Aerodynamic Characteristics; Aerodynamic Noise; Exhaust Diffusers

20030020408 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering, UK

A CFD Coupled Acoustics Approach for the Prediction of Coaxial Jet Noise

Page, G. J., Loughborough Univ. of Technology, UK; McGuirk, J. J., Loughborough Univ. of Technology, UK; Behrouzi, P., Loughborough Univ. of Technology, UK; Hossain, M., Loughborough Univ. of Technology, UK; Fisher, M. J., Southampton Univ., UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 10-1 - 10-12; In English; Also announced as 20030020397; Original contains color illustrations

Contract(s)/Grant(s): EPSRC-GR/M84985; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Prediction of jet noise is important for civil aircraft. Some CAA methodologies predict the full unsteady flow field of a jet in order to ascertain the far-field noise. The approach adopted here is to utilize CFD to obtain steady state information using a turbulence model and hence to provide inputs to a semi-empirical noise model, herein after referred to as the four source model. Predictions of a coaxial jet in comparison to laser measurements show that the CFD methodology can reproduce the experimental velocity field mixing and turbulence intensities. This leads to confidence that the CFD model can predict the influence of geometrical changes (such as nozzle area ratio) on the mean and turbulence field and so increase the validity of the four source model. Predictions of two geometries with differing area ratios showed that peak turbulence intensities are increased in the smaller

area ratio, but this can be accounted for by the use of a 'fully mixed' velocity in a four source model for jet acoustics. Predictions of a three-quarter cowl geometry were used to determine the equivalent parallel coaxial jet found immediately downstream of the bullet. This was achieved by integrating the areas and mass flows in the primary and secondary streams at the nozzle exits and downstream of the bullet. It is found that a velocity ratio of 0.7 and area ratio of 2.6 at the nozzle exit planes can be considered equivalent to a velocity ratio of 0.5 and area ratio 5 in the parallel flow downstream of the bullet. Input of such information from a RANS CFD prediction may be a relatively simple method for extending the applicability of the four source model.

Author

Computational Fluid Dynamics; Acoustics; Jet Aircraft Noise; Coaxial Flow; Turbulence Models; Noise Prediction (Aircraft)

20030020409 QinetiQ Ltd., Farnborough, UK

Predicting the Jet Near-Field Noise of Combat Aircraft

Harper-Bourne, M., QinetiQ Ltd., UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 12-1 - 12-15; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

QinetiQ (previously DERA) is currently undertaking on behalf of the UK MOD an integrated programme of applied research to develop improved prediction methods for acoustic fatigue assessment on next generation combat aircraft. This paper describes ongoing work to develop practical methods of predicting the near-field noise of the high-speed exhausts of military jet engines, for use at an engineering level. The study encompasses both jet mixing noise and broadband shock noise for single and twin jets and is focussed on predicting the intensity, spectra and spatial coherence of jet noise at the airframe, using a semi-empirical basis that marries aeroacoustic theory with source location data. The background to the development of the method through small scale heated model noise tests in the QinetiQ Noise Test Facility is described, followed by validation through near-field noise tests conducted in the QinetiQ GLEN sea-level engine test facility on a Rolls-Royce Spey turbojet engine.

Author

Aeroacoustics; Aerodynamic Noise; Engine Tests; Fighter Aircraft; Jet Aircraft Noise; Jet Mixing Flow; Near Fields

20030020410 Ecole Centrale de Lyon, Lab. de Mecanique des Fluides et d'Acoustique, France

Flow Field and Sound Radiation of a Mach 0.9 Jet Computed by LES

Bogey, Christophe, Ecole Centrale de Lyon, France; Bailly, Christophe, Ecole Centrale de Lyon, France; Juve, Daniel, Ecole Centrale de Lyon, France; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 13-1 - 13-12; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Spectacular improvements in jet noise prediction have been performed in the last decade, due to the progress in numerical simulations. Noting that hybrid approaches based on acoustic analogies present difficulties related to the modelling of source terms and to the formulation of a wave operator accounting for acoustic flow interactions, methods for computing the sound directly from the resolution of the unsteady compressible Navier-Stokes equations have been developed. The objective of this approach is to determine both the flow field and the acoustic waves in the same calculation. In this way, the computed sound field is a priori exact because no acoustic model is used. It will also permit to investigate the sound generation mechanisms since all flow and acoustic quantities are provided by the computation. However, serious numerical issues must be taken into account in this direct acoustic approach, owing to the great disparity of levels and length scales between the flow and the acoustic field. To overcome these difficulties, numerical techniques specific to Computational AeroAcoustics (CAA), suited to the behaviour of acoustic waves, have been proposed, such as non dispersive and non dissipative numerical schemes, or non-reflective boundary conditions. To make direct aeroacoustic calculations, the challenge is then to combine these CAA techniques with one of the methods used to solve the Navier-Stokes equations. The three classical approaches commonly used to solve these flow equations have thus been experimented for aeroacoustic simulations: Direct Numerical Simulations (DNS) consisting in computing all turbulent scales, Large Eddy Simulations (LES) where only larger scales are calculated whereas the effects of unresolved ones are modeled via a subgrid scale model, and the unsteady Reynolds Averaged Navier-Stokes equations (RANS) using turbulence closures. Among the first three-dimensional applications performed in the last five years, we can put forward the DNS of Freund et al. of the noise radiated by supersonic and subsonic circular jets, the LES of Morris et al. of the radiation of a supersonic rectangular jet, and the study of screech tones generation in a round jet using unsteady RANS by Shen & Tam. The use of LES is important because it can theoretically be applied to high Reynolds number flows unlike DNS which is restricted to very low Reynolds number flows. Therefore, in the present study, a Large Eddy Simulation of a three-dimensional circular jet with a Mach number of 0.9 and a Reynolds number of 65000 is performed, carrying on earlier preliminary works. The motivation is to show the feasibility of the direct computation by LES of the sound generated by a subsonic flow. For this, CAA numerical methods are used in the simulation. The validation of the computation is then carried out by comparing systematically both flow properties

and the radiated sound field with experimental data. This paper is organized as follows. Numerical procedure, characteristics of the jet and parameters of the simulation are presented. The flow development is briefly shown, by studying the mean flow and the turbulent intensities. The radiated acoustic field is then investigated. Finally, concluding remarks are given.

Author

Flow Distribution; Noise Prediction; Subsonic Flow; Sound Waves; Supersonic Jet Flow; Numerical Analysis; Computation

20030020412 Boston Univ., Coll. of Engineering, Boston, MA USA

Flow-Structure Interaction Noise at Low Mach Numbers

Howe, M. S., Boston Univ., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 14-1 - 14-13; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The method of compact Green's functions is described for calculating the sound produced by low Mach number turbulence interacting with a surface and by surfaces in relative motion. The method is very powerful and can supply analytical predictions of complex fluid-structure interaction noise, and can also be used to make acoustic predictions by 'postprocessing' data obtained from a numerical simulation of a hydrodynamic interaction. The theory is illustrated by cases of sound production by a vortex interacting with a sphere, by the linear and nonlinear theories of parallel vortex-airfoil interaction noise, the trailing edge noise produced by an airfoil of finite thickness and of arbitrary chord, and by the compression wave generated when a projectile is fired into a long duct.

Author

Acoustic Properties; Aerodynamic Noise; Compression Waves; Flow Noise; Low Turbulence; Mach Number

20030020413 Centre National de la Recherche Scientifique, Lab. d Etudes Aerodynamiques, Poitiers, France

Prediction of Noise Radiated by a Non-Isothermal Mixing Layer Using a Low Mach Number Approximation

Golanski, F., Centre National de la Recherche Scientifique, France; Fortune, V., Centre National de la Recherche Scientifique, France; Lamballais, E., Centre National de la Recherche Scientifique, France; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 15-1 - 15-12; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

The ability of an acoustic analogy to predict the sound radiated by a transitional mixing layer is evaluated by means of Direct Numerical Simulation results. The specific case of low Mach number flows with density variations is investigated. We consider the strategy where the acoustic source information is based on numerical results where the sound waves has been removed in order to limit the global computational cost of the prediction. It is shown that the low Mach number approximation coupled to the acoustic analogy can lead to very accurate predictions for the radiated sound if the acoustic sources in Lighthill's equation are taken into account carefully. The scaling laws of the acoustic intensity deduced from a repeated use of the Lighthill's analogy on a wide range of Mach numbers suggest a new interpretation about the experimental observations on the sound emission from hot and cold jets.

Author

Sound Waves; Acoustic Emission; Direct Numerical Simulation; Isothermal Layers; Jet Flow; Mixing Layers (Fluids)

20030020415 Technische Hochschule, Aerodynamisches Inst., Aachen, Germany

Computation of Aeroacoustic Sound Via Hybrid CFD/CAA-Methods

Ewert, R., Technische Hochschule, Germany; Meinke, M., Technische Hochschule, Germany; Schroeder, W., Technische Hochschule, Germany; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 17-1 - 17-11; In English; Also announced as 20030020397; Original contains color illustrations

Contract(s)/Grant(s): BMBF-20A9702B; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Different formulations for a two step CFD/CAA approach are investigated. The acoustic field is simulated using linearized perturbation equations which are excited by sources determined from the unsteady compressible near field flow. The sound generated by a cylinder in laminar flow at Mach number $M=0.3$ and Reynolds number $Re=200$ is used as a test problem. It is examined whether the viscous/ acoustic splitting method of Shen et al., which is based on a simulation of the incompressible flow field, can be adapted to a compressible base flow simulation. It is found that excessive artificial vorticity is generated in the wake of the cylinder due to the excitation of hydrodynamic instabilities. A new set of governing acoustic perturbation equations (APE)

is proposed, which includes sources determined from a compressible flow simulation. As shown for the test problem, the occurrence of vorticity is prevented completely since the source solely excites acoustic modes in the APE.

Author

Computational Fluid Dynamics; Aeroacoustics; Sound Fields; Acoustic Properties

20030020418 Ecole Centrale de Lyon, Lab. de Mecanique des Fluides et d'Acoustique, Ecully, France

Direct Calculation of Cavity Noise and Validation of Acoustic Analogies

Gloerfelt, Xavier, Ecole Centrale de Lyon, France; Bailly, Christophe, Ecole Centrale de Lyon, France; Juve, Daniel, Ecole Centrale de Lyon, France; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 22-1 - 22-12; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Flow-induced cavity noise is a harmful noise source in many applications. A complex nonlinear phenomenon is responsible for the intense self-sustained oscillations observed in experiments. However, the physics is difficult to model analytically. The tonal Strouhal numbers are well approximated by Rossiter's formula for a wide range of configurations but this simple semi-empirical analysis is not able to indicate the main oscillation mode neither its amplitude. Moreover, it is now generally recognized that noise generation mechanism can be dependent on the incoming boundary layer, the geometric properties of the cavity, the Mach number of the mean flow, and many other parameters. To predict detailed assessments of noise generation in complex cases, direct evaluation from fluid mechanics equations through DNS or LES with CAA tools represents the most thorough technique currently available. Nevertheless, the storage requirement and computation time make simulations of both the flow and acoustic fields difficult for realistic applications. An alternative approach for computing the cavity noise consists of a two step calculation: nonlinear generation of sound and linear sound propagation. Once sources have been identified, with CFD or CAA calculations, there are several techniques to calculate the resulting radiated field. In this work, we propose to study numerical issues of three integral formulations: the Ffowcs Williams and Hawkings (FW-H) analogy which extends Lighthill's theory to account for solid boundaries and two Wave Extrapolation Methods (WEM) from a control surface, the Kirchhoff and porous FW-H methods. All these integral formulations have similar analytical insights based on Green's function formalism and suffer from the limitation of the observer in a uniform flow. The linear wave equation is assumed valid outside the source region, so that nonlinear propagation of acoustic waves is also not described. In the first part of this paper, we shall present the direct computation of Navier-Stokes equations for a two-dimensional rectangular cavity with aspect ratio of 2, matching one configuration of Karamcheti's experiments. In the second part, the far-field noise, associated with sources computed from the previous DNS, is obtained using the three integral formulations. Each method shall be described and the results shall be compared with those of direct acoustic simulation taken as a reference.

Author

Cavities; Noise Generators; Acoustic Simulation; Computational Fluid Dynamics; Direct Numerical Simulation; Flow Noise; Sound Propagation

20030020419 Lisbon Univ., Center for Human Performance, Portugal

Low Frequency Noise: A Major Risk Factor in Military Operations

Branco, Nuno A. A. Castelo, Lisbon Univ., Portugal; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. INV3-1 - INV3-12; In English; Also announced as 20030020397; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Noise is a major factor in many military environments. Usually the concern is with the higher frequency bands (greater than 500 Hz) that cause hearing damage or interfere with speech. Protection against noise is thus focused on these higher frequencies, while the bands of lower frequencies (less than 500 Hz) are neglected, and non-audible bands, infrasound (less than 20Hz) are ignored. In reality, long-term exposure to low frequency noise (less than 500 Hz, including infrasound) (LFN) can be quite detrimental to one's health. LFN-Induced Pathology. The disorders associated with occupational exposure to LFN have been described for aeronautical technicians and pilots. Diagnostic tools and methodologies for monitoring and controlling the development of LFN-induced pathology, have already been outlined. Immediate effects of LFN-exposure can include a) decreased capacity for cognitive functions, which implies a decline in performance, the consequences of which can be minor to devastating; b) sudden onset of acute respiratory problems, neurological disturbances, and mood alterations, such as, rage reactions. Cumulative effects of LFN-exposure can include triggering of early aging processes, and the development of vibroacoustic disease in susceptible (70%) individuals. Early compulsory retirement is a frequent situation. Costs. Almost all military equipment require training programs for the operator. Long-term exposure to LFN can severely decrease the cost-return ratio for these operators, i.e., investment in training programs has little or no return. Accident/incidents can also damage the equipment itself, potentially jeopardizing missions. Waste of ammunition and other resources is another consequence of

unmonitored LFN-exposed operators. The cost of ignoring LFN as an agent of disease is ultimately more expensive than the prevention, protection and, above all, selection of personnel for noise-environment positions.

Author

Acoustics; Vibrational Stress; Low Frequencies; Infrasonic Frequencies; Hearing; Damage

20030020421 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA

Advances in High-Resolution Schemes for Computational Acoustics on General Geometries

Visbal, Miguel R., Air Force Research Lab., USA; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 25-1 - 25-12; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

A high-order compact-differencing and Pade-type filtering algorithm, coupled with either the standard fourth-order Runge-Kutta scheme or with a sub-iterative implicit method is developed and implemented to simulate aeroacoustic phenomena on curvilinear geometries. Several issues pertinent to the use of such schemes are addressed. The impact of mesh stretching in the generation of high-frequency spurious modes is examined and the need for a discriminating higher-order spatial filter procedure is established and resolved. The incorporation of these filtering techniques also permits a robust treatment of outflow radiation condition by taking advantage of energy transfer to high frequencies caused by rapid mesh stretching. Computations demonstrate that these algorithmic components are also suitable for interface treatments created in domain-decomposition strategies. For three-dimensional computations, special metric relations are employed to assure the fidelity of the scheme in curvilinear and dynamic meshes. Application to several benchmark 2D and 3D problems demonstrates the success of the overall computational approach.

Author

Algorithms; Aeroacoustics; High Resolution; Finite Difference Theory; Computation

20030020424 British Airways, Heathrow, UK

Technical Evaluation Report

Eady, C. J., British Airways, UK; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. T2-1 - T2-8; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The goal of the NATO-RTO is to conduct and promote cooperative research and information exchange within NATO and with its Partners. to achieve this goal, the RTO has set out three key objectives: 1. to support the development and effective use of national defence R&T and thus maintain a technological lead within the alliance. 2. to meet the military needs of the alliance. 3. To provide advice to NATO and national decision-makers. The requirement for the RTO-AVT-075 Symposium on Monitoring and Management of Gas Turbine Fleets for Extended Life and Reduced Costs grew out of the activities of the RTO Working Group 28. The objective of the symposium was to facilitate additional information exchange to provide professionals responsible for monitoring and management of gas turbine fleets with guidance on existing and proven techniques, and an insight into new technologies and practices planned for future systems. Therefore, the objective of the symposium was assessed as effectively supporting the achievement of RTO's key objectives. The symposium addressed gas turbine life management issues under four session headings: 1. Maintenance and Logistics Practices -knowledge of methodologies for forecasting spares requirements, parts tracking and determination of service levels. 2. General Design Practices - defining the impact of component deterioration, performance sensitivities to component changes made to improve life, and performance levels required by new or different roles or mission profiles. 3. Usage Data and Mission Analysis - information on monitoring systems, translation algorithms, sampling methodologies, design practices, and methodologies for assessing unforeseen in-service usage. 3. Life Determination Methodologies - understanding of design models, failure modes, material properties, and life assessment methodologies. The quality of the written papers and delivery of the presentations conveyed an enormous quantity of valuable information concerning research and development efforts in this area of specific military interest. The benefit of RTO's ability to bring together operators, logisticians, designers, scientists and academics in such highly focused symposia was evident in the lively and thought provoking discussions. In informing those who attended, provoking thought and promoting discussion, and in bringing together this collection of papers for publication and wider distribution, the RTO-AVT-075 Symposium successfully met its objective and contributed to the satisfaction of RTO's key objectives and the achievement of its goal.

Derived from text

Algorithms; Component Reliability; Logistics Management; Mission Planning

ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.

20030018902 Computer Sciences Corp., Moffett Field, CA USA

Modeling of Switching and Hysteresis in Molecular Transport

Samanta, Manoj P., Computer Sciences Corp., USA; Dec. 13, 2002; 1p; In English; 6th Eng. Found. Conference, 15-19 Dec. 2002, Key West, FL, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 704-40-32; RTOP 519-40-12; No Copyright; Avail: Issuing Activity; Abstract Only

The conventional way of modeling current transport in two and three terminal molecular devices could be inadequate for certain cases involving switching and hysteresis. Here we present an alternate approach. Contrary to the regular way where applied bias directly modulates the conducting energy levels of the molecule, our method introduces a nonlinear potential energy surface varying with the applied bias as a control parameter. A time-dynamics is also introduced properly accounting for switching and hysteresis behavior. Although the model is phenomenological at this stage, we believe any detailed model would contain similar descriptions at its core.

Author

Hysteresis; Molecular Interactions; Switching; Current Distribution; Energy Levels; Bias

20030019077 NASA Ames Research Center, Moffett Field, CA USA

Kepler Mission: A Search for Habitable Planets

Koch, David, NASA Ames Research Center, USA; Jun. 21, 2002; 1p; In English

Contract(s)/Grant(s): RTOP 853-10-01; No Copyright; Avail: Issuing Activity; Abstract Only

The Kepler Mission was selected by NASA as one of the next two Discovery Missions. The mission design is based on the search for Earth-size planets in the habitable zone of solar-like stars, but does not preclude the discovery of larger or smaller planets in other orbits of non-solar-like stars. An overview of the mission, the scientific goals and the anticipated results will be presented.

Author

Habitability; Mission Planning; Planets

20030019460 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Computational Method for Atomistic-Continuum Homogenization *Final Report, Nov. 2001-Nov 2002*

Chung, Peter W.; Namburu, Raju R.; Cornwell, Charles; Henz, Brian J.; Clarke, Jerry A.; Dec. 2002; 45p; In English

Contract(s)/Grant(s): Proj-DR1FY02CIS01

Report No.(s): AD-A409719; ARL-TR-2894; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The homogenization method is used as a framework for developing a multiscale system of equations involving atoms at zero temperature at the small scale and continuum mechanics at the very large scale. The Tersoff-Brenner Type II potential (Tersoff J. "Empirical Interatomic Potential for Carbon, With Applications to Amorphous Carbon." Physical Review Letters. vol. 61, no. 25, pp. 2879-2882, 19 December 1988; Brenner, D. W. "Empirical Potential for Hydrocarbons for Use in Simulating the Chemical Vapor Deposition of Diamond Films". Physical Review B, vol. 42, no. 15, pp. 94589471, 15 November 1990) is employed to model the atomic interactions while hyper elasticity governs the continuum A quasi-static assumption is used together with the Cauchy-Born approximation of enforce the gross deformation of the continuum on the positions of the atoms. The two-scale homogenization method establishes coupled self-consistent variational equations in which the information at the atomistic scale, formulated in terms of the Lagrangian stiffness tensor, concurrently feeds the material information to the continuum equations. Analytical results for a one-dimensional molecular wire and numerical experiments for a two-dimensional graphene sheet demonstrate the method and its applicability.

DTIC

Continuum Mechanics; Homogenizing; Atomic Interactions; Deformation

73 NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.

20030020395 NASA Ames Research Center, Moffett Field, CA USA

Effects of Lateral Plasma Density and Temperature Diffusion on VCSEL Performance

Li, Jian-Zhong, NASA Ames Research Center, USA; Cheung, Samson H., NASA Ames Research Center, USA; Ning, Cun-Zheng, NASA Ames Research Center, USA; [2002]; 4p; In English; Asia Pacific Optical Wireless and Communications, 14-18 Oct. 2002, Shanghai, China

Contract(s)/Grant(s): RTOP 704-40-32; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The hydrodynamic model is further verified by applying to a gain-guided single mode VCSEL. DC effects of $D(\text{sub NN})$: (1) increase threshold current $J(\text{sub th})$ and decrease slope efficiency; (2) within the studied range (50% pumping within threshold and realistic diffusion coefficient for a single mode), the L-I relation scales with the relative Injection current $(J/J(\text{sub th}) - 1)$. AC effects of $D(\text{sub NN})$: (1) decrease spectral bandwidth and responsivity of direct-current modulation; (2) within the studied range, the frequency response follows the same formal dependence as predicted without diffusion and under a linear gain model, while the resonant frequency position similarly scales with the relative injection current; (3) therefore, it is concluded that the AC effects of $D(\text{sub NN})$ is purely of static nature and reflected via its influence on o_t and $J(\text{sub th})$. Within this study, the nonlinear effects of $D(\text{sub NN})$ are mostly reproducible with an equivalent constant diffusion coefficient.

Derived from text

Plasma Density; Temperature Effects; Hydrodynamics; Surface Emitting Lasers; Performance Prediction; Diffusion

74 OPTICS

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

20030019260 Montana State Univ., Dept. of Mathematical Sciences, Bozeman, MT USA

Computational Methods for Atmospheric Optics Final Report, 1 Mar. 1999-31 Aug. 2002

Vogel, Curtis R.; Aug. 2002; 13p; In English

Contract(s)/Grant(s): F49620-99-1-0180

Report No.(s): AD-A409646; AFRL-SR-AR-TR-02-0446; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The development of efficient non-negatively constrained optimization algorithms for image deblurring. This includes a new pre-conditioner based on a sparse approximation to the blurring operator. The development of efficient pre-conditioners for the joint phase and object estimation problem in phase diversity. These pre-conditioners were based on the Hessian of the (quadratic) regularization terms. This paper also contains a careful numerical study and comparison of trust region vs. limited memory BFGS methods for the numerical solution to optimization problems arising in phase diversity estimation. Data for this study was obtained from the US Air Force Maui Spate Surveillance Complex in collaboration with Dr. David Tyler. The development of obtained preconditioned conjugate gradient schemes for volume refractive index (turbulence) estimation. These schemes make efficient use of the layered structure of the atmospheric turbulence profiles. This layered structure gave rise to block-structured matrices. We employed a block analogue of symmetric Gauss-Seidel iteration as our multi-grid smoother.

DTIC

Algorithms; Optical Properties; Numerical Analysis; Atmospheric Physics; Atmospheric Optics

20030020387 Virginia Polytechnic Inst. and State Univ., Dept. of Aerospace and Ocean Engineering, Blacksburg, VA USA

Lunar UV/Optical/IR Long-Baseline Interferometric Arrays

Jakubowski, Antoni K., Virginia Polytechnic Inst. and State Univ., USA; Youssef, Hazim, Virginia Polytechnic Inst. and State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 408-420; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Two 1992-93 Space Design student teams designed UV/ Optica/IRlong-baseline interferometric arrays to be emplaced on the far side of the moon. The array's primary objectives will be to detect and characterize extrasolar planets up to 10 par sec away and to carry exploration of the structure and evolution of the universe with an angular resolution 3 orders of magnitude better than Hubble's designed goal and over a greatly increased spectral range (up to 10 microns). Addressing requirements established by

NASA, the student teams developed two proposals named LOLA (Lunar Optical Long-baseline Array) and LOITA (Lunar Optical/Infrared Telescope Array). Both designs use maximum baseline of 5 km and will be capable of imaging with an angular resolution of 20 micro arc sec at 500 nm. LOLA is an array of twenty seven 1.5 m telescopes arranged in a Y-configuration. A two-stage, coarse and fine, optical delay system controlled by the laser metrology equalizes the optical path lengths of all 27 beams. Scientific instruments provide pupil plane imaging and spectroscopic analysis with fields of view ranging from 15 arc sec to $10(\exp -3)$ arc sec. A planet detection module operating in IR utilizes an achromatic nulling interferometer and single mode fiber optics. For continuous communication with Earth, a satellite orbiting L2 libration point is used. LOITA is composed of eighteen 1.75 m alt-azimuth telescopes arranged in a circular geometry and uses a three-stage delay system to equalize optical path lengths to within a few wavelengths. To ensure high IR sensitivity at wavelengths up to 10 microns, the optics and some detectors are cooled to about 70 K temperature. The array science instruments will allow: (a) wide-to-medium field imaging utilizing various beam combiners and large format mosaics of CCDs with $10(\exp 8)$ to $2.5 \times 10(\exp 9)$ pixels, (b) direct planet detection by starlight suppression at a level of $10(\exp 8)$, (c) astrometric measurements providing 0.1 micro arc sec: accuracy, and (d) single telescope option for direct imaging in the focal plane. A relay satellite at the L4 libration point will serve communications with Earth. LOITA will be constructed in 3 phases of 6 telescopes each. The combined mass of the array is estimated at about 77,000 kg.

Author

Interferometers; Astrometry; Design Analysis; Ultraviolet Detectors; Spectroscopic Analysis; Optical Paths; Imaging Techniques

20030020394 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Nanotechnology Infrared Optics for Astronomy Missions Annual Report, 1 Apr. 2002 - 31 Mar. 2003

Smith, Howard A., Smithsonian Astrophysical Observatory, USA; February 2003; 28p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-7394; NAG5-9363; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The program "Nanotechnology Infrared Optics for Astronomy Missions" will design and develop new, nanotechnology techniques for infrared optical devices suitable for use in NASA space missions. The proposal combines expertise from the Smithsonian Astrophysical Observatory, the Naval Research Laboratory, the Goddard Space Flight Center, and the Physics Department at the Queen Mary and Westfield College in London, now relocated to the University of Cardiff, Cardiff, Wales. The method uses individually tailored metal grids and layered stacks of metal mesh grids, both inductive (freestanding) and capacitive (substrate-mounted), to produce various kinds of filters. The program has the following goals: 1) Model FIR filter properties using electric-circuit analogs and near-field, EM diffraction calculations. 2) Prototype fabrication of meshes on various substrates, with various materials, and of various dimensions. 3) Test filter prototypes and iterate with the modeling programs. 4) Travel to related sites, including trips to Washington, D.C. (location of NRL and GSFC), London (location of QMW), Cardiff, Wales, and Rome (location of ISO PMS project headquarters). 5) Produce ancillary science, including both publication of testing on mesh performance and infrared astronomical science.

Derived from text

Technology Assessment; Infrared Radiation; Optical Equipment; Nanotechnology; Fir Filters

20030020406 Pratt and Whitney Aircraft of Canada Ltd., Dept. of Acoustics and Installations, Longueuil, Quebec Canada

Fan Tone Generation and Radiation System

Ait-Ali-Yahia, Djaffar, Pratt and Whitney Aircraft of Canada Ltd., Canada; Jay, Alexandre, Pratt and Whitney Aircraft of Canada Ltd., Canada; Moustapha, Hany, Pratt and Whitney Aircraft of Canada Ltd., Canada; Ageing Mechanisms and Control Symposium; February 2003, Parts A and B, pp. 6-1 - 6-12; In English; Also announced as 20030020397; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; Distribution within the U.S. granted by agreement

Designing modern turbofan engines with higher bypass ratios is significantly limited by increasingly restrictive airport noise regulations. Independent of takeoff, cruise or landing operations, the fan rotor-stator interactions remain as one of the major engine sources of noise. Therefore, interest in understanding, modeling and eventually reducing this noise has increased the need for advanced Computational Aero-Acoustics (CAA) codes to serve as a primary tool in the fan design process. Two years ago, Pratt & Whitney Canada (PWC) initiated a research effort to develop a fan tone generation and radiation system. As displayed in figure 1, this system integrates three in-house computational tools: a CFD fan analysis code such as NS3D, a CAA linear and nonlinear radiation codes, and a fan tone generation module which serves as a link between these CFD and CAA codes. NS3D is a PWC proprietary code which solves the 3D Navier-Stokes equations for turbomachinery and external flow problems by using an SUPG finite element method on structured and unstructured grids. The development and the validation of this code was already dealt with and here will be mainly used to perform 3D unsteady rotor-stator analyses of fan stages. Therefore, the present paper focuses

on the development of a noise generation module which computes the incident fan tone modes, as well as on the validation of the PWC CAA codes that serve in the propagation of the noise sources to the far-field. Both axisymmetric, nonlinear and linear CAA codes were developed for noise radiation from aircraft engines and, more specifically, for fan tone radiation computations. The nonlinear in-house codes, based on the Euler equations with a multidomain spectral method in space and an explicit 2N-storage Runge-Kutta in time, were first developed to achieve a more complete modelling of sound propagation phenomena. However, for typical industrial applications with high frequency incoming spinning modes, the nonlinear code is still demanding in terms of computer resources and it is limited to axisymmetric incident modes. An intermediate approach has been developed by Eversman that uses a linear modelling of sound propagation in which the mean-flow computation is decoupled from the acoustic field prediction. The methodology involves the solution in an axisymmetric frame of an incompressible potential equation for the mean-flow field and a linearized potential equation in the frequency domain for the acoustic field. Both equations are numerically discretized by a Galerkin finite element method with a direct solution of the resulting linear system of equations. Although this approach is attractive for fan noise design purposes, it may eventually become prohibitive for acoustic modes with high frequencies. In fact, an accurate prediction of noise propagation with quadratic isoparametric elements requires a fine mesh spacing, with at least six to seven elements (equivalent to between 13 to 15 points) per wavelength. The demand on computer resources is further increased by the use of direct matrix solvers. In the present paper, a fan tone generation procedure which is based on a high accurate spectral method is presented. The linear acoustic model is also revisited with several numerical and implementation improvements. Finally, several relevant benchmarks are included to demonstrate the efficiency and the accuracy of the current fan tone system.

Derived from text

Acoustic Properties; Aerodynamic Noise; Aircraft Engines; Aircraft Noise; Computational Fluid Dynamics; Noise Prediction; Sound Propagation

75

PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

20030018931 NASA Ames Research Center, Moffett Field, CA USA

The Delta(dot)B = 0 Constraint vs. Minimization of Numerical Errors in MHD Simulations

Yee, H. C., NASA Ames Research Center, USA; Sjoegreen, Bjoern, Royal Inst. of Tech., Sweden; Yee, H. C., NASA Ames Research Center, USA; Nov. 27, 2002; 1p; In English; International Conference on High Performance Scientific Computing, 10-14 Mar. 2003, Hanoi, Viet Nam; No Copyright; Avail: Issuing Activity; Abstract Only

The MHD equations are a system of non-strictly hyperbolic conservation laws. The non-convexity of the inviscid flux vector resulted in corresponding Jacobian matrices with undesirable properties. On the other hand, the MHD equations can be derived from basic principles in either conservative or non-conservative form. The non-conservative system has a better conditioned eigensystem. The $\Delta(\dot{B}) = 0$ constraint of the A4HD equations is only an initial condition constraint. One does not need the $\Delta(\dot{B})$ condition to close the MHD system. We formulate our new low dissipative high order scheme together with the Cargo & Gallice (1997) form of the MHD approximate Riemann solver in curvilinear grids for both versions of the MHD equations. A novel feature of our new method is that the well-conditioned eigen-decomposition of the non-conservative MHD equations is used to solve the conservative equations. This new feature of the method provides well-conditioned eigenvectors for the conservative formulation, so that correct wave speeds for discontinuities are assured. The justification for using the non-conservative eigen-decomposition to solve the conservative equations is that our scheme has a better control of the numerical error associated with the $\Delta(\dot{B})$ condition. Consequently, computing both forms of the equations with the same eigen-decomposition is almost equivalent. It will be shown that this approach, using the non-conservative eigensystem when solving the conservative equations, also works well in the context of standard shock-capturing schemes.

Author

Magnetohydrodynamics; Eigenvectors; Decomposition; Discontinuity; Inviscid Flow

20030019074 NASA Ames Research Center, Moffett Field, CA USA

A New Low Dissipative High Order Schemes for MHD Equations

Yee, H. C., NASA Ames Research Center, USA; Sjoegreen, Bjoern, Royal Inst. of Tech., Sweden; Nov. 27, 2002; 1p; In English; 25th General Assembly of the International Astronomical Union (IAUXXV), 13-26 Jul. 2003, Sydney, Australia; No Copyright; Avail: Issuing Activity; Abstract Only

The goal of this talk is to extend our recently developed highly parallelizable nonlinear stable high order schemes for complex multiscale hydrodynamic applications to the viscous MHD equations. These schemes employed multiresolution wavelets as adaptive numerical dissipation controls to limit the amount and to aid the selection and/or blending of the appropriate types of dissipation to be used. The new scheme is formulated for both the conservative and non-conservative form of the MHD equations in curvilinear grids.

Author

Magnetohydrodynamics; Adaptive Control; Numerical Control; Wavelet Analysis

20030020481 Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

Comparison of Bootstrap Current Models in a Self-Consistent Equilibrium Calculation for Tokamak Plasmas

Andrade, M. C. R., Instituto Nacional de Pesquisas Espaciais, Brazil; Ludwig, G. O., Instituto Nacional de Pesquisas Espaciais, Brazil; [2002]; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Different bootstrap current formulations are employed in a self-consistent equilibrium for tokamak plasmas where the total plasma current profile is supposed to have contributions of the diamagnetic, Pfirsch-Schlifter, and the neoclassical ohmic and bootstrap currents. A comparison among the different bootstrap current models is performed for a variety of plasma parameters of the small aspect ratio tokamak ETE (Experimento Tokamak Esférico), placed at the Associated Plasma Laboratory of ME, in Brazil. The calculations described here were performed using the Mathematica package in a PC type computer.

Author

Diamagnetism; Plasma Currents; Plasma Equilibrium

20030020482 Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

Radio Frequency Wave Dissipation by Electron Landau Damping in Elongated Spherical Tokamaks

Grishanov, N. I., Laboratorio Nacional de Computacao Cientifica, Brazil; deAzevedo, C. A., Universidade do Estado do Rio de Janeiro, Brazil; Ludwig, G. O., Instituto Nacional de Pesquisas Espaciais, Brazil; Neto, J. P., Laboratorio Nacional de Computacao Cientifica, Brazil; 2002; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Spherical Tokamaks (or Low Aspect Ratio Tokamaks) represent a promising alternative route to magnetic thermonuclear fusion. In order to achieve fusion conditions in these devices additional plasma heating must be employed. Effective schemes of heating and current drive in tokamak plasmas can be realized using radio frequency waves. As is well known, the kinetic wave theory of any toroidal plasma should be based on the solution of the Vlasov-Maxwell's equations. However, this problem is not simple even in the scope of linear theory since to solve the wave (or Maxwell's) equations it is necessary to use the-correct dielectric (or wave conductivity) tensor valid in the given frequency range for the realistic two-or three-dimensional plasma model. In this paper, the longitudinal permittivity elements are derived for radio frequency waves in a two-dimensional axisymmetric tokamak with elliptic magnetic surfaces, for arbitrary elongation and arbitrary aspect ratio. A high-temperature collisionless plasma model is considered. The drift-kinetic equation is solved separately for untrapped and usual t-trapped particles as a boundary-value problem, in the case when the so-called d-trapped particles are absent in the plasma, using an approach developed for Low Aspect Ratio Tokamak (LART) with circular magnetic surfaces.

Derived from text

Radio Frequencies; Wave Equations; Wave Degradation; Collisionless Plasmas; Landau Damping; Three Dimensional Models; Tokamak Devices

20030020483 Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

2001 Activities Report on the Research and Development Line in Controlled Thermonuclear Fusion (FUSION) of the Plasma Associated Laboratory (PAL) *Relatorio de Atividades de 2001 da Linha de Pesquisa e Desenvolvimento em Fusao Termonuclear Controlada (FUSAO), do Laboratorio Associado de Plasma (LAP)*

Ludwig, Gerson Otto, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 12p; In Portuguese
Report No.(s): INPE-9394-NTC/350; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The general purpose of this line is to research plasma in magnetic confinement, through the development of spherical tokamaks and auxiliary systems of diagnostics and heating of the plasma, aiming at the future generation of energy by fusion. More specifically the objective are: 1. Investigate compact toroidal systems of plasma magnetic confinement, following the international advances in the field. 2. Develop the ETE spherical tokamak, exploring the properties of this configuration and its potential as a fusion reactor of compact geometry, high beta and continuous operation. 3. Develop plasma heating systems and

current generation, namely by an injection of radio-frequency waves and high temperature plasma diagnostic systems suitable to the spherical tokamaks.

CASI

Controlled Fusion; Toroidal Plasmas; Plasma Control; High Temperature Plasmas; Fusion Reactors

20030020484 Instituto Nacional de Pesquisas Espaciais, Associated Plasma Lab., Sao Jose dos Campos, Brazil

Development of a High-Power Monotron for RF Applications in Spherical Tokamaks

Barroso, J. J., Instituto Nacional de Pesquisas Espaciais, Brazil; Kostov, K. G., Instituto Nacional de Pesquisas Espaciais, Brazil; Castro, P. J., Instituto Nacional de Pesquisas Espaciais, Brazil; Rossi, J. O., Instituto Nacional de Pesquisas Espaciais, Brazil; Patire, H., Jr., Instituto Nacional de Pesquisas Espaciais, Brazil; Ludwig, G. O., Instituto Nacional de Pesquisas Espaciais, Brazil; Goncalves, J. A., Instituto Nacional de Pesquisas Espaciais, Brazil; Sandonato, G. M., Instituto Nacional de Pesquisas Espaciais, Brazil; LeiteNeto, J. P., Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Electron cyclotron heating (ECH) assist has been demonstrated to significantly improve startup performance of tokamaks by decreasing the loop voltage, which translates into ramp current rates higher than those of pure Ohmic startup at equivalent loop voltages. This has been observed on several machines that normally rely on the use of gyrotrons or an assembly of klystrons to produce such beneficial effects at particular electron cyclotron resonance frequencies. However, specific RF source requirements in terms of frequency and power demand specially customized designs, leading to costly industrial tubes. In light of these considerations, preionization and plasma production on the ETE spherical tokamak of LAP/INPE are currently being pursued on the basis of the monotron, which, consisting of an electron beam that traverses a standing-wave cavity resonator, ranks as the simplest microwave tube. Thus describing the design, construction techniques and simulation results of a high-power microwave tube, the present paper reports on a proof-of-principle monotron experiment currently under way at our laboratory.

Author

Radio Frequencies; Electron Beams; Tokamak Devices; Resonant Frequencies; Electron Cyclotron Resonance; Construction

20030020491 Instituto Nacional de Pesquisas Espaciais, Lab. Associado de Plasma, Sao Jose dos Campos, Brazil

Overview of the ETE Spherical Tokamak Experiment

DelBosco, E., Instituto Nacional de Pesquisas Espaciais, Brazil; Ferreira, J. G., Instituto Nacional de Pesquisas Espaciais, Brazil; Berni, L. A., Instituto Nacional de Pesquisas Espaciais, Brazil; Oliveira, R. M., Instituto Nacional de Pesquisas Espaciais, Brazil; Ludwig, G. O., Instituto Nacional de Pesquisas Espaciais, Brazil; Shibata, C. S., Instituto Nacional de Pesquisas Espaciais, Brazil; Patire, H., Jr., Instituto Nacional de Pesquisas Espaciais, Brazil; Rossi, J. O., Instituto Nacional de Pesquisas Espaciais, Brazil; Vilela, W. A., Instituto Nacional de Pesquisas Espaciais, Brazil; Barbosa, L. F. W., Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper gives an overview of the ETE spherical tokamak activities in course at LAP/INPE, emphasizing the measurements of stray fields in the plasma region, produced mainly by eddy currents in the vacuum vessel, as well as measurements of gas breakdown and first plasma formation.

Author

Tokamak Devices; Eddy Currents; Electromagnetic Measurement

20030020496 Instituto Nacional de Pesquisas Espaciais, Lab. Associado de Plasma, Sao Jose dos Campos, Brazil

Present Status of ETE Diagnostics

Berni, L. A., Instituto Nacional de Pesquisas Espaciais, Brazil; Machida, M., Universidade Estadual de Campinas, Brazil; Monteiro, M. J. R., Universidade Estadual de Campinas, Brazil; Oliveira, R. M., Instituto Nacional de Pesquisas Espaciais, Brazil; DelBosco, E., Instituto Nacional de Pesquisas Espaciais, Brazil; Vilela, W. A., Instituto Nacional de Pesquisas Espaciais, Brazil; Ueda, M., Instituto Nacional de Pesquisas Espaciais, Brazil; Cioban, D., Universidade Estadual de Campinas, Brazil; Daltrini, A. M., Universidade Estadual de Campinas, Brazil; Castro, R. M., Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 4p; In English

Contract(s)/Grant(s): FAPESP-1998/3860-9; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The spherical tokamak ETE (Experimento Tokamak Esferico) has started its operation at LAP/INPE. The ETE is a small aspect ratio tokamak ($R/a = 1.5$), with major radius $R = 0.3$ m and minor radius $a = 0.2$ m. In the first phase of operation the following macroscopic plasma parameters are expected: toroidal induction field of 0.4 T, ohmic current up to 220 kA, plasma pulse duration of 15 ms, density of about $5 \times 10^{19}/\text{cu m}$ and temperature around 300 eV. A set of fundamental diagnostics is now being implemented comprising electromagnetic, Thomson scattering, mass spectrometer, fast visible spectroscopy and CCD

camera. Other diagnostics as fast neutral lithium beam probe, CO₂ interferometer and soft X-ray tomographer are being developed.

Author

Diagnosis; Interferometers; Neutral Beams; Pulse Duration; Spectroscopy; Tokamak Devices; Toroidal Plasmas

76

SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

20030018891 NASA Ames Research Center, Moffett Field, CA USA

Nanotube Heterojunctions and Endo-Fullerenes for Nanoelectronics

Srivastava, Deepak, NASA Ames Research Center, USA; Menon, M., Kentucky Univ., USA; Andriotis, Antonis, Inst. of Electronic Structure and Laser, Greece; Cho, K., Stanford Univ., USA; Park, Jun, Stanford Univ., USA; Dec. 04, 2002; 6p; In English; 6th Molecular Electronics Conference (UEF), 15-19 Dec. 2002, Key West, FL, USA

Contract(s)/Grant(s): DTTS59-99-D-00437; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under contract DTTS59-99-D-00437; Distribution as joint owner in the copyright under contract DTTS59-99-D-00437

Topics discussed include: (1) Light-Weight Multi-Functional Materials: Nanomechanics; Nanotubes and Composites; Thermal/Chemical/Electrical Characterization; (2) Biomimetic/Revolutionary Concepts: Evolutionary Computing and Sensing; Self-Heating Materials; (3) Central Computing System: Molecular Electronics; Materials for Quantum Bits; and (4) Molecular Machines.

Derived from text

Heterojunctions; Molecular Electronics; Nanotechnology; Biomimetics; Nanotubes

20030018930 NASA Ames Research Center, Moffett Field, CA USA

Competing Classical and Quantum Effects in Shape Relaxation of a Metallic Nanostructure

Chen, Dongmin, Harvard Univ., USA; Okamoto, Hiroshi, Harvard Univ., USA; Yamada, Toshishi, NASA Ames Research Center, USA; [2003]; 1p; In English; American Physical Society March 2003 Meeting, 3-7 Mar. 2003, Austin, TX, USA

Contract(s)/Grant(s): DTTS59-99-D-00437; No Copyright; Avail: Issuing Activity; Abstract Only

We demonstrate for the first time that the quantum size effect (QSE) plays a competing role along side the classical thermodynamic effect in the shape relaxation of a small metallic island. Together, these effects transform a lead(Pb) island grown on Si(111) substrate from its initially flat-topped morphology to a peculiar ring-shaped island, a process catalysed by the tip electric field of a scanning tunnelling microscope (STM). We shall show for the first time how QSE affects the relaxation process dynamically. In particular, it leads to a novel strip-flow growth and double-step growth on selective strips of a plateau inside the ring, defined by the substrate steps more than 60° below. It appears that atoms diffusing on the plateau can clearly (sub) i) sense (sub) i) +/- the quantized energy states inside the island and have preferentially attached to regions that further reduce the surface energy as a result of the QSE, limiting its own growth and stabilizing the ring shape. The mechanism proposed here offers a sound explanation for ring-shaped metal and semiconductor islands observed in other systems as well.

Author

Shapes; Nanostructure (Characteristics); Quantum Theory; Semiconductors (Materials); Electric Fields; Surface Energy

20030018984 Vilnius Gediminas Technical Univ., Semiconductor Physics Inst., Vilnius, Lithuania

Defect Engineering of Low-Temperature Grown GaAs for Terahertz Radiation Applications Final Report, 21 Sep. 2001-21 Sep 2002

Krotkus, Arunas; Jan. 2002; 39p; In English

Contract(s)/Grant(s): F61775-01-W-E012

Report No.(s): AD-A409608; EOARD-SPC 01-4012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Semiconductor Physics Institute as follows: The contractor will investigate Gallium Arsenate (GaAs) based terahertz emitters. A variety of GaAs devices will be grown and characterized by standard electrical and optical techniques. The terahertz emission efficiency and its spectral width of the samples will also be measured.

The goal of this investigation is to find the optimal conditions for the growth of GaAs layers from which efficient terahertz emitters for a frequency range of 0-10 THz can be manufactured.

DTIC

Gallium Arsenides; Semiconductors (Materials); Frequency Ranges; Arsenates

20030019868 California Univ., Dept. of Mathematics, Berkeley, CA USA

Numerical Methods for Solidification Processes in Materials Science Final Report, 1 Dec. 1998-30 Nov. 2001

Strain, John; Apr. 25, 2002; 8p; In English

Contract(s)/Grant(s): F49620-99-1-0065

Report No.(s): AD-A410140; AFRL-SR-AR-TR-02-0448; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our work on moving interface problems in materials science combines fast PDE solvers such as boundary integral methods with fast geometric algorithms and semi-Lagrangian implicit representations to build effective numerical methods. We developed an implicit boundary integral method for computing periodic dendrite formation in the symmetric model of unstable solidification 7 and fast algorithms for evaluating heat potentials 2 which speeded up our method by several orders of magnitude. In 6, we combined the boundary integral method of 7 with fast algorithms from 2,3,8 and the level set method of 4: the level set method handled topological changes effectively while fast boundary integral techniques ensured accuracy and efficiency in the velocity evaluation. We developed and analyzed efficient and accurate new vortex methods for modeling convection in the melt 4,10,11, together with new error analyses 12 and quadrature rules 9 for general integral equations. Since 1999, we have focused on the development and implementation of highly effective new numerical methods for general moving interface problems and widely applicable subsidiary computations. We summarize three projects below: the fast modular semi-Lagrangian method for general moving interfaces (described in Publications P112 and references 13-16), accurate contouring methods in two and three dimensions, and fast solution of two-point boundary value problems P3,P4.

DTIC

Solidification; Crystal Growth; Vortex Generators; Numerical Analysis

20030020386 Vanderbilt Univ., USA

Automated Protein Crystal Growth

Alves, Clayton, Vanderbilt Univ., USA; Apple, Chris, Vanderbilt Univ., USA; Anderson, David, Vanderbilt Univ., USA; Beckham, David, Vanderbilt Univ., USA; Bryan, John, Vanderbilt Univ., USA; Chandler, Christopher, Vanderbilt Univ., USA; Cocks, Andrew, Vanderbilt Univ., USA; Cross, Melissa, Vanderbilt Univ., USA; Erdmann, Stephen, Vanderbilt Univ., USA; Fowler, Mike, Vanderbilt Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 403-407; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The scientific value of experimental protein crystal growth has been well established in recent years. For full three dimensional growth of crystals, the zero gravity environment of space has been found to be an improvement to normal laboratory environments. The Automated Protein Crystal Growth Facility was designed to provide a fully automated protein crystal growth facility that is fully compatible with the Space Station Freedom (SSF). The precipitant, protein, and quenching solutions are pre-mixed, pre-loaded, and contained in the chamber. Growth is induced and terminated through the use of an automated robot. The rack was designed to optimize the space available in the ISPR (International Standard Payload Rack) by using an octagonal shape with a combination of storage and active growth sites. The automation of this experiment uses both a robotic arm and an end-effector designed to interface with the crystal growth chambers. The end-effector operates plungers and grasps chambers through the use of attachments to the end effector. The experiment is supported by an integrated environmental control and data management system. The data management system offers continuous groundbased control of the experiment through the use of optical sensors (fiber optics and photo transistors), heat sensors (thermocouples), and heat generators (electrical resistance heating coils).

Author

Protein Crystal Growth; Experimentation; Three Dimensional Models; Weightlessness; Environmental Control

PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.

20030019301 Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

Theoretical Determination of the Heats of Formation of Selected High-Energy Molecules

Mills, J. D.; Boatz, J. A.; Apr. 30, 1998; 18p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409570; AFRL-PR-ED-TP-1998-093; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a measure of the intrinsic energy content of a substance, the standard enthalpy of formation constitutes a critical parameter in the evaluation of the likely performance of candidate rocket fuels and propellant additives.

DTIC

Molecules; Enthalpy

20030019338 Texas A&M Univ., Dept. of Physics, College Station, TX USA

Fundamental and Applied Quantum Optics Final Report, 1 Oct. 1998-31 Dec. 2002

Scully, Marlan O.; Jan. 15, 2003; 16p; In English

Contract(s)/Grant(s): N00014-99-1-0001; Proj. 99PR00171

Report No.(s): AD-A409783; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent advances in quantum optics resulting from the study of atomic coherence effects have lead to substantial breakthroughs in quantum computing, metrology, high precision spectroscopy, telecommunications, generation of high-and low-frequency coherent radiation, etc. Using the most recent theoretical and experimental tools, we work on both the theory of basic physical phenomena and on practical implementation of these theoretical ideas.

DTIC

Quantum Theory; Coherent Radiation

SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20030019056 Rehabilitation Inst. of Chicago, Center for International Rehabilitation, Chicago, IL USA

International Rehabilitation Network Annual Report, 29 Sep. 2001-28 Sep 2002

Smith, William K.; Oct. 2002; 100p; In English

Contract(s)/Grant(s): DAMD17-00-1-0711

Report No.(s): AD-A410076; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The International Rehabilitation Network's goal is to improve the quality of services for land mine survivors and other amputees through the dissemination of educational programs and electronic services to rehabilitation professionals. This has been accomplished through the use of information telecommunications technologies and computer-based training. In Year 2, the CIR completed a 10-month distance learning program in Lower Extremity Prosthetics. The curriculum is delivered over WebCT courseware and was made available to 23 students in 11 centers in Guatemala, Nicaragua and El Salvador. The educational material is supplemented by interactive hybrid CD-ROMs that adjust for low bandwidth Internet connections. In addition, the CIR established a field office in Bosnia and completed a Balkans regional training assessment. New curriculum content in Upper Extremity Prosthetics was also completed. The CIR integrated WebCT's distance learning platform with online database capabilities that enable remote network members to perform data management functions through a secure login system. The types of data managed by the CIR are 1) regional rehabilitation center data and 2) outcome measurement data.

DTIC

Computer Networks; Clinical Medicine; Computer Assisted Instruction; Data Management; Telecommunication

ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030019758 NASA, Washington, DC USA

University Program Management Information System, FY 2001

[2002]; 558p; In English

Report No.(s): NASA/TM-2002-211518; NAS 1.15:211518; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche

As basic policy, NASA believes that colleges and universities should be encouraged to participate in the nation's space and aeronautics program to the maximum extent practicable. Indeed, universities are considered as partners with government and industry in the nation's aerospace program. NASA's objective is to have them bring their scientific, engineering, and social research competence to bear on aerospace problems and on the broader social, economic, and international implications of NASA's technical and scientific programs. It is expected that, in so doing, universities will strengthen both their research and their educational capabilities to contribute more effectively to the national well-being. This annual report is one means of documenting the NASA-university relationship, frequently denoted, collectively, as NASA's University Program. This report is consistent with agency accounting records, as the data is obtained from NASA's Financial and Contractual Status (FACS) System, operated by the Financial Management Division and the Procurement Office. However, in accordance with interagency agreements, the orientation differs from that required for financial or procurement purposes. Any apparent discrepancies between this report and other NASA procurement or financial reports stem from the selection criteria for the data. This report was prepared by the Education Division/FE, Office of Human Resources and Education.

Author

NASA Programs; University Program; Management Information Systems; Financial Management; Universities

20030019874 NASA, Washington, DC USA

University Program Management Information System: NASA's University Program Active Projects, FY 2002

[2003]; 702p; In English

Report No.(s): NASA/TM-2003-212256; NAS 1.15:212256; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

As basic policy, NASA believes that colleges and universities should be encouraged to participate in the nation's space and aeronautics program to the maximum extent practicable. Indeed, universities are considered as partners with government and industry in the nation's aerospace program. NASA's objective is to have them bring their scientific, engineering, and social research competence to bear on aerospace problems and on the broader social, economic, and international implications of NASA's technical and scientific programs. It is expected that, in so doing, universities will strengthen both their research and their educational capabilities to contribute more effectively to the national well being. This annual report is one means of documenting the NASA-university relationship, frequently denoted, collectively, as NASA's University Program. This report is consistent with agency accounting records, as the data is obtained from NASA's Financial and Contractual Status (FACS) System, operated by the Financial Management Division and the Procurement Office. However, in accordance with interagency agreements, the orientation differs from that required for financial or procurement purposes. Any apparent discrepancies between this report and other NASA procurement or financial reports stem from the selection criteria for the data. This report was prepared by the Office of Education/N.

Derived from text

Management Information Systems; University Program; NASA Programs; Aeronautical Engineering

20030020396 NASA, Washington, DC USA

Performance and Accountability Report, FY 2002

[2003]; 310p; In English; Original contains color illustrations

Report No.(s): NASA/NP-2003-01-297-HQ; NAS 1.83:01-297-HQ; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The NASA Fiscal Year 2002 Performance and Accountability Report is presented. Over the past year, significant changes have been implemented to greatly improve NASA's management while continuing to break new ground in science and technology. Excellent progress has been made in implementing the President's Management Agenda. NASA is leading the government in its implementation of the five government-wide initiatives. NASA received an unqualified audit opinion on FY 2002 financial

statements. The vast majority of performance goals have been achieved, furthering each area of NASA's mission. The contents include: 1) NASA Vision and Mission; 2) Management's Discussion and Analysis; 3) Performance; and 4) Financial.

CASI

NASA Programs; Reports; Aerospace Sciences; Technology Utilization; Management Planning

20030020442 Turbomeca S.A. - Brevets Szydlowski, Bordes, France

Cost of Maintenance and Service Life of Turbomotors *Cout de Maintenance et Duree de Vie des Turbomoteurs*

Claveau, Charles, Turbomeca S.A. - Brevets Szydlowski, France; Ageing Mechanisms and Control Symposium; February 2003, pp. 19-1 - 19-6; In French; Also announced as 20030020397; Copyright; Avail: CASI; A02, Hardcopy; Distribution within the U.S. granted by agreement

The sections in this paper are: The components of Direct Maintenance costs (DMC); The programmed maintenance; The classical method of programmed maintenance; The disadvantages of classical programmed maintenance; The different categories of parts; Optimizing parts service life; Operational management of parts; and A new method of turbomotors maintenance.

CASI

Costs; Maintenance; Turbomachinery; Service Life

20030020486 Bowling Green State Univ., OH USA

Achieving Recognition as A World Class Airport Through Education and Training

Quilty, Stephen M., Bowling Green State Univ., USA; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 3-14; In English; Copyright; Avail: Issuing Activity

The need and requirement exists for the implementation of proper safety oversight systems by airport operators and management. The ability to achieve world-class airport operations can occur only if airport personnel receive the proper education and training to manage safe operations and increase operating efficiency. This paper addresses the current requirements of the International Civil Aviation Organization for the certification of airports and means by which to obtain a proper safety oversight system, provides examples of airports making progress toward meeting world class standards, and describes a program for certifying airport personnel as a means to achieve world class airport operations.

Author

Airports; Safety; Civil Aviation

20030020489 British Columbia Univ., Faculty of Commerce and Business Administration, Vancouver, British Columbia Canada

Electronic Technology and Simplification of Customs Regulations and Procedures in Air Cargo Trade

Zhang, Anming, British Columbia Univ., Canada; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 87-102; In English; Copyright; Avail: Issuing Activity

One of the biggest barriers to air cargo trade is cumbersome customs regulations and procedures that have failed to keep up with the rapid development of the sector. This paper attempts to contribute to a better understanding of: (a) the issues surrounding the application of electronic technology and the simplification of customs procedures to air cargo trade and (b) why the issues are important. The current measures and practices are discussed, both generally and in the Asia Pacific Economic Cooperation (APEC) context particularly. The paper further examines regulatory lag and reforms. Finally, the requirements and factors that would affect a successful application of technology to customs and related administrative practices are discussed.

Author

Air Cargo; Electronic Equipment; Regulations

20030020492 Santa Clara Univ., CA USA

Written Communication Practices as Impacted by a Maintenance Resource Management Training Intervention

Taylor, James C., Santa Clara Univ., USA; Thomas, Robert L., III, Alliant International Univ., USA; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 69-90; In English

Contract(s)/Grant(s): FAA/AAM-240; NCC2-1025; Copyright; Avail: Issuing Activity

Written communication was examined in a large airline company that had implemented a Maintenance Resource Management training program. Respondent recollections of training content regarding written communication, along with trends in archival paperwork error data, were examined throughout training periods. Data from written work turnover documents were also collected from one site and analyzed to explore specific written communication practices and to examine training effects on

such practices. Implications for future research geared to airline maintenance error reduction are discussed, as well as conclusions regarding program impact on error reduction.

Author

Procedures; Maintenance Training; Resources Management; Communication Networks

20030020495 Purdue Univ., Dept. of Aviation Technology, West Lafayette, IN USA

Ethics Education in University Aviation Management Programs in the US, Part 2A, The Current Status

Oderman, Dale B., Purdue Univ., USA; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 15-36; In English; Copyright; Avail: Issuing Activity

This three-part study examines how four-year universities in the United States with baccalaureate programs in aviation management include ethics instruction in their curricula. Part One justified the need for ethics education and developed hypotheses to evaluate the current status of ethics instruction. Part Two of the study continues with an extensive survey conducted in 2000 of all collegiate aviation management department heads. Part Two A, the first of two reports on the results of the survey, describes the current status of teaching ethics in the nation's aviation management education programs. It was found that ethics is not widely included in collegiate aviation programs at levels expected in light of current industry problems.

Author

Education; Ethics; Surveys; University Program

82

DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

20030018912 NASA Ames Research Center, Moffett Field, CA USA

Two Paths from the Same Place: Task Driven and Human Centered Evolution of a Group Information Surface

Russell, Daniel M., IBM Almaden Research Center, USA; Trimble, Jay, NASA Ames Research Center, USA; Wales, Roxana, NASA Ames Research Center, USA; [2003]; 16p; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This is the tale of two different implementations of a collaborative information tool, that started from the same design source. The Blueboard, developed at IBM Research, is a tool for groups to use in exchanging information in a lightweight, informal collaborative way. It began as a large display surface for walk-by use in a corporate setting and has evolved in response to task demands and user needs. At NASA, the MERBoard is being designed to support surface operations for the upcoming Mars Exploration Rover Missions. The MERBoard is a tool that was inspired by the Blueboard design, extending this design to support the collaboration requirements for viewing, annotating, linking and distributing information for the science and engineering teams that will operate two rovers on the surface of Mars. The ways in which each group transformed the system reflects not only technical requirements, but also the needs of users in each setting and embedding of the system within the larger socio-technical environment. Lessons about how task requirements, information flow requirements and work practice drive the evolution of a system are illustrated.

Author

Information Flow; Support Systems; Mars Surface; Biological Evolution

20030018987 Brooke Army Medical Center, Fort Sam Houston, TX USA

Computer Simulation: A Methodology to Improve the Efficiency in the Brooke Army Medical Center Family Care Clinic (A Patient Wait Case Study) Final Report, Jul. 1999-Jul 2000

Merkie, John F.; Mar. 24, 2000; 87p; In English

Report No.(s): AD-A409614; AMEDDCS-3A-00; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The executive leadership at Brooke Army Medical Center (BAMC) believes there are inefficiencies, characterized by poor access, high patient total time in the clinic, high patient wait time and inappropriate resource utilization in the BAMC primary care clinics. Computer simulation was selected to assist in reengineering the primary care clinics at BAMC to improve efficiency and patient satisfaction. The purpose of this study was to describe the current system and to evaluate the potential impact of process/resource changes in patient wait times, access and resource utilization at the BAMC Family Care Clinic (FCC). The base models were utilized to compare results of proposed process/resource changes. Alternate models were compared to the base models for the time the patient waits for the PCPs (Primary Care Providers), the total time a patient is in the clinic and resource

utilization (e.g. PCPs, LVNs Licensed Vocational Nurse and exam rooms). Comparison of mod outputs revealed that two alternate models were more efficient than the base model. Ultimately, these alternate models' multiple resources were optimized at 110,120 and 130 percent of FY99 FCC visits to ascertain the best process/resource to improve access and patient wait times in the FCC.

DTIC

Computerized Simulation; Medical Services; Clinical Medicine; Computer Techniques

20030019023 Massachusetts Univ., Dept. of Computer Science, Amherst, MA USA

Getting What You Want: Accurate Document Filtering in a Terabyte World *Final Report, Sep. 1999-Sep 2002*

Callan, Jamie; Nov. 2002; 79p; In English

Contract(s)/Grant(s): F30602-98-C-0110; AF Proj. 4594

Report No.(s): AD-A409665; AFRL-IF-RS-TR-2002-304; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document describes information retrieval research techniques to users who are interested in receiving filtered information for specific topics or domains. The research includes techniques for setting document filtering thresholds, for adaptive learning and for filtering based upon user feedback in order to refine the document filtering process.

DTIC

Information Retrieval; User Requirements

20030019026 Government Printing Office, Washington, DC USA

Study to Identify Measures Necessary for a Successful Transition to a More Electronic Federal Depository Library Program

DiMario, Michael F.; Mar. 29, 1996; 203p; In English; Report to Congress

Report No.(s): AD-A409670; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A study to identify measures necessary for a successful transition to a more electronic Federal Depository Library Program is presented.

DTIC

Data Processing; Information Dissemination

20030019307 Imperial Coll. of Science and Technology, London, UK

A Comprehensive Web-Based Patient Information Environment

Kitney, R. I.; Claesen, S.; Halls, J.; Oct. 25, 2001; 3p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images

Report No.(s): AD-A409972; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The paper describes a new type of medical information environment which is fully web-enabled. The system can handle any type medical information including text, physiological waveforms, images and moving images, etc. The key to the PiRiLiS design is advanced web-browser based software integrated with a full Dicom library covering all modalities. This has resulted in a fast and robust system. The system has been evaluated at a number of sites including the USC radiology Department in Los Angeles where it is connected to a number of scanners and PACS systems in three hospitals. This paper describes a comprehensive, web-enabled, patient-centric medical information system called PiRiLiS. PiRiLiS is a Level 6 system on the international scale for EPR systems. In addition to providing the functionality of a Level 3 system, it has telemedicine and other multi-media, document imaging, access to knowledge bases and embedded guidelines. Another important feature of the PiRiLiS design is that it is fully compatible with the DICOM 3.0 standard which has been widely adopted by all of the world's major manufactures of medical equipment.

DTIC

Computer Programs; Data Bases; Information Systems; Patients; Medical Equipment

20030019757 NASA Ames Research Center, Moffett Field, CA USA

CICT Computing, Information, and Communications Technology Program

Laufenberg, Lawrence, NASA Ames Research Center, USA; Aug. 15, 2002; 10p; In English

Contract(s)/Grant(s): RTOP 704-00-00; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The CICT Program is part of the NASA Aerospace Technology Enterprise's fundamental technology thrust to develop tools, processes, and technologies that enable new aerospace system capabilities and missions. The CICT Program's four key objectives are: Provide seamless access to NASA resources- including ground-, air-, and space-based distributed information technology resources-so that NASA scientists and engineers can more easily control missions, make new scientific discoveries, and design

the next-generation space vehicles, provide high-data delivery from these assets directly to users for missions, develop goal-oriented human-centered systems, and research, develop and evaluate revolutionary technology.

Author

NASA Programs; Information Systems; Aerospace Systems; Systems Management; Computer Networks

20030020488 Embry-Riddle Aeronautical Univ., Coll. of Business Administration, Daytona Beach, FL USA

An Empirical Investigation of Financial and Operational Efficiency of Private Versus Public Airports

Vasigh, Bijan, Embry-Riddle Aeronautical Univ., USA; Haririan, Mehdi, Bloomsburg Univ., USA; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 91-110; In English; Copyright; Avail: Issuing Activity

The primary purpose of this paper is to compare efficiency of privatized and government owned airports. Although in the U.S. almost all of the airports used by commercial air carriers are owned and operated by the public sector, the trend towards airport privatization, especially in Western Europe, Asia, and Latin America, has stimulated new thinking in this regard both from the U.S. government, as well as businesses. As the privatization trend in the airport industry continues, airport managers are facing an increased pressure to find more cost-efficient ways of running their airports. Implementing improvement standards will become a necessity. Moreover, there is an increasing economic pressure on local governments to privatize

Author

Airports; Commerce; Economics; Governments; Industries

20030020490 Technische Hogeschool, Delft, Netherlands

Methodology for Assessing Sustainability of an Air Transport System

Janic, Milan, Technische Hogeschool, Netherlands; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 115-152; In English; Copyright; Avail: Issuing Activity

Assessment and operationalization of the concept of a sustainable air transport system have been recognized recently as an important but complex research, operational and policy tasks. In the scope of the current academic efforts to properly address these problems, this paper develops methodology for assessing the sustainability of an air transport system. The methodology is based on the indicator systems of sustainability defined for the operational, economic, social, and environmental dimensions of the system performance. The measures are defined for each indicator to express the system effects (benefits) and impacts (costs) for particular actors such as the system users-air travelers, air transport operators, aerospace manufacturers, local community members, local and central government. They are assumed to evaluate the system sustainability with respect to the values of selected indicators. Generally, for all of them the system will be sustainable if the indicators representing effects (benefits) are as high as possible and increase with increasing system output, and the indicators representing impacts (costs) are as low as possible and decrease with increasing system output.

Author

Air Transportation; Economics; Operational Problems

20030020493 Center for Global Development, Washington, DC USA

Who Soars in Open Skies? A Review of the Impacts of Anti-Trust Immunity and International Market Deregulation on Global Alliances, Consumers and Policy Makers

Stober, Andrew, Center for Global Development, USA; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 111-133; In English; Copyright; Avail: Issuing Activity

The past decade has seen a proliferation of global airline alliances. A significant shift in two government economic policies, international market deregulation (open skies) and the granting of anti-trust immunity to alliances has made these unions a reality. These policy shifts have affected the tripartite relationship between government, airlines, and consumers. This article reviews the analysis by the U.S. Department of Transportation (2000a), Brueckner (2001) and Oum (2001), and builds a link between open skies policy and findings of lower fares, higher revenues, higher profits, and service improvements. The article suggests that U.S. policy makers advanced the open skies agenda through foreign coalition building and multilateral agreements.

Author

Agreements; Airline Operations; Policies

20030020494 Nanyang Technological Univ., School of Civil and Environmental Engineering, Nanyang, Singapore

Development of An Intelligent Agent For Airport Gate Assignment

Lam, Soi-Hoi, Nanyang Technological Univ., Singapore; Cao, Jia-Meng, Nanyang Technological Univ., Singapore; Fan, Henry, Nanyang Technological Univ., Singapore; Journal of Air Transportation; 2003; ISSN 1093-8826; Volume 8, No. 1, pp. 103-114; In English; Copyright; Avail: Issuing Activity

The Aircraft-Gate Assignment Problem (AGAP) is a well-known Non-deterministic Polynomial-time (NP)-hard problem for optimization. During daily airport operations the arrival and departure times of flights may vary compared to their original schedules. This may require reassignment of gates to capture the dynamics of nights and gate status to enhance the level of services provided to passengers. For busy airports with high numbers of arrivals/departures, the assignment decisions must be made within a short time to capture all the changes. To satisfy this requirement, an intelligent agent for airport gate assignment (InGates) is being developed for this purpose for the management and assignment of gates at an airport for daily operations. The agent is aimed at performing the gate assignment for every flight, taking into consideration gate and flight dynamics, transfers, requirements of the airlines, aircraft types, airport operation rules, etc. A knowledge-based expert system forms the cores of the system and is connected to external databases for flight and passenger information. Real-time changes on airport gates and flights can be made through a graphical user interface, with the capabilities of performing real-time updating of the results and information. Data obtained at Singapore's Changi Airport is used to examine the performance of the System. Results obtained from the scenario analysis have shown that the system provides an enhanced way to assign gates at an airport. In the development of the next stage, InGates will be integrated with an optimization model to provide an integrated solution for planning and assignment of gates at an airport.

Author

Airline Operations; Airports; Expert Systems; Graphical User Interface; Real Time Operation; Schedules

89

ASTRONOMY

Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030019946 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Spectral Diagnostics of Galactic and Stellar X-Ray Emission from Charge Exchange Recombination *Annual Report, 29 Dec. 2001 - 28 Dec. 2002*

Wargelin, B., Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English

Contract(s)/Grant(s): NAG5-10443; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The proposed research uses the electron beam ion trap at the Lawrence Livermore National Laboratory to study the X-ray emission from charge-exchange recombination of highly charged ions with neutral gases. The resulting data fill a void in the existing experimental and theoretical data and are needed to explain all or part of the observed X-ray emission from the Galactic Ridge, solar and stellar winds, the Galactic Center, supernova ejecta, and photoionized nebulae.

Derived from text

Charge Exchange; Charge Transfer; Electron Beams; Ion Emission; Ion Recombination; Neutral Gases; X Rays

90

ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030018906 NASA Ames Research Center, Moffett Field, CA USA

Blowing in the Wind: I. Velocities of Chondrule-sized Particles in a Turbulent Protoplanetary Nebula

Cuzzi, Jeffrey N., NASA Ames Research Center, USA; Hogan, Robert C., Bay Area Environmental Research Inst., USA; [2003]; 44p; In English

Contract(s)/Grant(s): RTOP 344-30-51-03; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Small but macroscopic particles - chondrules, higher temperature mineral inclusions, metal grains, and their like - dominate the fabric of primitive meteorites. The properties of these constituents, and their relationship to the fine dust grains which surround them, suggest that they led an extended existence in a gaseous protoplanetary nebula prior to their incorporation into their parent primitive bodies. In this paper we explore in some detail the velocities acquired by such particles in a turbulent nebula. We treat velocities in inertial space (relevant to diffusion), velocities relative to the gas and entrained microscopic dust (relevant to accretion of dust rims), and velocities relative to each other (relevant to collisions). We extend previous work by presenting explicit, closed-form solutions for the magnitude and size dependence of these velocities in this important particle size regime, and compare these expressions with new numerical calculations. The magnitude and size dependence of these velocities have

immediate applications to chondrule and CAI rimming by fine dust, and to their diffusion in the nebula, which we explore separately.

Author

Chondrule; Turbulence; Meteorites; Minerals; Planetary Nebulae; Blowing

20030019493 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Physics of Galaxy Clusters and How it Affects Cosmological Tests *Annual Report, 15 Feb. 2002 - 14 Feb. 2003*

Vikhlinin, Alexey, Principal Investigator, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English
Contract(s)/Grant(s): NAG5-9217; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have worked on the analysis of the Chandra observations of the distant clusters of galaxies, and on exploring new ways to obtain cosmological constraints from the cluster data. Some of the scientific results are discussed below: (1) Evolution of the cluster scaling relations at z is approximately 0.5; (2) Using gas mass as a proxy for the total cluster mass.

Author

Galactic Clusters; Cosmology; Astronomical Models; Time

20030019494 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Basic Modeling of the Solar Atmosphere and Spectrum *Final Report, 1 Jul. 2000 - 30 Jun. 2002*

Avrett, Eugene, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English
Contract(s)/Grant(s): NAG5-9851; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant supported the research and publication of a major 26-page paper in *The Astrophysical Journal*, by Fontenla, Avrett, & Loeser (2002): 'Energy Balance in the Solar Transition Region. IV. Hydrogen and Helium Mass Flows with Diffusion.' This paper extended our previous modeling of the chromosphere-corona transition region to include cases with particle and mass flows. Inflows and outflows were shown to produce striking changes in the profiles of hydrogen and helium lines. An important conclusion is that line shifts are much less significant than the changes in line intensity and central reversal due to the influence of flows on the excitation and ionization of atoms in the solar atmosphere. This modeling effort at SAO is the only current one being undertaken anywhere to simulate in detail the full range of non-LTE absorption, emission, and scattering processes in the solar atmosphere to account for the entire solar spectrum from radio waves to X-rays. This effort is being continued with internal SAO funding at a relatively slow pace. Further NASA support in the future would yield results of great value for the interpretation of solar observations from NASA spacecraft.

Author

Solar Transition Region; Solar Spectra; Absorption Spectra; Helium; Hydrogen; Astronomical Models; Mass Flow

20030019826 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Constraints on Variability of Brightness and Surface Magnetism on Time Scales of Decades to Centuries in the Sun and Sun-Like Stars: A Source of Potential Terrestrial Climate Variability *Final Report, 1 Oct. 1998 - 30 Sep. 2002*

Baliunas, Sallie L., Smithsonian Astrophysical Observatory, USA; February 2003; 6p; In English
Contract(s)/Grant(s): NAG5-7635; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The following summarizes the most important, results of our research: (1) Conciliation of solar and stellar photometric variability; (2) Demonstration of an inverse correlation between the global temperature of the terrestrial lower troposphere, inferred from the NASA Microwave Sounding Unit (MSU) radiometers, and the total area of the Sun covered by coronal holes from January 1979 to present (up to May 2000); (3) Identification of a possible climate mechanism amplifying the impact of solar ultraviolet irradiance variations; (4) Exploration of natural variability in an ocean-atmosphere climate model; (5) Presentation of a review of the sun's coronal influence on the terrestrial space environment; (6) Quantification of stellar variability as an influence on the analysis of periodic radial velocities that imply the presence of a planetary companion.

Derived from text

Brightness; Magnetic Properties; Intervals; Stellar Atmospheres; Climate Models; Earth Atmosphere; Solar Radiation; Solar Activity

20030019873 California Univ., Lick Observatory, Santa Cruz, CA USA

The Ionization History of The Intergalactic Medium: *Final Report*

Madau, Piero, California Univ., USA; [2003]; 5p; In English
Contract(s)/Grant(s): NAG5-10232; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The funded project sought a unified description of the ionization, physical structure, and evolution of the intergalactic medium (IGM) and quasar intervening absorption systems. We proposed to conduct theoretical studies of the IGM and QSO

absorbers in the context of current theories of galaxy formation, developing and using numerical and analytical techniques aimed at a detailed modeling of cosmological radiative transfer, gas dynamics, and thermal and ionization evolution. The ionization history of the IGM has important implications for the metagalactic UV background, intergalactic helium absorption 21-cm tomography, metal absorption systems, fluctuations in the microwave background, and the cosmic rate of structure and star formation. All the original objectives of our program have been achieved, and the results widely used and quoted by the community. Indeed, they remain relevant as the level and complexity of research in this area has increased substantially since our proposal was submitted, due to new discoveries on galaxy formation and evolution, a flood of high-quality data on the distant universe, new theoretical ideas and direct numerical simulations of structure formation in hierarchical clustering theories.

Derived from text

Cosmology; Intergalactic Media; Ionization; Star Formation; Galactic Evolution

20030019875 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Possible Very Distant or Optically Dark Cluster of Galaxies Final Report, 1 Oct. 2000 - 30 Sep. 2002

Vikhlinin, Alexey, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English

Contract(s)/Grant(s): NAG5-10052; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this proposal was an XMM followup observation of the extended X-ray source detected in our ROSAT PSPC cluster survey. Approximately 95% of extended X-ray sources found in the ROSAT data were optically identified as clusters of galaxies. However, we failed to find any optical counterparts for C10952-0148. Two possibilities remained prior to the XMM observation: (1) This is was a very distant or optically dark cluster of galaxies, too faint in the optical, in which case XMM would easily detect extended X-ray emission and (2) this was a group of point-like sources, blurred to a single extended source in the ROSAT data, but easily resolvable by XMM due to a better energy resolution. The XMM data have settled the case --- C10952-0148 is a group of 7 relatively bright point sources located within 1 square arcmin. All but one source have no optical counterparts down to I=22. Potentially, this can be an interesting group of quasars at a high redshift. We are planning further optical and infrared followup of this system.

Author

X Ray Sources; X Ray Astronomy; Quasars; Active Galactic Nuclei; Infrared Radiation; Galactic Clusters

20030019935 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Chemical Compositions and Abundance Anomalies in Stellar Coronae ADP 99 Annual Report, 29 Jan. 2002 - 28 Jan. 2003

Drake, Jeremy, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English

Contract(s)/Grant(s): NAG5-9105; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Progress has been made using both EUVE (Extreme Ultraviolet Explorer) and ASCA (Advanced Satellite for Cosmology and Astrophysics) data and a new postdoctoral scientist has now been hired. Stars studied to date include YY Gem (dMe binary), xi Boo A (intermediate activity G8 V), xi UMa (more active G quadruple system) HR1099 (K1 IV + G5 V) RS CVn-like, AU Mic (dMe). In addition to a paper that concentrated on abundancies in HR1099, a paper was recently submitted on the coronal abundances of AR(tilde)Lac that revealed an interesting pattern of overabundances of very low FIP elements (Al and Ca) compared to the low FIP elements Si, Mg and Fe. Two papers are nearing completion on methods of analysis and on the abundances in the corona of AU(tilde)Mic. Additionally, two invited conference proceedings papers are being published on this work. The main conclusion of the study to date is that our existing ideas of coronal abundance anomalies need complete revision. The solar-like FIP effect is replaced by a pattern than appears to enhance high FIP elements rather than low FIP elements in very active stars. The archival studies we are undertaking now are revealing some key details of these patterns, and are beginning to map out the anomalies as a function of spectral type, a key goal of this study.

Derived from text

Abundance; Anomalies; Chemical Composition; Stellar Coronas

20030018895 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Summer 1997 Eruption at Pillan Patera on Io: Implications for Ultrabasic Lava Flow Emplacement

Williams, David A., Arizona State Univ., USA; Davies, Ashley G., Jet Propulsion Lab., California Inst. of Tech., USA; Keszhelyi,

Laszlo, Arizona Univ., USA; Greeley, Ronald, Arizona State Univ., USA; Journal of Geophysical Research; Dec. 25, 2001; ISSN 0148-0227; Volume 106, No. E12, pp. 33,105-33,119; In English
Contract(s)/Grant(s): RTOP 624-02-00-18
Report No.(s): Paper-2000JE001339; Copyright; Avail: Issuing Activity

Galileo data and numerical modeling were used to investigate the summer 1997 eruption at Pillan Patera on Io. This event, now defined as 'Pillanian' eruption style, included a high-temperature (greater than 1600 C), possibly ultrabasic, 140-km-high plume eruption that deposited dark, orthopyroxene-rich pyroclastic material over greater than 125,000 sq km, followed by emplacement of dark flow-like material over greater than 3100 sq km to the north of the caldera. We estimate that the high-temperature, energetic episode of this eruption had a duration of 52- 167 days between May and September 1997, with peak eruption temperatures around June 28, 1997. Galileo 20 m/pixel images of part of the Pillan flow field show a widespread, rough, pitted surface that is unlike any flow surface we have seen before. We suggest that this surface may have resulted from (1) a fractured lava crust formed during rapid, low-viscosity lava surging, perhaps including turbulent flow emplacement; (2) disruption of the lava flow by explosive interaction with a volatile-rich substrate; or (3) a combination of 1 and 2 with or without accumulation of pyroclastic materials on the surface. Well-developed flow lobes are observed, suggesting that this is a relatively distal part of the flow field. Shadow measurements at flow margins indicate a thickness of approx. 8-10 m. We have modeled the emplacement of putative ultrabasic flows from the summer 1997 Pillan eruption using constraints from new Galileo data. Results suggest that either laminar sheet flows or turbulent channelized flows could have traveled 50-150 km on a flat, unobstructed surface, which is consistent with the estimated length of the Pillan flow field (approx. 60 km). Our modeling suggests low thermal erosion rates (less than 0.1 m/d), and that the formation of deep (greater than 20 m) erosion channels was unlikely, especially distal to the source. We calculate a volumetric flow rate of approx. $2-7 \times 10^{(exp 3)}$ cu m/s, which is greater than those for typical Mauna Loa/Kilauea flows but comparable to those for the (1783) Laki eruption and the inferred flow rates of the Roza flows in the Columbia River flood basalts. The differences in ultrabasic eruption styles on Earth and Io appear to be controlled by the different eruption environments: Plumes at sites of ultrabasic eruptions on Io suggest strong magma-volatile: interactions on a low-gravity body lacking an atmosphere, whereas the geology at sites of komatiite eruptions on Earth suggest mostly submarine emplacement of thick flows with a pronounced lack of subaerial explosive activity.

Author

Io; Volcanic Eruptions; Lava; Flow Characteristics; Fluid Flow

20030018897 Arizona State Univ., Dept. of Geological Sciences, Tempe, AZ USA

Geology of Lofn Crater, Callisto

Greeley, Ronald, Arizona State Univ., USA; Heiner, Sarah, Arizona State Univ., USA; Klemaszewski, James E., Arizona State Univ., USA; Journal of Geophysical Research; Feb. 25, 2001; ISSN 0148-0227; Volume 106, No. E2, pp. 3261-3273; In English
Report No.(s): Paper-2000JE001262; Copyright; Avail: Issuing Activity

Lofn crater is a 180-km-diameter impact structure in the southern cratered plains of Callisto and is among the youngest features seen on the surface. The Lofn area was imaged by the Galileo spacecraft at regional-scale resolutions (875 m/pixel), which enable the general geology to be investigated. The morphology of Lofn crater suggests that (1) it is a class of impact structure intermediate between complex craters and palimpsests or (2) it formed by the impact of a projectile which fragmented before reaching the surface, resulting in a shallow crater (even for Callisto). The asymmetric pattern of the rim and ejecta deposits suggests that the impactor entered at a low angle from the northwest. The albedo and other characteristics of the ejecta deposits from Lofn also provide insight into the properties of the icy lithosphere and subsurface configuration at the time of impact. The "target" for the Lofn impact is inferred to have included layered materials associated with the Adlinda multiring structure northwest of Loh and ejecta deposits from the Heimdall crater area to the southeast. The Lofn impact might have penetrated through these materials into a viscous substrate of ductile ice or possibly liquid water. This interpretation is consistent with models of the current interior of Callisto based on geophysical information obtained from the Galileo spacecraft.

Author

Craters; Geology; Geophysics

20030018903 NASA Ames Research Center, Moffett Field, CA USA

The NASA/Ames Mars General Circulation Model: Model Improvements and Comparison with Observations

Haberle, R. M., NASA Ames Research Center, USA; Hollingsworth, J. L., NASA Ames Research Center, USA; Colaprete, A., NASA Ames Research Center, USA; Bridger, A. F. C., San Jose State Univ., USA; McKay, C. P., NASA Ames Research Center, USA; Murphy, J. R., New Mexico State Univ., USA; Schaeffer, J., Raytheon Co., USA; Freedman, R., NASA Ames Research Center, USA; [2003]; 5p; In English; Mars Atmosphere Modeling and Observations Workshop, 11-16 Jan. 2003, Granada, Spain

Contract(s)/Grant(s): RTOP 344-33-20-16; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

For many years, the NASA/Ames Mars General Circulation Model (GCM) has been built around the UCLA B-grid dynamical core. An attached tracer transport scheme based on the aerosol microphysical model of Toon et al. (1988) provided a tool for studying dust storm transport and feedbacks (Murphy et al., 1995). While we still use a B-grid version of the model, the Ames group is now transitioning to the ARIES/GEOS Goddard C-grid dynamical core (Suarez and Takacs, 1995). The C-grid produces smoother fields when the model top is raised above 50 km, and has a built in transport scheme for an arbitrary number of tracers. All of our transport simulations are now carried out with the C-grid. We have also been updating our physics package. Several years ago we replaced our bulk boundary layer scheme with a level 2 type diffusive scheme, and added a multi-level soil model (Haberle et al., 2000). More recently we replaced our radiation code with a more generalized two-stream code that accounts for aerosol multiple scattering and gaseous absorption. This code gives us much more flexibility in choosing aerosol optical properties and radiatively active gases.

Derived from text

Atmospheric General Circulation Models; Optical Properties; Dust Storms; Aerosols

20030018904 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Geological History of the Tyre Region of Europa: A Regional Perspective on European Surface Features and Ice Thickness

Kadel, Steven D., Arizona State Univ., USA; Chuang, Frank C., Arizona State Univ., USA; Greeley, Ronald, Arizona State Univ., USA; Moore, Jeffrey M., NASA Ames Research Center, USA; Journal of Geophysical Research; Sep. 25, 2000; ISSN 0148-0227; Volume 105, No. E9, pp. 22657-22669; In English

Report No.(s): Paper-1999JE001203; Copyright; Avail: Issuing Activity

Galileo images of the Tyre Macula region of Europa at regional (170 m/pixel) and local (approx. 40 m/pixel) scales allow mapping and understanding of surface processes and landforms. Ridged plains, doublet and complex ridges, shallow pits, domes, "chaos" areas, impact structures, tilted blocks and massifs, and young fracture systems indicate a complex history of surface deformation on Europa. Regional and local morphologies of the Tyre region of Europa suggest that an impactor penetrated through several kilometers of water ice to a mobile layer below. The surface morphology was initially dominated by formation of ridged plains, followed by development of ridge bands and doublet ridges, with chaos and fracture formation dominating the latter part of the geologic history of the Tyre region. Two distinct types of chaos have been identified which, along with upwarped dome materials, appear to represent a continuum of features (domes-play chaos-knobby chaos) resulting from increasing degree of surface disruption associated with local lithospheric heating and thinning. Local and regional stratigraphic relationships, block heights, and the morphology of the Tyre impact structure suggest the presence of low-viscosity ice or liquid water beneath a thin (several kilometers) surface ice shell at the time of the impact. The very low impact crater density on the surface of Europa suggests that this thin shell has either formed or been thoroughly resurfaced in the very recent past.

Author

Geology; Landforms; Europa; Paleontology; Ice

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A Mission to Mercury and a Mission to the Moons of Mars

Melton, Robert G., Pennsylvania State Univ., USA; Thompson, Roger C., Pennsylvania State Univ., USA; Starchville, Thomas F., Jr., Pennsylvania State Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 338-349; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The primary objective of this mission is to study the planet Mercury and advance the findings of Mariner 10. A proof of concept for use in later missions is a solar sail used during the spacecraft's interplanetary trajectory. Once at Mercury, the sail will detach and the planet will be mapped paying particular attention to regions of interest (the Caloris Basin, the hilly and lineated terrain, the intercrater plains, and the smooth plains) for possible landing sites. In order to avoid the extreme temperatures and radiation at the surface of Mercury, the probes will land on the dark side to perform their analyses. The scientific study on the surface will include seismic and tectonic activity and in-situ analysis of the regolith.

Author

Mercury (Planet); Space Missions; Mission Planning; Spacecraft Design; Product Development; Structural Design; Systems Engineering

20030020380 Texas Univ., Dept. of Aerospace Engineering and Engineering Mechanics, Austin, TX USA

Leo, Lunar and Mars Projects

Botbyl, George W., Texas Univ., USA; Fowler, Wallace T., Texas Univ., USA; Economopoulos, Anthony, Texas Univ., USA; Proceedings of the Ninth Annual Summer Conference: NASA/USRA University Advanced Design Program; [1993], pp. 350-362; In English; Also announced as 20030020346; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Degobah Satellite Systems (DSS), in cooperation with the University Space Research Association (USRA), NASA-Johnson Space Center (JSC), and the University of Texas, has completed the preliminary design of a satellite system to provide inexpensive on-demand video images of all or any portion of Space Station Freedom (SSF). DSS has narrowed the scope of the project to complement the work done by Mr. Dennis Wells at Johnson Space Center. This three month project has resulted in completion of the preliminary design of AERCAM, the Autonomous Extravehicular Robotic Camera. The final report begins by providing information on the project background, describing the mission objectives, constraints, and assumptions. Preliminary designs for the primary concept and satellite subsystems are discussed in detail. Included in the technical portion of the report are detailed descriptions of an advanced imaging system and docking and safing systems that ensure compatibility with the SSF. The report concludes by describing management procedures and project costs.

Author

Satellite Design; Product Development; Structural Design; Systems Engineering; Mission Planning; Imaging Techniques; Cameras

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

20030018922 Colorado Univ., Boulder, CO USA

Global and Local Helioseismic Studies of Solar Convection Zone Dynamics Using SOI-MDI on SOHO Final Report

Toomre, Juri, Colorado Univ., USA; Haber, Deborah, Colorado Univ., USA; Hindman, Bradley, Colorado Univ., USA; Christensen-Dalsgaard, Joergen, Colorado Univ., USA; Gough, Douglas, Colorado Univ., USA; Thompson, Michael, Colorado Univ., USA; February 2003; 7p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-7996; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under grant NAG5-7996; Distribution as joint owner in the copyright under grant NAG5-7996

Our joint collaborative analyses of global mode data to characterize the solar differential rotation (e.g. Thompson et al. 1996, Schou et al. 1998), and most recently to detect and analyze temporal variations in angular velocity Omega profiles both within the convection zone and in the deeper radiative interior (e.g. Howe et al 2000a,b; Toomre et al. 2000), have led to a series of fascinating discoveries. These should be pursued further as the solar cycle continues. The physical deductions being made from these studies have been greatly strengthened by utilizing both SOI-MDI and GONG data in order to have two independent observational realizations of Doppler images spanning a five-year interval, using two separate procedures to determine global mode splittings, and then analyzing those splitting data sets using both RLS and SOLA inversion procedures. There are considerable subtleties in the effects of instrumental response functions and calibrations, sensitivity of peak finding algorithms and their mode leakage estimates, and stochastic variations in mode amplitudes that can all contribute to apparent changes in the Omega profiles being inferred from sequences of helioseismic data. We have come to understand the implications of many of these calibration and analysis steps, greatly aided by frequent multi-week collaborative working sessions in our Helioseismic Analysis Facility (HAF) at JILA involving many members of the SOI dynamics and inversion team, including most of our Co-Is during the summer months when we hold intensive working sessions. Considerable further focused attention is required in a collaborative setting on such global mode issues as we continue studying the changing sun.

Derived from text

Helioseismology; Solar Oscillations; Convection; Solar Cycles; Angular Velocity; Velocity Distribution

20030018929 NASA Ames Research Center, Moffett Field, CA USA

The Early Evolution of the Solar Nebula with Implications for the Formation of Primitive Material

Bell, K. Robbins, NASA Ames Research Center, USA; Jun. 16, 2002; 1p; In English; Goldschmidt Conference, 18-24 Aug. 2002, Davos, Switzerland

Contract(s)/Grant(s): RTOP 344-37-22-07; No Copyright; Avail: Issuing Activity; Abstract Only

I will present a review of our understanding of the early evolution of the solar nebula especially as it bears on the formation of primitive meteorites. Although my emphasis will be on the results of theoretical studies, I will also summarize some of the

observational evidence supporting these conclusions. In particular, I will summarize our current best deductions about midplane temperatures and densities of the solar nebula and about both long-term and episodic evolution.

Author

Meteorites; Solar Nebula; Planetary Evolution

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