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National Aeronautics and Space Administration
Langley Research Center

Scientific and Technical Information Program Office

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Scientific and Technical Aerospace Reports (STAR) is an electronic abstract journal, listing citations with abstracts for aerospace-related reports obtained from worldwide sources. It is electronically published biweekly and announces documents that have recently been entered into the NASA Scientific and Technical Information (STI) Database. The documents are of the following types:

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- Domestic and foreign dissertations and theses.

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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

Abstracts in *STAR* are categorized by 10 major subject divisions that are divided further into 76 specific subject categories. The subject divisions and categories are listed in the Table of Contents together with a note for each that defines its scope and provides any cross-references.

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Subject Divisions

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F. Life Sciences
G. Mathematical and Computer Sciences
H. Physics
I. Social Sciences
J. Space Sciences
K. General

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for searching on *NASA Thesaurus* subject terms and personal author names.

Subject Term Index
Personal Author Index

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Subject Categories of the Division A. Aeronautics

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01 Aeronautics (General)

02 Aerodynamics

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information, see also *34 Fluid Mechanics and Heat Transfer.*

03 Air Transportation and Safety

Includes passenger and cargo air transport operations; and aircraft accidents. For related information, see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

04 Aircraft Communications and Navigation

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information, see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *32 Communications Radar.*

05 Aircraft Design, Testing and Performance

Includes aircraft simulation technology. For related information, see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles, see *85 Urban Technology and Transportation*.

06 Aircraft Instrumentation

Includes cockpit and cabin display devices; and flight instruments. For related information, see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

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*.

08 Aircraft Stability and Control

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

09 Research and Support Facilities (Air)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information, see also *14 Ground Support Systems and Facilities (Space).*

Subject Categories of the Division B. Astronautics

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

12 Astronautics (General)

For extraterrestrial exploration, see *91 Lunar and Planetary Exploration*.

13 Astrodynamics

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

14 Ground Support Systems and Facilities (Space)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators. *For related information, see also 09 Research and Support Facilities (Air).*

15 Launch Vehicles and Space Vehicles

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information, see also *20 Spacecraft Propulsion and Power.*

16 Space Transportation

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 *18 Spacecraft Design, Testing and Performance*. For space suits, see *54 Man/System Technology and Life Support*.

17 Space Communications, Spacecraft Communications, Command and Tracking

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

18 Spacecraft Design, Testing and Performance

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. 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*.

19 Spacecraft Instrumentation

For related information, see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

20 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, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles*.

Subject Categories of the Division C. Chemistry and Materials

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

23 Chemistry and Materials (General)

24 Composite Materials

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see *27 Nonmetallic Materials*.

25 Inorganic and Physical Chemistry

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also *77 Thermodynamics and Statistical Physics*.

26 Metallic Materials

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

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.*

28 Propellants and Fuels

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

29 Materials Processing

Includes space-based development of products and processes for commercial application. For biological materials see *55 Space Biology.*

Subject Categories of the Division D. Engineering

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31 Engineering (General)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

32 Communications and Radar

Includes radar; land and global communications; communications theory; and optical communications. 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*.

33 Electronics and Electrical Engineering

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 Fluid Mechanics and Heat Transfer

Includes boundary layers; hydrodynamics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

35 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 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 Lasers and Masers

Includes parametric amplifiers. For related information see also *76 Solid-State Physics*.

37 Mechanical Engineering

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

38 Quality Assurance and Reliability

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics

Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

Subject Categories of the Division E. Geosciences

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

42 Geosciences (General)

43 Earth Resources and Remote Sensing

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see *35 Instrumentation and Photography.*

44 Energy Production and Conversion

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

45 Environment Pollution

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see *93 Space Radiation*.

47 Meteorology and Climatology

Includes weather forecasting and modification.

48 Oceanography

Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

Subject Categories of the Division F. Life Sciences

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

51 Life Sciences (General)

52 Aerospace Medicine

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

53 Behavioral Sciences

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 Man/System Technology and Life Support

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also *16 Space Transportation.*

55 Space Biology

Includes exobiology; planetary biology; and extraterrestrial life.

Subject Categories of the Division G. Mathematical and Computer Sciences

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

59 Mathematical and Computer Sciences (General)

60 Computer Operations and Hardware

Includes hardware for computer graphics, firmware, and data processing. For components see *33 Electronics and Electrical Engineering*.

61 Computer Programming and Software

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

62 Computer Systems

Includes computer networks and special application computer systems.

63 Cybernetics

Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also *54 Man/System Technology and Life Support.*

64 Numerical Analysis

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 Systems Analysis

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics

Includes topology and number theory.

Subject Categories of the Division H. Physics

Select a category to view the collection of records cited. If the link is broken, there are no records to view.

70 Physics (General)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics*.

71 Acoustics

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution.*

72 Atomic and Molecular Physics

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics

Includes elementary and nuclear particles; and reactor theory. For space radiation see *93 Space Radiation.*

74 Optics

Includes light phenomena and optical devices. For lasers see *36 Lasers and Masers*.

75 Plasma Physics

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics*.

76 Solid-State Physics

Includes superconductivity. For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 Thermodynamics and Statistical Physics

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

Subject Categories of the Division I. Social Sciences

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80 Social Sciences (General)

Includes educational matters.

81 Administration and Management

Includes management planning and research.

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*.

83 Economics and Cost Analysis

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

85 Urban Technology and Transportation

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

Subject Categories of the Division J. Space Sciences

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88 Space Sciences (General)

89 Astronomy

Includes radio, gamma-ray, and infrared astronomy; and astrometry.

90 Astrophysics

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also *75 Plasma Physics*.

91 Lunar and Planetary Exploration

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

92 Solar Physics

Includes solar activity, solar flares, solar radiation and sunspots. For related information see also *93 Space Radiation.*

93 Space Radiation

Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics.*

Subject Categories of the Division K. General

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99 General

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

19990027061 Institute for Human Factors TNO, Technische Menskunde, Soesterberg, Netherlands

Evaluation of the Training Value of Alternative Simulator Configurations for the Chinook and Cougar Transport Helicopters ***Final Report Evaluatie van deTrainingswaarde van Alternatieve Simulator Configuraties voor de Chinook en Cougar Transporthelikopters***

vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; Boot, E. W., Institute for Human Factors TNO, Netherlands; deVries, S. C., Institute for Human Factors TNO, Netherlands; Kappe, B., Institute for Human Factors TNO, Netherlands; Ligthart, V. H. M., National Aerospace Lab., Netherlands; Marsman, A. P. L. A., National Aerospace Lab., Netherlands; Jul. 17, 1998; 70p; In Dutch

Contract(s)/Grant(s): A97/KLu/307; TNO Proj. 730.1

Report No.(s): TD-98-0251; TM-98-A042; Copyright; Avail: Issuing Activity (TNO technische Menskunde, Kampweg 5, Postbus 23, 3769 ZG Soesterberg, Netherlands), Hardcopy, Microfiche

In the context of the procurement of simulator capacity for training pilots of Chinook CH-47D and Cougar MK2 cargo helicopters, in a previous study a global training analysis has been conducted. Also, requirements for different possible simulator configurations have been formulated. On the basis of these requirements the Royal Netherlands Air Force (RNLAF) has formulated and issued a Request for Information (RFI) to potential suppliers. The aim of the RFI is to gather information about the technical and financial feasibility of the proposed simulator configurations. In order to evaluate the responses to the RFI on basis of their training value, a more detailed training analysis has been conducted and is reported here. Within the context of this analysis the minimally required level of simulator configuration and necessary training time for each training topic has been determined. On the basis of these results it is concluded that: (1) more than a quarter of all training hours can only be performed with the most advanced level of simulator configuration (about the same as FAA level D). These training hours are mostly concerned with training topics associated with flight safety (emergency procedures) and operating under maximum and special conditions; (2) given such a level of simulator configuration, the total training time for both helicopter types will be at least 1200 hours. If those training topics which could be trained in a helicopter are also trained on this simulator configuration, the total training time amount to 1660 hours for both types. There is reason to believe that these estimates are conservative. It is expected that once such a level of simulator configuration is available, the total training time for both types could exceed 2600 hours. to specify simulator requirements more accurately, training scenarios have been specified for each of the essential (level D) training topics. For each scenario, the minimum requirements have been determined. On the basis of these requirements RFI responses can be evaluated and compared. It appeared that a number of suppliers can meet the requirements. During subsequent phases of the procurement process, the training scenarios can be used to specify test scenario's for evaluating proposals. Ultimately the results reported can also be used for the development of the training programmes that are delivered on the simulators). The training analysis and the specification of the simulator requirements have been mainly focussed on the most important cost drivers, viz. the image systems and the moving bass systems. It is recommended to pay also attention during subsequent phases to the requirements with respect to the instructional facilities. Although they are not the main cost drivers, they are important benefit drivers, i.e. they are essential for effective and efficient use of the simulator facilities.

Author

Training Evaluation; Training Simulators; Technology Assessment; CH-47 Helicopter

19990027429 NASA Langley Research Center, Hampton,VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 397
Apr. 01, 1999; 62p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL397; NAS 1.21:7037/SUPPL397; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.
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02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information see also 34 Fluid Mechanics and Heat Transfer.

19990027435 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA
Remote Infrared Thermography for In-Flight Flow Diagnostics ***Final Report***
Shiu, H. J., California Univ., USA; vanDam, C. P., California Univ., USA; February 1999; 31p; In English
Contract(s)/Grant(s): NCC4-114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The feasibility of remote in-flight boundary layer visualization via infrared in incompressible flow was established in earlier flight experiments. The past year's efforts focused on refining and determining the extent and accuracy of this technique of remote in-flight flow visualization via infrared. Investigations were made into flow separation visualization, visualization at transonic conditions, shock visualization, post-processing to mitigate banding noise in the NITE Hawk's thermograms, and a numeric model to predict surface temperature distributions. Although further flight tests are recommended, this technique continues to be promising.
Author
Boundary Layer Separation; Flight Tests; Incompressible Flow; Flow Visualization; Infrared Radiation; Boundary Layers

19990027451 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Investigation of Effects of Surface Roughness on Symmetric Airfoil Lift and Lift-to-Drag Ratio
Beierle, Mark T.; Feb. 08, 1999; 192p; In English
Report No.(s): AD-A360065; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This research investigated the effects of surface roughness in the form of protuberances on the lift and lift-to-drag ratio of an airfoil with a NACA 0015 profile. Russian researchers first recorded the positive effect on lift from naturally formed surface protuberances in 1984 and reported on their research in 1991. Based on experimental studies, the Russian researchers identified a protuberance geometry on a low aspect ratio wing which created both additional lift and an improved lift-to-drag ratio for a given angle-of-attack over the low to moderate angle-of-attack region. The primary objective of this research was to develop a phenomenological understanding of the flow physics related to the effects of surface roughness on the lift and lift-to-drag ratio of a symmetric airfoil. Two wind tunnel experiments were conducted at the University of Maryland's Glenn L. Martin Wind Tunnel to investigate the effect of protuberance coverage, size, and density. A two-dimensional computational experiment studied the effect of protuberance location, geometry, and spacing using the OVERFLOW Navier-Stokes flow solver. Results indicated that the variation of the aerodynamic lift and the lift-to-drag ratio for symmetric airfoils and wings populated with protuberances is due to the increased pressure induced by a recirculation region downstream of the protuberance. An alternative understanding based on changes in the effective camber and thickness of the airfoil was developed. Wind tunnel and computational results qualitatively validated the lift enhancement on symmetric airfoils due to surface roughness. Results indicated that the magnitude of the lift increment was strongly dependent on airfoil angle-of-attack and protuberance height and had a weak dependence on protuberance width and spacing. Just one configuration, based on a wind tunnel test of a wing with protuberances, generated a larger lift-to-drag ratio compared to a smooth wing.
DTIC
Surface Roughness Effects; Airfoils; Wind Tunnel Tests; Lift; Low Aspect Ratio Wings; Protuberances

19990027594 Naval Postgraduate School, Dept. of Aeronautics and Astronautics, Monterey, CA USA
Summary of Research 1997, Department of Aeronautics and Astronautics, *1 Jan. - 31 Dec. 1997*
Lindsey, Gerald H.; Biblarz, Oscar; Jan. 1999; 60p; In English
Report No.(s): AD-A360675; NPS-09-98-015; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains summaries of research projects in the Department of Aeronautics and Astronautics. A list of recent publications is also included which consists of conference presentations and publications, books, contributions to books, published journal papers, technical reports, and thesis abstracts.

DTIC

Spacecraft; Air Navigation; Aerodynamics

19990027831 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Regional Nature of Aerodynamic Jump *Final Report, Nov. 1997 - Nov. 1998*
Bundy, Mark; Jan. 1999; 60p; In English
Report No.(s): AD-A360570; ARL-TR-1872; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

It is shown that aerodynamic jump for a nonspinning kinetic energy penetrator is neither a point change in direction, nor a curving change that takes place over a domain of infinite extent, as conventional definitions may infer. Rather, with the aid of an alternate kinematical definition, it is shown that aerodynamic jump for such a projectile is a localized redirection of the center-of-gravity motion, caused by the force of lift due to yaw over the relatively short region from entry into free flight until the yaw reaches its first maximum. A rigorous proof of this statement is provided, but the primary objective of this report is to provide answers to the questions: What is aerodynamic jump, what does it mean, and what aspects of the flight trajectory does it refer to, or account for?

DTIC

Aerodynamics; Free Flight; Jumpers; Flight Paths

19990027877 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
High Order Accuracy Computational Methods in Aerodynamics Using Parallel Architectures *Final Report, 15 Jun. 1995 - 14 Jun. 1998*
Gottlieb, David; Shu, Chi-Wang; Jun. 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0430; F49620-93-1-0090
Report No.(s): AD-A360518; TR-4; AFRL-SR-BL-TR-99-0068; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is an AASERT grant associated with AFOSR grant F49620-93-1-0090, with principal investigator David Gottlieb. This grant has supported one graduate student over three years. The research topic is parallel spectral methods for complex geometries. The Ph.D. thesis of Gerald W. Kruse was prepared under this grant. In the last year, after the graduation of Kruse, the work was continued by another graduate student, Henry Tufo. One conference proceeding and one journal article resulted from this work.

DTIC

Computational Fluid Dynamics; Aerodynamics; Accuracy; Computer Programs

19990028208 Illinois Univ., Urbana-Champaign, IL USA
[Low-Frequency Flow Oscillation *Final Report*
Bragg, Michael B., Illinois Univ., USA; Jul. 1997; 3p; In English
Contract(s)/Grant(s): NAG1-1374; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The results of the research conducted under this grant are presented in detail in three Master theses, by Heinrich, Balow, and Broeren. Additional analysis of the experimental data can be found in two AIAA Journal articles and two conference papers. Citations for all of the studies' publications can be found in the bibliography which is attached. The objective of Heinrich's study was to document the low-frequency flow oscillation on the LRN-1007 airfoil, which had been previously observed at low Reynolds number, to determine its origin, and explore the phenomenon at higher Reynolds number. Heinrich performed detailed flow visualization on the airfoil using surface fluorescent oil and laser-sheet off-body visualization. A large leading-edge separation bubble and trailing-edge separation was identified on the airfoil just prior to the onset of the unsteady stall flow oscillation. From the laser-sheet data, the unsteady flow appeared as a massive boundary-layer separation followed by flow reattachment. Hot-wire data were taken in the wake to identify the presence of the flow oscillation and the dominant frequency. The oscillation was found in the flow from a Reynolds number of 0.3 to 1.3 x 10 exp 6. The Strouhal number based on airfoil projected height was nominally 0.02 and increased slightly with increasing Reynolds number and significantly with increasing airfoil angle of attack. Balow focused his research on the leading-edge separation bubble which was hypothesized to be the origin of the low-frequency oscillation. Initially, experimental measurements in the bubble at the onset of the low-frequency oscillation were attempted to study the

characteristics of the bubble and explain possible relationships to the shear-layer-flapping phenomena. Unfortunately, the bubble proved to be extremely sensitive to the probe interference and it drastically reduced the size of the bubble. These detailed measurements were then abandoned by Balow. However, this led to a series of tests where the leading-edge bubble and trailing-edge separation were altered and the affect on the flow-oscillation studied. Balow found that by tripping the airfoil boundary-layer with ”zigzag” tape ahead of bubble separation, the bubble was effectively eliminated mid the oscillation suppressed. Wake survey drag measurements showed a drastic reduction in airfoil drag when the bubble and oscillation were eliminated. Using the ”zigzag” tape, the trailing-edge separation was moved downstream approximately 5 percent chord. This was found to reduce the amplitude of the oscillation, particularly in the onset stage at low angle of attack (around 14 degrees). Through detailed analysis of the wake behind the airfoil during the unsteady flow oscillation, Balow provided a better understanding of the wake flowfield. Broeren studied the oscillating flowfield in detail at Reynolds number equal 3 x 10 exp 5 and an angle of attack of 15 degrees using laser Doppler velocimetry (LDV). Two-dimensional LDV data were acquired at 687 grid points above the model upper surface while hot-wire data were taken simultaneously in the wake. Using the hot-wire signal, the LDV data were phase averaged into 24 bins to represent a single ensemble average of one oscillation cycle. The velocity data showed a flowfield oscillation that could be divided into three flow regimes. In the first regime, the flow over the airfoil was completely separated initially, the flowfield reattached from the leading edge and the reattachment point moved downstream with increasing time or phase. Broeren referred to this as the reattachment regime. The bubble development regime followed, where a leading-edge separation bubble formed at the leading edge and grew with increasing time. During the initial part of this regime the trailing-edge separation continued to move downstream. However, during the last 30 degrees of phase the trailing-edge separation moved rapidly forward and appeared to merge with the leading-edge bubble. During the third regime, the separation regime, the flow was segmented from the airfoil leading edge and did not reattach to the airfoil surface. The reverse flow was seen to grow in vertical extent up from the model surface as the phase increased. Next reattachment began again at the leading edge signaling the start of the reattachment regime, and so the cycle continued. From Broeren’s work, the details of the unsteady flowfield over the airfoil were seen for the first time. From this research a great deal has been learned about the low-frequency flow oscillation which naturally occurs on the LRN-1007 airfoil near stall. The oscillation was seen to persist at higher Reynolds number, the dependence of the Strouhal number on angle of attack and Reynolds number were discovered, the critical role played by the laminar bubble was shown and the entire upper surface flowfield during a flow oscillation cycle was measured and analyzed. What still eludes understanding is the scaling of the flow oscillation and why certain airfoils, such as the LRN, have a very strong low-frequency mode and other airfoils exhibit no organized low-frequency oscillation at all.
Derived from text

Airfoils; Angle of Attack; Boundary Layer Separation; Bubbles; Flow Distribution; Leading Edges; Low Reynolds Number; Oscillating Flow; Shear Layers; Unsteady Flow; Wakes

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents. For related information see also 16 Space Transportation and 85 Urban Technology and Transportation.

19990026834 NASA Lewis Research Center, Cleveland, OH USA
[Tail Plane Icing]
1997; 16p; In English
Contract(s)/Grant(s): NCC3-624; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Aviation Safety Program initiated by NASA in 1997 has put greater emphasis in safety related research activities. Ice-contaminated-tailplane stall (ICTS) has been identified by the NASA Lewis Icing Technology Branch as an important activity for aircraft safety related research. The ICTS phenomenon is characterized as a sudden, often uncontrollable aircraft nose- down pitching moment, which occurs due to increased angle-of-attack of the horizontal tailplane resulting in tailplane stall. Typically, this phenomenon occurs when lowering the flaps during final approach while operating in or recently departing from icing conditions. Ice formation on the tailplane leading edge can reduce tailplane angle-of-attack range and cause flow separation resulting in a significant reduction or complete loss of aircraft pitch control. In 1993, the Federal Aviation Authority (FAA) and NASA embarked upon a four-year research program to address the problem of tailplane stall and to quantify the effect of tailplane ice accretion on aircraft performance and handling characteristics. The goals of this program, which was completed in March 1998, were to collect aerodynamic data for an aircraft tail with and without ice contamination and to develop analytical methods for predicting the effects of tailplane ice contamination. Extensive dry air and icing tunnel tests which resulted in a database of the aerodynamic effects associated with tailplane ice contamination. Although the FAA/NASA tailplane icing program generated

some answers regarding ice-contaminated-tailplane stall (ICTS) phenomena, NASA researchers have found many open questions that warrant further investigation into ICTS. In addition, several aircraft manufacturers have expressed interest in a second research program to expand the database to other tail configurations and to develop experimental and computational methodologies for evaluating the ICTS phenomenon. In 1998, the icing branch at NASA Lewis initiated a second multi-phase research program for tailplane icing (TIP II) to develop test methodologies and tailplane performance and handling qualities evaluation tools. The main objectives of this new NASA/Industry/Academia collaborative research programs were: (1) define and evaluate a subscale wind tunnel test methodology for determining tailplane performance degradation due to icing. (2) develop an experimental database of tailplane aerodynamic performance with and without ice contamination for a range of tailplane configurations. Wind tunnel tests were planned with representative general aviation aircraft, i.e., the Learjet 45, and a twin engine low speed aircraft. This report summarizes the research performed during the first year of the study, and outlines the work tasks for the second year. Derived from text

Aircraft Control; Aircraft Safety; Angle of Attack; Horizontal Tail Surfaces; Ice Formation; Pitching Moments; Wind Tunnel Tests; Aerodynamic Stalling; Computational Fluid Dynamics; Reynolds Number; Navier-Stokes Equation; Lear Jet Aircraft; General Aviation Aircraft

19990026969 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA

Symbol Standardization in Airway Facilities

Ahlstrom, Vicki; Cranston, Robert L.; Mogford, Richard; Ramakrishnan, Arvind; Dec. 1998; 28p; In English

Report No.(s): AD-A359966; DOT/FAA/CT-TN98/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project was to develop and evaluate visual symbols for future Airway Facilities (AF) systems. A research team designed symbols, developed test software, and evaluated test procedures. A subsequent field evaluation of these symbols resulted in user assessment of two alternative visual symbols for 32 AF facilities and services. Two groups of 14 AF field subjects learned and evaluated alternative symbols. The report provides sufficient data to show the quality differences between the various symbols as judged by the user community. This report provides a recommended set of AF facility/service symbols for standardized use.

DTIC

Computer Programs; Air Traffic Control; Standardization; Symbols

19990027089 National Transportation Safety Board, Washington, DC USA

Aircraft Accident Report: In-Flight Fire/Emergency Landing, Federal Express Flight 1406, Douglas DC-10-10, N68055, Newburgh, New York, September 5, 1996

Jul. 22, 1998; 146p; In English

Report No.(s): AD-A359870; NTSB/AAR-98/03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report explains the accident involving Federal Express flight 1406, a Douglas DC-10-10, which made an emergency landing at Stewart International Airport on September 5, 1996, after the flightcrew determined that there was smoke in the cabin cargo compartment. Safety issues in the report include flightcrew performance of emergency procedures, undeclared hazardous materials in transportation, dissemination of hazardous materials information, airport emergency response, and adequacy of aircraft interior firefighting methods. Safety Recommendations concerning these issues were made to the Federal Aviation Administration, the Department of Transportation, and the Research and Special Programs Administration.

DTIC

Aircraft Accident Investigation; Douglas Aircraft; Aircraft Accidents; Flight Safety

19990027600 Nebraska Univ., Aviation Inst., Omaha, NE USA

The UNO Aviation Monograph Series: Aviation Security: An Annotated Bibliography of Responses to the Gore Commission

Carrico, John S., Nebraska Univ., USA; Schaaf, Michaela M., Nebraska Univ., USA; April 1998; 26p; In English

Contract(s)/Grant(s): NAGw-4414

Report No.(s): UNOAI-98-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This monograph is a companion to UNOAI Monograph 96-2, ”The Image of Airport Security: An Annotated Bibliography,” compiled in June 1996. The White House Commission on Aviation Safety and Security, headed by Vice President Al Gore, was formed as a result of the TWA Flight 800 crash in August 1996. The Commission’s final report included 31 recommendations addressed toward aviation security. The recommendations were cause for security issues to be revisited in the media and by the aviation industry. These developments necessitated the need for an updated bibliography to review the resulting literature. Many

of the articles were written in response to the recommendations made by the Gore Commission. ”Aviation Security: An Annotated Bibliography of Responses to the Gore Commission” is the result of this need.
Author
Aircraft Safety; Airport Security; Flight Safety; Annotations

19990027849 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Jan. 15, 1998; 164p; In English
Report No.(s): AD-A359793; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This document contains safety recommendations regarding aircraft by the National Transportation Safety Board to the Federal Aviation Administration.
DTIC
Safety Management; Aircraft Safety

19990027974 Army Safety Center, Fort Rucker, AL USA
Flightfax: Army Aviation Risk-Management Information. February 1999, Volume 27, Number 2
Feb. 1999; 12p; In English
Report No.(s): AD-A360005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Flightfax is published by the U.S. Army Safety Center, Fort Rucker, Alabama. Information included is for accident-prevention purposes only.
DTIC
Safety; Accidents; Accident Prevention

19990028197 NASA Lewis Research Center, Cleveland, OH USA
Ice Accretion Calculations for a Commercial Transport Using the LEWICE3D, ICEGRID3D and CMARC Programs
Bidwell, Colin S., NASA Lewis Research Center, USA; Pinella, David, AeroLogic, USA; Garrison, Peter, AeroLogic, USA; Jan. 1999; 30p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 548-20-23
Report No.(s): NASA/TM-1999-208895; E-11494; NAS 1.15:208895; AIAA Paper 99-0250; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Collection efficiency and ice accretion calculations were made for a commercial transport using the NASA Lewis LEWICE3D ice accretion code, the ICEGRID3D grid code and the CMARC panel code. All of the calculations were made on a Windows 95 based personal computer. The ice accretion calculations were made for the nose, wing, horizontal tail and vertical tail surfaces. Ice shapes typifying those of a 30 minute hold were generated. Collection efficiencies were also generated for the entire aircraft using the newly developed unstructured collection efficiency method. The calculations highlight the flexibility and cost effectiveness of the LEWICE3D, ICEGRID3D, CMARC combination.
Author
Ice Formation; Commercial Aircraft; Computer Programs; Computer Aided Design; Aircraft Structures; Aircraft Design; Structural Design

19990028245 Nebraska Univ., Aviation Inst., Omaha, NE USA
The UNO Aviation Monograph Series: The Airline Quality Rating 1998, *1998*
Bowen, Brent D., Nebraska Univ., USA; Headley, Dean E., Nebraska Univ., USA; April 1998; 52p; In English
Contract(s)/Grant(s): NAGw-4414
Report No.(s): UNOAI-98-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The Airline Quality Rating (AQR) was developed and first announced in early 1991 as an objective method of comparing airline performance on combined multiple factors important to consumers. Development history and calculation details for the AQR rating system are detailed in The Airline Quality Rating 1991 issued in April, 1991, by the National Institute for Aviation Research at Wichita State University. This current report, Airline Quality Rating 1998, contains monthly Airline Quality Rating scores for 1997. Additional copies are available by contacting Wichita State University or University of Nebraska at Omaha. The Airline Quality Rating 1998 is a summary of month-by-month quality ratings for the ten major U.S. airlines operating during 1997. Using the Airline Quality Rating system and monthly performance data for each airline for the calendar year of 1997, individual and comparative ratings are reported. This research monograph contains a brief summary of the AQR methodology, detailed data

and charts that track comparative quality for major airlines domestic operations for the 12 month period of 1997, and industry average results. Also, comparative Airline Quality Rating data for 1991 through 1996 are included to provide a longer term view of quality in the industry.
Author
Airline Operations; Commercial Aircraft; Civil Aviation; Quality Control

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 17 Space Communications, Spacecraft Communications, Command and Tracking and 32 Communications and Radar.

19990027164 Honeywell Technology Center, Minneapolis, MN USA
Weather Avoidance Using Route Optimization as a Decision Aid: An AWIN Topical Study, Phase 1
Dec. 30, 1998; 68p; In English
Contract(s)/Grant(s): NCC1-291; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The aviation community is faced with reducing the fatal aircraft accident rate by 80 percent within 10 years. This must be achieved even with ever increasing, traffic and a changing National Airspace System. This is not just an altruistic goal, but a real necessity, if our growing level of commerce is to continue. Honeywell Technology Center's topical study, "Weather Avoidance Using Route Optimization as a Decision Aid", addresses these pressing needs. The goal of this program is to use route optimization and user interface technologies to develop a prototype decision aid for dispatchers and pilots. This decision aid will suggest possible diversions through single or multiple weather hazards and present weather information with a human-centered design. At the conclusion of the program, we will have a laptop prototype decision aid that will be used to demonstrate concepts to industry for integration into commercialized products for dispatchers and/or pilots. With weather a factor in 30% of aircraft accidents, our program will prevent accidents by strategically avoiding weather hazards in flight. by supplying more relevant weather information in a human-centered format along with the tools to generate flight plans around weather, aircraft exposure to weather hazards can be reduced. Our program directly addresses the NASA's five year investment areas of Strategic Weather Information and Weather Operations (simulation/hazard characterization and crew/dispatch/ATChazard monitoring, display, and decision support) (NASA Aeronautics Safety Investment Strategy: Weather Investment Recommendations, April 15, 1997). This program is comprised of two phases, Phase I concluded December 31, 1998. This first phase defined weather data requirements, lateral routing algorithms, an conceptual displays for a user-centered design. Phase II runs from January 1999 through September 1999. The second phase integrates vertical routing into the lateral optimizer and combines the user interface into a prototype software testbed. Phase II concludes with a dispatcher and pilot evaluation of the route optimizer decision aid. This document describes work completed in Phase I in contract with NASA Langley August 1998 - December 1998. This report includes: (1) Discuss how weather hazards were identified in partnership with experts, and how weather hazards were prioritized; (2) Static representations of display layouts for integrated planning function (3) Cost function for the 2D route optimizer; (4) Discussion of the method for obtaining, access to raw data of, and the results of the flight deck user information requirements definition; (5) Itemized display format requirements identified for representing weather hazards in a route planning aid.
Derived from text
Aircraft Accidents; Aircraft Safety; Decision Support Systems; Flight Plans; Meteorological Parameters; Weather; National Airspace System; Flight Hazards; Avoidance

19990027260 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Study of the Algorithm for GPS Positioning and Velocity Measurement
Chang. Qing, Beijing Univ. of Aeronautics and Astronautics, China; Liu, Zhongkan, Beijing Univ. of Aeronautics and Astronautics, China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 510-513; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The mathematical models of the GPS positioning and velocity measurement are given. The iterative algorithm for GPS positioning and velocity measurement under normal conditions is discussed based on the Gauss-Newton method and the solution under the condition that there are only three visible satellites of G(sub DOP) is too large is given. Finally, a complete iteration algorithm for GPS positioning and velocity measurement is obtained. This algorithm consists of two parts. In the first part, the positioning solution is obtained iteratively and the satellite signal propagation time is renewed as the positioning solution is

renewed in each iteration. In the second part, the velocity is obtained by using the satellite signal propagation time and the normal matrix obtained in the last iteration in the first part.
Author
Mathematical Models; Global Positioning System; Velocity Measurement; Newton Methods; Positioning; Algorithms

19990027261 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Study of Automatic Vehicle Location and Dispatching System
Wu, Shaochun, Beijing Univ. of Aeronautics and Astronautics, China; Xu, Ningshou, Beijing Polytechnic Univ., China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 502-505; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Trunked mobile radio system has the capacity of dispatching through voice, but does not have the capacity of location and navigation. GPS (Global Positioning System) has the capacity of location and navigation but does not have communication links between users. So, it is of significance to realize automatic vehicle location and dispatching system, which remedy their defects and absorb their quintessence, by organically integrating trunked radio system with GPS . Based on the analysis about Motolora's SmartNet trunked radio system, the authors point out some key techniques to realize the system. Those are how to distinguish control signal and voice for establishing stable GPS data link and balance channel load etc. The experiment results have proved out our means.
Author
Position (Location); Global Positioning System; Communication Networks; Radio Communication; Systems Integration

19990027267 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
GPS C/A Code Search and Implement in GPS Receiver
Sun, Li, Beijing Univ. of Aeronautics and Astronautics, China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 506-509; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

From GPS signal characteristics, a time/frequency two dimension sequential search principle is introduced in this paper. Three basic sequential search techniques and an improved search technique are compared with performances of false alarm probability, detection probability and searching rate. A digital system based on a spread spectrum correlator is proposed and verified for GPS C/A code acquisition, while parameters are traded off for better performance. The improved search algorithm is adopted for shortening average acquisition time and improving acquiring reliability. It has been successfully used in a digital GPS receiver.
Author
Global Positioning System; Receivers; Search Profiles; Algorithms; Digital Systems; Satellite Navigation Systems

19990027422 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Development of a Method for Kinematic GPS Carrier-Phase Ambiguity Resolution Using Multiple Reference Receivers
Raquet, John F.; May 1998; 282p; In English
Report No.(s): AD-A359919; AFIT-FY99-62; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

To perform the most precise relative positioning using GPS, it is necessary to resolve the carrier-phase integer cycle ambiguities. This process becomes increasingly difficult as the distance between the mobile and reference GPS receivers increases, due to the decorrelation of the GPS errors with distance, resulting in a practical limit on the distance over which ambiguity resolution can be performed when using a single reference receiver. This thesis proposes a novel method, called NetAdjust, which uses multiple reference receivers to reduce code and carrier-phase differential measurement errors and improve the ability to resolve carrier-phase ambiguities. The NetAdjust method is based upon an optimal linear minimum error variance estimator, and it "encapsulates" all of the network information into the measurements of a single reference receiver, so standard single-reference differential GPS processing algorithms can be used. The geometry of the reference receiver network is embedded within the error covariance matrix, and a functional form of this covariance matrix is described. The NetAdjust method was tested using two different GPS networks, an 11-receiver network covering a 400 km x 600 km region in southern Norway, and a 4-receiver network covering a 50 km x 150 km region at Holloman AFB in New Mexico. The results for L1 code, L1 phase, and widelane phase measurements are analyzed in the measurement domain and the position domain, showing improvements in RMS errors of up to 50% when using NetAdjust. Significant improvements in the ability to resolve carrier-phase ambiguities are also demonstrated for the Holloman and Norway test networks. Issues relating to development of an operational, real-time NetAdjust system are discussed. Also, a

covariance analysis method is developed which can be used to predict NetAdjust effectiveness under various conditions and network configurations.
DTIC
Global Positioning System; Signal Processing; Phase Error; Positioning; Real Time Operation; Statistical Analysis; Error Analysis

19990027965 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
On-Line Estimation of Allan Variance Parameters
Ford, J. J., Defence Science and Technology Organisation, Australia; Evans, M. E., Defence Science and Technology Organisation, Australia; January 1999; 28p; In English
Report No.(s): AD-A360671; DSTO-RR-0141; DODA-AR-010-684; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new on-line method is presented for estimation of the angular random walk and rate random walk coefficients of IMU (Inertial Measurement Unit) gyros and accelerometers. The on-line method proposes a state space model and proposes parameter estimators for quantities previously measured from off-line data techniques such as the Allan variance graph. Allan variance graphs have large off-line computational effort and data storage requirements. The technique proposed here requires no data storage and computational effort of O(100) calculations per data sample.
DTIC
Angular Velocity; Statistical Analysis; Inertial Navigation; Random Walk; Data Storage; Gyroscopes

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Urban Technology and Transportation.

19990026972 Naval Postgraduate School, Monterey, CA USA
Causes of EA=6B Cannibalizations
Griffea, Jimmie S.; Dec. 1998; 106p; In English
Report No.(s): AD-A360088; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Cannibalization of any system is defined as replacing a defective part or component of one system with an in-use part or component from another system. Cannibalizations are an integral part of high tempo operations where aircraft and weapon systems fail and must be repaired on the spot and immediately deployed. However, there has been an every increasing reliance on cannibalizations in some aviation communities over the past three years. Cannibalizations have several undesirable affects on a system for several reasons. First, they triple the work of maintenance personnel, due to switching parts with another aircraft, in essence impairing an aircraft and repairing both aircraft to complete a single maintenance action. Second, removing parts multiple times between aircraft while conducting cannibalizations reduces the reliability of parts. Third, improper or lack of documentation of cannibalizations underreports the severity of the problem and hides. inefficiencies. New innovative practices and techniques to improve the documentation of cannibalizations and reduce the total number of cannibalizations that occur are needed.
DTIC
Aircraft Maintenance; Aircraft Parts

19990027088 Department of the Air Force, Washington, DC USA
Flightfax: Army Aviation Risk-Management Information. Spotlight: CH-47 Safety Performance Review, Volume 26
Dec. 1998; 12p; In English
Report No.(s): AD-A359833; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The May 1998 issue of Flightfax contained the first-person accounts of the crew of a CH-47 that did a barrel roll. As a result of that incident, Aviation Safety Action Message CH-47-98-ASAM-Ol (151327Z Oct 98) requested information from users on uncommanded control inputs. Input from users confirmed that this was not the only incident of uncommanded flight-control input experienced in the CH-47 community in the last several years. According to the Analytical Investigation Branch at Corpus Christi Army Depot, 21 activities responded to the ASAM, reporting 27 AFCS/electrical malfunctions, 4 hydraulic-related malfunctions, 4 unknowncauses, and suspected ice-and-water contamination incidents.
DTIC
Flight Tests; CH-47 Helicopter; Flight Safety; Flight Control

19990027092 Kaman Aerospace Corp., Bloomfield, CT USA

Unit Maintenance Aerial Recovery Kit (UMARK) ***Final Report, 23 Sep. 1992 - 15 Dec. 1998***

Bielefield, Mike; Dec. 1998; 34p; In English

Contract(s)/Grant(s): DAAJ02-92-C-0048; DAAJ02-97-M-0004

Report No.(s): AD-A359915; R2206; USAAMCOM-TR-98-D-31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the activities performed under Contracts DAAJ02-92-C-0048 and DAAJ02-97-M-0004, to produce prototype UMARK kits. The objective of the program was to develop a means of aerial recovery of inoperative and lightly and heavily damaged helicopters using medium-lift and heavy-lift helicopters as the recovery vehicles. The UNMARK is the result of this work. UMARK can recover the following helicopters (and can easily accommodate others): AH-64, AH-64 Longbow, CH-47, UH-60, AH-1 and UH-1 (all Army models), OH-58 (A/C and D), and RAH-66 Comanche. UMARK is lightweight, compact and can fit in a HMMWV, CUCV, van, pickup track, or helicopter. Three people can fully rig any helicopter in 15 minutes or less. It is adaptable to future requirements without extensive modifications or additions to the Kit. Kit complexity is minimized to reduce training, reduce rigging time, and heighten safety. UMARK is a major improvement over previous methods of aerial recovery. This report discusses all tasks performed under these contracts, including: Design and analysis, prototype fabrication, limit and ultimate strength testing, ground testing to develop and verify rigging procedures, and flight testing to fine-tune rigging procedures and verify Kit effectiveness.

DTIC

Aircraft Maintenance; Flight Tests; Heavy Lift Helicopters; Recovery Vehicles

19990027162 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA

Lessons Learned from Executing an ADS Air-to-Air Missile Test in Near Real Time

Sturgeon, Steven; Duffany, James P.; Mar. 1998; 20p; In English; Presented at the Simulation Interoperability Workshop, Mar 98, Orlando, FL.

Report No.(s): AD-A359416; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Live Fly Phase (LFP) of the Systems Integration Test (SIT) was executed by the Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) and the 46th Test Wing at Eglin AFB, FL during 1997. The purpose of the SIT is to evaluate the utility of using advanced distributed simulations (ADS) to support cost-effective testing of an integrated missile weapon/launch aircraft system in an operationally realistic scenario. The SIT missions simulate a single shooter aircraft launching an air-to-air missile against a single target aircraft. In the LFP, the shooter and target were represented by live aircraft and the missile by a simulator. ADS techniques were used to link two live F-16 fighter aircraft flying over the Eglin Gulf Test Range to the AMRAAM AIM-120 hardware-in-the-loop (HWIL) simulation facility at Eglin. In order to successfully integrate these assets for a near real-time test, the JADS team learned several lessons during the risk reduction and test execution phases. The lessons highlighted here concern test control aspects, computer processing, and telemetry issues. Control of a distributed test dealt with tactical aircraft control, scenario and data collection decisions, collocation of critical project personnel, and voice communications. Computer processing lessons dealt with simulated GPS data, pre-processing live GPS data from several aircraft pods, creation of an aircraft to HWIL-missile interface, and contingency planning for real-time malfunctions. Telemetry issues concerned aircraft and terrain shielding, and an implementation to handle random sensor dropouts. These lessons would be applicable for other projects when coupling live and virtual assets for evaluation of fire control radars or precision guided munitions. Many lessons on control and processing also apply to simulation tests which link distributed facilities.

DTIC

Air to Air Missiles; Aircraft Control; F-16 Aircraft; Flight Simulation; Distributed Interactive Simulation; Hardware-In-The-Loop Simulation; Missile Systems; Missile Tests; Real Time Operation

19990027246 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Applications of Inverse Flight Dynamics

Zhang, Shuguang, Beijing Univ. of Aeronautics and Astronautics, China; Fang, Zhenping, Beijing Univ. of Aeronautics and Astronautics, China; Wang, Yong; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 563-566; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Two computational techniques for inverse fight dynamics, namely derivation-iteration and integration-iteration techniques, are investigated. The application of inverse dynamics to determine control power requirements for post-stall maneuvering is researched, and a maneuvering flight trajectory based algorithm is provided, which lays a numerical foundation for simplifying design criteria for post-stall aircraft. With the model of inverse dynamics employed, a flight control mode for the outermost loop

of the control system, named maneuver generator, is designed to follow desired complicated maneuvering flight trajectories. An example of rapid heading-reversal maneuver and other numerical simulations show the feasibility of the algorithm and the design idea.
Author
Flight Control; Aircraft Maneuvers; Controllability; Algorithms; Aerodynamic Stalling

19990027253 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Effect of Radar Cross Section on Aircraft Survivability
Ma, Dongli, Beijing Univ. of Aeronautics and Astronautics, China; Kao, Zhang, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 538-541; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Radar cross section (RCS) of an aircraft is one of the important influences on aircraft survivability. A computational method for the probability that an aircraft survives hostile air-defense system consisting of early warning radar, interceptor and surface-to-air missile has been developed in this paper. The method includes calculation of the probability of detection, the probability of hit and the probability of kill. The influence of the pattern propagation factor and atmospheric loss and the influence of signal-to-noise ratio on miss distance are considered in calculating the probability of detection and the probability of hit, respectively. The effect of RCS on aircraft's survivability is analyzed by the calculation. The results show that reduction of aircraft's RCS can remarkably reduce the probability of detection, and decrease the maximum intercept distance when interceptor and surface-to-air missile intercept penetrating aircraft. In order to enhance the aircraft survivability, its RCS must be reduced.
Author
Radar Cross Sections; Aircraft Survivability; Antimissile Defense

19990027508 Royal Aeronautical Society, London, UK
Multidisciplinary Design and Optimisaton: Proceedings
Multidisciplinary Design and Optimisaton: Proceedings; 1998; In English; Multidisciplinary Design and Optimisaton, 26-27 Oct. 1998, London, UK; Sponsored by Royal Aeronautical Society, UK; See also 19990027509 through 19990027525; ISBN 1-85768-074-X; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

From the dawn of aviation up to the middle of the 20th century aircraft design was an art practiced by a few talented individuals. These individuals had a comprehensive understanding of the aeronautical sciences, and personal experience of the strengths and weaknesses of successive designs. With the increasing sophistication of the aeronautical technologies it became impossible for the designers to have all of the required personal expertise. The design of aircraft became a multidisciplinary enterprise. The economic pressures on the aircraft design industry required the use of optimization techniques, to assist in keeping the cost down. Papers presented in this conference discuss the use of multidisciplinary optimization techniques in the design of modern aircraft.
CASI
Aircraft Design; Conferences; Aeronautical Engineering; Computational Fluid Dynamics; Computer Aided Design; Finite Element Method; Multidisciplinary Design Optimization

19990027509 University Coll., London, UK
Pioneering Multidisciplinary Aircraft Design
Kirkpatrick, D. L. I., University Coll., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 1.1 - 1.8; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper describes the multivariate optimisation program for the preliminary design of subsonic transport aircraft which was developed at the Royal Aircraft Establishment nearly three decades ago. It also describes some of the earliest applications of the programs to illuminate contemporary issues of aircraft design and research planning. Many lessons from the development of that pioneering program remain relevant to the systems engineering of modern complex projects, in the defense of civilian sectors. Computer-based design and optimisation programs can play a valuable role in system design provided that the program has been properly validated, the system is optimized at the appropriate level and the objective function is valid.
Author
Multidisciplinary Design Optimization; Aircraft Design; Subsonic Speed; Systems Engineering; Computer Aided Design; Transport Aircraft

19990027510 British Aerospace Airbus Ltd., Woodford, UK

Multidisciplinary Design, Analysis and Optimisation of Aircraft: The "MDO Project"

Allwright, Steve E., British Aerospace Airbus Ltd., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 2.1 - 2.12; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper presents an overview of the multi-discipline design, analysis and optimization research and development work completed by the "MDO project". This major two year program spawned and focused research in a number of areas : (1) shape optimization, (2) Planform optimization, (3) structural design optimization, and (4) control system optimization. Integration of methodology was a primary theme through the project and this paper in particular focuses on the integration aspects that are vital in securing the successful and accelerating industrial exploitation of MDO in aircraft design.

Author

Aircraft Design; Design Analysis; Structural Design; Aerodynamic Characteristics; Computer Systems Design; Algorithms; Aeroelasticity; Aerodynamics; Multidisciplinary Design Optimization

19990027511 British Aerospace Public Ltd. Co., Sowerby Research Centre, Bristol, UK

Automated Surface Shape Optimisation in the MDO Project

Gould, Alan R. B., British Aerospace Public Ltd. Co., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 3.1 - 3.12; In English; See also 19990027508

Contract(s)/Grant(s): CEC-BE95-2056; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Surface shape optimization was one of several topics researched under the multi-disciplinary Optimization (MDO) project. Several project partners participated in this activity which set out to develop validate and demonstrate a number of technical issues related to automated shape design. Each of the participants brought together in-house and/or commercial analysis tools, a variety of different modelling and optimization techniques, and common database and model generation methods. The objectives of this work were to validate the methodologies established in the preliminary MDO project phase and to demonstrate the optimization process when applied to a simplified civil aircraft wing design problem. Several issues were central to the investigation, including alternative means of parametric descriptions for the wing surface shape, alternative optimization strategies for wing MDO and impact of different levels of physical and geometrical modelling on MDO performance and resulting product optima. The outcomes of this work demonstrate the need for advanced analysis tools to be incorporated into aerospace vehicle design problems at a relatively early stage and highlight the dangers of over-simplification of the vehicle model.

Author

Aircraft Design; Design Analysis; Surface Properties; Wings; Grid Generation (Mathematics); Body-Wing Configurations; Twisted Wings; Multidisciplinary Design Optimization

19990027513 Tsentralni Aerogidrodinamicheskii Inst., Zhukovsky, Russia

Multidisciplinary Structural Design with Aeroelasticity Constraints in ARGON Software Package

Chedrik, V. V., Tsentralni Aerogidrodinamicheskii Inst., Russia; Ishmuratov, F. Z., Tsentralni Aerogidrodinamicheskii Inst., Russia; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 5.1 - 5.12; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

A method for multidisciplinary design of airframes based on a two-level structural modeling (with a polynominal displacement field and a finite element model) is presented. Basic relations for computing the strength/stiffness/aeroelasticity constraints are shown. Particular attention is paid to the new option in the ARGON system - the allowance for aeroelastic constraints in optimization the nonlinear programming techniques are used. Two examples of sweptback and sweptforward wing optimization are reported; constraints on strength and aeroelasticity are imposed.

Author

Aeroelasticity; Finite Element Method; Mathematical Models; Nonlinearity; Structural Design; Sweptback Wings; Swept Forward Wings; Nonlinear Programming; Multidisciplinary Design Optimization

19990027515 Defence Evaluation Research Agency, Aero-Structures Dept., Farnborough, UK

The Application of Pareto Methods to Multidisciplinary Design Optimisation

Harris, J. C., Defence Evaluation Research Agency, UK; Fenwick, Steven V., Defence Evaluation Research Agency, UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 7.1 - 7.9; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Multidisciplinary Design Optimization (MDO) provides a framework for a timely exchange of data necessary to support the highly integrated tasks typical of aerospace design. This will help reduce the duration of the design cycle and improve efficiency of the final product. Well implemented MDO capabilities will play an increasingly important role in DERA's activities to support the definition of future system requirements and the assessment of new equipment. The framework in which an MDO approach is realized must be flexible and accommodate the diverse range of individual discipline-based tools that contribute to the overall process. This paper describes DERA's activity within the EC Framework IV 'FRONTIER' project to investigate the use of modern graphical user interface (GUI) methods, and genetic algorithms (GAs) for the combined aerodynamic and structural design of a modern combat aircraft. The application of the techniques to identify a Pareto frontier in high level design objective space that represents the boundary beyond which improvements cannot be made without sacrificing one or other aspect of overall aircraft performance is described. The scope of the method as an aid during the definition of system requirements and for the evaluation of trade-offs during the concept assessment stage of a project is discussed.
Author
Fighter Aircraft; Genetic Algorithms; Graphical User Interface; Multidisciplinary Design Optimization; Structural Design; Aircraft Design; Computer Aided Design

19990027517 Southampton Univ., British Aerospace/Rolls Royce Univ. Technology Partnership for Design, UK
A Case for Multi-Level Optimisation in Aeronautical Design
Robinson, G. M., Southampton Univ., UK; Keane, A. J., Southampton Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 9.1 - 9.6; In English; See also 19990027508; Sponsored in part by Applied Computing and Engineering Ltd.; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper discusses how the inevitable limitations of computing power available to designers has restricted adoption of optimization as an essential design tool. It is argued that this situation will continue until optimization algorithms are developed which utilize the range of available analysis methods in a manner more like human designers. The concept of multi-level algorithms is introduced and a case made for their adoption as a way forward. The issues to be addressed in the development of multi-level algorithms are highlighted. This paper goes on to discuss a system developed at Southampton University to act as a test bed for multi-level algorithms deployed on a realistic design task. The Multi-level wing design environment integrates drag estimation algorithms ranging from an empirical code to an Euler CFD code. A simple multi-level optimization of a civil transport aircraft wing is presented.
Author
Aircraft Design; Algorithms; Euler Equations of Motion; Transport Aircraft; Wings; Computational Fluid Dynamics; Navier-Stokes Equation

19990027521 Greenwich Univ., Centre for Numerical Modelling and Process Analysis, London, UK
The Use of Multiphysics Modelling Technology in the Design of Aerospace Components
Cross, M., Greenwich Univ., UK; Bailey, C., Greenwich Univ., UK; Croft, T. N., Greenwich Univ., UK; McManus, K., Greenwich Univ., UK; Moran, G., Greenwich Univ., UK; Pericleous, K., Greenwich Univ., UK; Slone, A., Greenwich Univ., UK; Taylor, G., Greenwich Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 14.1 - 14.10; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The requirement for the capability to model closely coupled multiphysics phenomena in the context of aerospace design for both performance and manufacture is demonstrated. An approach to the design and implementation of an integrated multiphysics modeling software framework is described based upon finite volume methods using unstructured meshes. The framework is then applied to two transient problems: (1) shape casting in the context of design for manufacture and (2) dynamic fluid structure interaction in the context of aeroelasticity. Such software tools must play an increasingly significant role in the analysis of key problems in the assessment of aerospace design and manufacture.
Author
Finite Volume Method; Unstructured Grids (Mathematics); Finite Element Method; Thermal Energy; Casting; Aerospace Engineering; Structural Design

19990027522 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Structural Mechanics, Brunswick, Germany

Design Aspects of the Adaptive Wing: The Elastic Trailing Edge and the Local Spoiler Bump

Monner, H. P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Bein, T., Magdeburg Univ., Germany; Hanselka, H., Magdeburg Univ., Germany; Breitbach, E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 15.1 - 15.9; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Market research predicts for the aircraft industry a large growth in numbers of passengers as well as in airfreight rate. Leading to an increased competition for the European aircraft industry, the efficiency of new aircraft has to improved drastically. One approach among others is the aerodynamical optimization of the wing. The fixed wing is designed optimally only for one flight condition. This flight condition is described by the parameters altitude, mach number and aircraft weight which vary permanently during the mission of the aircraft. Therefore the aircraft is just periodically near chosen design point. To compensate for this major disadvantage an ”adaptive wing” for optimal adaptation and variation fo the profile geometry to the actual flight conditions will be developed. Work is being done on concepts for a variable camber and a local spoiler bump. In this paper structural concepts developed for both objectives will be presented. The concepts are designed under the aspect of adaptive structural systems and require a high integration of actuators sensor and controllers in the structure. Special aspects of the design will be discussed and first results analytical, numerical as well as experimental will be presented. Part of the concept design is also the development of new actuators optimized for the specific problem. A new actuator concept for the spoiler bump based on a cylindrical tube and activated either by pressure of multifunctional material (eg. shape memory alloys) will be shown.
Author

Research Aircraft; Shape Memory Alloys; Trailing Edges; Flexible Wings; Transonic Flow; Wing Camber

19990027525 Bath Univ., Dept. of Mechanical Engineering, Bath, UK

Sequential Use of Conceptual MDO and Panel Sizing Methods for Aircraft Wing Design

Butler, R., Bath Univ., UK; Lillico, M., Bath Univ., UK; Banerjee, J. R., City Univ., UK; Patel, M. H., City Univ., UK; Done, G. T. S., City Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 18.1 - 18.11; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The optimisation results for composite and metallic versions of a regional aircraft wing are compared using the multidisciplinary optimisation (MDO) program CALFUNOPT. The program has been developed for the conceptual design stage and models the wing using just 11 beam elements. The wing has been optimized for three combinations of the following constraint cases: (1) static strength; (2) aeroelastic roll efficiency and (3) aeroelastic divergence. As expected, comparison shows that the composite wing designs are significantly lighter than the metallic ones, due to the well-known tailoring of the composite material. However, the simple model reveals some insight that may be useful to the designer, and which could be lost within a more detailed Finite Element approach. The upper-skin compression panels produced by the conceptual MDO programs for both versions of the wing, have then been optimized using the more detailed and accurate panel sizing tool, VICONOPT, which takes buckling into account. Such optimization increases the panel mass by 5-10% and also provides a suitable ratio of stiffener to skin area for use in the conceptual MDO model.
Author

Composite Materials; Finite Element Method; Optimization; Wings; Multidisciplinary Design Optimization; Wing Panels; Metals; Computer Aided Design

19990027613 NASA Ames Research Center, Moffett Field, CA USA

Identification of 15-15 Aeroelastic Modes using Frequency-Domain Methods

Acree, C. W., Jr., NASA Ames Research Center, USA; Tischler, Mark B., Army Aviation Systems Command, USA; [1988]; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The XV-15 Tilt-Rotor wing has six major aeroelastic modes that are close in frequency. to precisely excite individual modes during flight test, dual flaperon exciters with automatic frequency-sweep controls were installed. The resulting structural data were analyzed in the frequency domain (Fourier-transformed). Modal frequencies and damping were determined by performing curve fits to frequency-response magnitude and phase data. Results are given for the XV-15 with its original metal rotor blades. Frequency and damping values are also compared with new predictions by two different programs, CAMRAD and ASAP.
Author

Aeroelasticity; Frequency Response; Frequency Control; XV-15 Aircraft; Tilt Rotor Aircraft

19990027732 Boeing Co., Saint Louis, MO USA

Aging Aircraft Structures Database ***Final Report, Jan. 1997 - Jan. 1998***

Perez, Rigoberto; Mar. 1998; 31p; In English

Contract(s)/Grant(s): F33615-95-C-3213; AF Proj. 2401

Report No.(s): AD-A359969; AFRL-VA-WP-TR-1998-3022; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the work performed by the Boeing Company to develop an aging aircraft structures database to be used to aid in the verification of structural integrity analysis of aircraft structures. Sample data were collected for the C-30 EC-135, C-141, and F-15 aircraft in the areas of fatigue, corrosion, and structural repair. A user-friendly database was developed using Microsoft Visual Basic, which can be accessed by other windows based structural analysis software. The report also summarizes work performed to link the database to the existing Air Force crack growth life prediction program, AFGROW.

DTIC

Aircraft Structures; Structural Analysis; Data Bases; Structural Failure; Aircraft Maintenance; Aging (Materials)

19990027736 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

Variational Bounds for the Equivalent Spring Constants for Bonded Repairs

Chalkley, Peter, Defence Science and Technology Organisation, Australia; Rose, L. R. F., Defence Science and Technology Organisation, Australia; Sep. 1998; 33p; In English; Original contains color illustrations

Contract(s)/Grant(s): RAAF-ASI-1A

Report No.(s): DSTO-RR-0139; DODA-AR-010-644; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Variational bounds, both upper and lower, are found for the equivalent spring constant of a double-strap joint which represents a sub-element of bonded repairs to cracked structure. Conservative estimates of the equivalent spring constant, needed for accurate design, are obtained from variational analyses of the joint. Estimates from various analytical models of varying level of approximation were obtained. Simpler expressions for the spring constant resulted from relaxing certain assumptions, however, the theoretical guarantee of a true upper or lower bound was lost. Spring constant estimates were compared with finite- element model results and so the fidelity of the variational bounds, specially for the simplified analyses, could be established. An improved formula is proposed for use in design procedures in RAAF C5033.

Author

Bonded Joints; Estimates; Structural Design; Crack Arrest

19990028018 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA

New Processing of Composite Grids for Aerospace Applications ***Final Report, Nov. 1997 - Nov. 1998***

Tsai, Stephen W.; Liu, Kevin K.; Feb. 1999; 15p; In English

Contract(s)/Grant(s): F69620-98-1-0099

Report No.(s): AD-A360443; AFRL-SR-BL-TR-99-0052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Composite grids offer a unique combination of performance and cost for many aerospace structures. A particular process suitable for shells of revolution is discussed in detail. This process has been developed by Stanford University.

DTIC

Aerospace Systems; Composite Structures; Aerospace Engineering; Grids

19990028283 Lockheed Martin Corp., Information Systems, Orlando, FL USA

Advanced Distributed Simulation Technology 2 (ADSR 2). MODSAF Aviation Development: Conceptual Model for PWA Enhancements

May 01, 1998; 23p; In English

Report No.(s): AD-A360332; ADST-II-CDRL-MODSAF-9800123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

ModSAF was built for tank simulation, and the modeling architecture was built on this concept. This has resulted in low-fidelity rotary wing model based off of a tank model, which does not effectively portray RWA to the level needed by most ModSAF users. This effort concentrates on building a new RWA model that contains automated simulation of Army Aviation tactics. These tactics are in accordance with system capabilities described in the aviation flight manuals for AH-64, AH-64D Longbow, CH-47D, OH-58D, RAH-66, and the UH-60L.

DTIC

Flight Simulation; Rotary Wing Aircraft; Distributed Interactive Simulation; Computerized Simulation

19990028284 Dayton Univ. Research Inst., Structural Integrity Div., OH USA

Maintainability Improvement Through Corrosion Prediction ***Final Report, 1 Mar. 1996 - 31 Dec. 1997***

Tritsch, D. E.; Konish, H. J.; Dec. 1997; 148p; In English

Contract(s)/Grant(s): F09603-95-D-0175; AF Proj. 4347

Report No.(s): AD-A360253; UDR-TR-1998-00093; AFRL-ML-WP-TR-1998-4187; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In 1994, the Scientific Advisory Board (SAB) reported that "Corrosion is the single most costly maintenance problem for USAF aging aircraft." In 1997, the National Materials Advisory Board (NMAB) investigated the aging of USAF aircraft and reported that "corrosion can progress significantly before being observed, leading to increased maintenance costs and time in PDM (Programmed Depot Maintenance)". These concerns are recognized by the USAF in having identified the C/KC-135 aircraft as being life limited by corrosion with respect to life cycle cost sustainment of the fleet (the first fleet identified in this manner). The NAMAB stated in its recommendations for the USAF, the "most important operational needs include...improved understanding of probable rates of corrosion and corrosion trends for specific operational aircraft for use in planning maintenance actions". The overall objective of this effort was to assess the possibility of developing corrosion damage formation and growth models to assist in prediction corrosion maintenance actions (inspection and repair) on aluminum airframe structure. The assessment involved a review and evaluation of corrosion research and available data for the purpose of identifying or proposing corrosion formation and growth models. The corrosion research and available data considered under this effort included current research efforts directed at airframe corrosion damage formation and growth, USAF corrosion maintenance programs, aircraft basing history information, fleet maintenance data (inspection reports and repair orders), and airbase corrosion severity indices. Two model types emerged as possible frame works to predict the location and severity of corrosion occurrences. First, a model based on aircraft historical trends using statistical models of historical corrosion repair records to predict near term corrosion damage trends. Second, a model based on corrosion damage mechanics.

DTIC

Aircraft Maintenance; Aircraft Structures; Corrosion; Mathematical Models; Aging (Materials); Predictions

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.

19990027574 NASA Lewis Research Center, Cleveland, OH USA

Flashback Arrestor for LPP, Low NOx Combustors

Kraemer, Gil, Precision Combustion, Inc., USA; Lee, Chi-Ming, NASA Lewis Research Center, USA; 1998; 18p; In English; Turbo Expo '98 Congress and Exhibition, 2-5 Ju. 1998, Stockholm, Sweden; Sponsored by American Society of Mechanical Engineers, USA

Contract(s)/Grant(s): RTOP 244-02-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Lean premixed, prevaporized (LPP) high temperature combustor designs as explored for the Advanced Subsonic Transport (AST) and High Speed Civil Transport (HSCT) combustors can achieve low NO(x), emission levels. An enabling device is needed to arrest flashback and inhibit preignition at high power conditions and during transients (surge and rapid spool down). A novel flashback arrestor design has demonstrated the ability to arrest flashback and inhibit preignition in a 4.6 cm diameter tubular reactor at full power inlet temperatures (725 C) using Jet-A fuel at 0.4 less than or equal to phi less than or equal to 3.5. Several low pressure loss (0.2 to 0.4% at 30 m/s) flashback arrestor designs were developed which arrested flashback at all of the test conditions. Flame holding was also inhibited off the flash arrestor face or within the downstream tube even velocities (less than or equal to 3 to 6 m/s), thus protecting the flashback arrestor and combustor components. Upstream flow conditions influence the specific configuration based on using either a 45% or 76% upstream geometric blockage. Stationary, lean premixed dry low NO(x) gas turbine combustors would also benefit from this low pressure drop flashback arrestor design which can be easily integrated into new and existing designs.

Author

Nitrogen Oxides; Jet Engine Fuels; Flashback; High Temperature; Supersonic Transports; Exhaust Gases; Exhaust Emission; Combustion Chambers

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information see also 14 Ground Support Systems and Facilities (Space).

19990026726 Royal Aeronautical Society, London, UK
The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings
1997; 100p; In English; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training, 5-6 Nov. 1997, London, UK; See also 19990026727 through 19990026738; ISBN 1-85768-009-X; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The international status of training devices for flight crews is examined in light of the Federal Aviation Authority (FAA) and the Joint Aviation Authorities (JAA) regulations. The many types of flight simulators used in training and retraining pilots are reviewed. The need for further simulator development is examined. International cooperation in the development of standards, and approval of flight simulators for air carriers is urged.
CASI
Air Transportation; Conferences; Flight Simulators; International Cooperation; Regulations; Training Devices; Pilot Training

19990026727 Joint Aviation Authorities, Hoofddorp, Netherlands
The Joint Aviation Authorities and STD Standardisation
Yates, Richard G., Joint Aviation Authorities, Netherlands; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 2.1-2.3; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This Paper begins with a brief description of the European Joint Aviation Authorities (JAA) followed by an explanation of the JAA's standardization machinery that is to be put in place in the field of Synthetic Training Devices (STDs). This explanation covers the philosophy behind standardization in the JAA, what the standardization activity will actually involve and the follow-up to standardization visits.
Author
Standardization; Training Devices; Cockpit Simulators; Flight Simulators; Onboard Equipment; Pilot Training

19990026728 Federal Aviation Administration, National Simulator Program, Washington, DC USA
Regulatory Cooperation in Simulator Qualification Evaluations
Ray, Paul A., Federal Aviation Administration, USA; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 3.1-3.8; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

To an ever increasing degree, airlines and the aviation industry have departed from their traditional role as a national enterprise by their expansion into what is rapidly becoming a global industry. National aviation authorities, if they are to fulfill their mandate to uphold the highest levels of aviation safety, must adapt to the impact of the global nature of the aviation industry by increasing their partnerships with other regulatory authorities. This will provide the only effective and efficient global means to accomplish surveillance and foster safety in an era of diminishing resources. No where is this clearer than in the area of simulator qualification evaluations, where not only is the simulator required to undergo an evaluation by the regulatory authority of their own country, they must also endure such an evaluation by each of the regulatory authorities from each of the foreign countries whose airlines purchase time on the subject simulator. This makes for neither an efficient nor effective operation from either an operator's or regulator's standpoint. If even a portion of these multiple evaluations are able to be eliminated while safety is maintained, all will benefit. I will touch briefly on a few areas related to the development of an agreement covering simulator qualifications between the Federal Aviation Administration (FAA) and the European Joint Aviation Authorities (JAA). After sharing some background on harmonization in this area, I will provide some background on the development of the regulatory framework for our cooperation and how, in collaboration with our European colleagues, we are making a more efficient regulatory process a reality in Europe.
Derived from text
Airline Operations; Flight Safety; Regulators; Flight Simulators; Cockpit Simulators; International Cooperation

19990026729 Luftfahrt-Bundesamt, Brunswick, Germany

The Evaluation and Approval of Flight Simulations for German Air Carriers

Zimmermann, Karl, Luftfahrt-Bundesamt, Germany; Krueger, Jens, Luftfahrt-Bundesamt, Germany; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 4.1-4.11; In English; See also 19990026726; Copyright; Avail: Issuing Activity (Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The increasing transfer of pilots training and checking from the airplane to Flight Simulators up to 'Zero Flight Time' leads to a steadily increasing number of simulator approvals. to save costs and efforts for both Simulator Operators and Aviation Authorities there have been several initiatives where the (Federal Civil Aviation Authority) LBA has been participating to define a common standard for simulator evaluations and qualifications which now will be established in Europe by implementing the Joint Aviation Requirements (JARSTD). Based on ECAC agreements the LBA extended the period between Simulator inspections already years ago to 24 months for some European Countries and joint evaluations have been carried out together with European Authorities as well as with the US Federal Aviation Authority (FAA) for familiarization with the evaluation process of these Authorities. The LBA appreciates the aspired mutual acceptance of Simulator qualifications as well as the bilateral agreement with the USA but it is at the same time aware of existing and appearing difficulties which have to be clarified on the way to a fully implementation and practical application.

Author

Flight Simulation; Flight Simulators; Inspection; Qualifications; International Cooperation

19990026730 Orbit Flight Training Ltd., Derby, UK

Reciprocal Simulator Approvals: A Frustrated Opportunity

Bryant, G. L., Orbit Flight Training Ltd., UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 6.1-6.3; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

My paper today is about reciprocal simulator approvals, and the sense of frustration I hope we all share regarding the rate of progress in this important area. Whilst Bilateral Aviation Safety Agreements (BASA), Simulator Implementation Procedures(SlP) and Joint Implementation Procedures (JlP) are all under way, I would suggest that time has not been of the essence. I will start by reviewing the expectations and then look at the current status to see how it matches, or has fallen short. I will follow this with a summary of the effort required to achieve simulator qualifications, and the challenges often associated with scheduling the time. The costs impact us all, whether we are training centre operators, regulators, airlines - or indeed the fare paying passenger. My conclusions will demonstrate what life could be like if reciprocal simulator approvals were a reality.

Derived from text

Aircraft Safety; Airline Operations; Commercial Aircraft; Flight Safety; Qualifications; Regulators; Flight Simulators; Cockpit Simulators; International Cooperation; Evaluation

19990026731 Mechtronix Systems, Inc., Dorval, Quebec Canada

What is Needed for Todays FNPT Requirements? Can PC Based Technology Meet the Challenge?

Petruzziello, Fernando, Mechtronix Systems, Inc., Canada; Herve, Xavier-Henri, Mechtronix Europe, France; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 7.1-7.7; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The past few years have witnessed a strong increase in the use of Personal Computer (PC) based training aids within the General Aviation (GA) training community. cost and safety benefits being the major contributing factors. Just as in the business world. as the first wave of PC applications conquered our offices. the very first use of PCs in the training community has mostly been limited to desktop environments for such tasks as Computer Based Training (CBT) or Instrument Flight Rules (IFR) training. The application of commonly used PC technology no longer satisfies the new and emerging needs of the GA training community. Tremendous growth in pilot demand is placing great strain on the community and new solutions must be found. In essence. the GA training community needs. but cannot afford the training features traditionally offered by full flight simulator technology. Mechtronix Systems Inc. (MSI) has used the latest generation of networking and distributed architectures centered on PC technologies to build a new generation of affordable flight training aids. MSI has applied this technology. and thus developed the ASCENT FULL FLIGHT TRAINER (FFT) concept. The following paper shall outline and define the FFT concept. Presented shall be the new training requirement. the product features needed to meet these needs. and an explanation of how the latest generation of PC technology has been used to build an affordable product. Also presented is a detailed description of the instructor station

capabilities and the visual system requirements embedded within the FFT concept. Thus. finally making affordable training features traditionally reserved for the major airline operators available lo the GA community.
Author
Flight Simulators; Flight Training; Personal Computers; Training Devices; Computer Assisted Instruction; Commercial Aircraft; General Aviation Aircraft

19990026732 Oxford Air Training School, Oxford, UK
FNPT 1 and 2 Devices in Training Programmes
Barrell, G. R., Oxford Air Training School, UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 8.1-8.4; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The paper examines the new regulations for Synthetic Training of professional pilots as part of an approved training course. The types of synthetic trainers are briefly defined the paper then concentrates on the Flight Navigation Procedures Trainer (FNPT) specifications, and the training allowances and credits available. The equipment in use at Oxford is briefly mentioned with some details of how it will be used for training towards the Joint Aviation Authorities (JAA) Airline Transport Pilot's Licence (ATPL), particular reference is made to the use of generic jet simulators for Multi Crew Conversion training.
Author
Airline Operations; Education; Pilot Training; Training Devices; Air Navigation; Flight Instruments; Flight Simulators; Cockpit Simulators

19990026733 CAE Electronics Ltd., Montreal, Quebec Canada
Implementation of JAA Level A and New FAA Level B Full Flight Simulators: A Manufacturers Perspective
Thompson, Ralph, CAE Electronics Ltd., Canada; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 9.1-9.8; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The new Federal Aviation Authority (FAA) and Joint Aviation Authorities (JAA) regulations on Flight Simulators open up opportunities for simulator manufacturers to develop creative and imaginative new concepts. They provide operators the opportunity to improve safety and reduce cost. Unfortunately, the Flight Simulator industry is not an exact science. In order to apply these regulations in practice, we must compare them to an established baseline. This baseline can only be the success and experience gained by the industry to date. The Simulator industry has evolved over many years into a sophisticated business. It is important that this experience is applied to the new regulations and that quality and high fidelity remain our trade marks. Terminology, common in the 70's and 80's such as reversal bump, Pilot Induced Oscillations (PIO), simulator sickness, "fudging the data" etc. are rarely heard today in reference to Qualified Full Flight Simulators. Above all, negative training characteristics have been all but eliminated. These detrimental characteristics must not be reintroduced.
Author
Flight Simulators; Safety; Cockpit Simulators; Standards

19990026734 Thomson Training and Simulation Ltd., Crawley, UK
Do the New JAA and FAA Flight Simulator Regulations Address the Training Requirements?
Hartley, N. Ray, Thomson Training and Simulation Ltd., UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 10.1-10.4; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The focus of industry effort has been on equipment definitions - in particular, the harmonisation process which resulted in the International Qualification Test Guides (IQTG). This benchmark of activity has not been matched in training terms whilst there have been revisions to training requirements in JAR-FCL, and the Federal Aviation Authority's (FAA) Practical Test Standards, this work has followed a well worn path which has not significantly changed for several decades. This paper highlights the FAA's Human Factors Team report which identified the vulnerabilities in flight crew management of automation and situation awareness. A report recommendation suggested that industry investigated the use of innovative training tools and methods to expand pertinent safety related knowledge of flight crews on a continuing basis - with incentives to encourage training beyond the minimum required by current regulations. The paper notes that the findings of the FM report are potentially exacerbated by the planned progress towards transcontinental Free Flight in Europe and the USA. Given the long periods of gestation of the FAA and Joint Aviation Authorities (JAA) regulatory definition process how is the industry going to best equip itself to meet the challenges? Is the

equipment available today sufficient and adequate? Is it readily available on sufficient scale to enable training on a continuing basis, as recommended by the FM? Should the equipment feature in the regulatory qualification process?
Author
Flight Crews; Flight Simulators; Qualifications; Training Simulators; Pilot Training; Airline Operations

19990026735 Federal Aviation Administration, Project Development Section, Washington, DC USA
Pilot Training and Checking in Flight Simulators: The New Standard, Not the Exception
Cook, Edward D., Federal Aviation Administration, USA; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 11.1-11.10; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

For years the purveyors and users of flight simulation have been extolling the virtues of flight simulation and its applicability to pilot training and testing. There is little doubt that using simulators instead of airplanes achieves fuel conservation. However, simulator use also reduces air traffic congestion, noise and air pollution, and direct training and other costs to the operator. Additionally true is the fact that flight simulators provide a safe flight training environment and would reduce the number of training accidents by allowing emergency situations to be encountered and resolved without jeopardizing safety. However, an even greater encouragement for the proper use of these simulators is that they allow more in-depth training, testing, and checking than can be accomplished in airplanes. The behavior learned, practiced, reinforced, and tested in the simulator is the behavior each pilot takes into the airplane and into operation " on the line." Included are those situations involving poor weather, malfunctioning systems on the airplane, challenging departures, rigorous arrivals, landings requiring tough, unyielding performance, and, if necessary, any emergency. This behavior is the correct behavior-- because it has been taught, practiced, and tested in realistic (although simulated) situations. As a result the pilot is more thoroughly trained and examined and is, therefore, more competent and more safe. Additionally, the regulatory authority (in the US, the Federal Aviation Administration, FAA) is to help ensure the safest possible operating environment in which airline passengers may be transported to their destinations. Allowing pilots to use training systems less than the safest possible would be questionable, at best. Accordingly, the FAA is preparing a regulation change that if adopted, will change the face of airplane training, testing. and checking applications in the US in several interesting and conceivably demanding ways.
Derived from text
Airline Operations; Flight Simulation; Flight Simulators; Flight Training; Pilot Training; Safety; Simulators; Cost Reduction; Flight Crews

19990026736 PARC Aviation, Dublin, Ireland
AQP: Q for Question?
Kane, R. F., PARC Aviation, Ireland; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 12.1-12.9; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The paper will contend that an increasing and troubling number of professional pilots are demonstrating serious deficiencies in both handling skills and technical knowledge. This situation is considered to arise not simply from the increased use of automation but also from changing perceptions in relation to training, changes frequently influenced by the current emphasis on Crew Resource Management (CRM). It will argue that the introduction of the Advanced Qualification Program (AQP) can only bring about a further dilution of skills by decreasing the total amount of time allocated to training and that the conclusion that AQP actually enhances performance is logically flawed.
Author
Education; Qualifications; Pilot Training; Flight Crews

19990026737 Thomson Training and Simulation Ltd., Crawley, UK
Innovation and the OTD: A Case of Chickens and Eggs
Ford, Keith, Thomson Training and Simulation Ltd., UK; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 13.1-13.9; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

A 'Chicken & Egg' situation can occur when introducing new technology to the flight training industry since it is not always clear what should come first, the innovation, or the regulation. The paper focuses on the issues associated with keeping regulations aligned with the innovative development of training equipment. It discusses how lack of regulation as well as over regulation can stifle innovation and its potential benefits. The absence of regulation Other Training Devices (OTDs) increases the risk when developing a new type of training device since under these circumstances, it may not be possible to guarantee exactly how it can

be used in pilot training. This results in a Catch-22 situation since the operators are reluctant to buy anything unless they know it will be approved by the regulators; the manufacturers may not be prepared to take financial developing a new device which the regulators may not certify; and the regulators will not sanction the use of the device in an airlines training programme unless they have seen and understood how it will be used. by describing the development of a new type of training device, the paper challenges the current thinking concerning the use virtual controls for devices that may come under the OTD banner. It concludes by saying that in order to capitalize on recent advances in multimedia technology, the industry should expedite the process of defining regulations for OTDs and produce a unified international agreement as for Full Flight Simulators (FFSs) and Flight Training Devices (FTDs).
Author
Airline Operations; Commercial Aircraft; Flight Training; Pilot Training; Training Devices; Aircraft Pilots

19990026738 Gromov Flight Research Inst., Training Devices, CBT and the Human Factor Lab., Zhykovsky, Russia
The Development and Regulation of Training Devices in Russia: Conditions, Problems, Perspectives
Meerovitch, G., Gromov Flight Research Inst., Russia; The Impact of the New FAA and JAA Regulations on Flight Simulators and Flight Simulator Training: Proceedings; 1997, pp. 14.1-14.5; In English; See also 19990026726; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Russia has a great need for modern effective inexpensive Training Devices (TD), that are examined with strong Certification Procedures. This report analysed the following subjects which are very important for estimation of TD development and perspectives: (1) The modern situation in Russian Civil Aviation; (2) The state of Flight Safety; (3) The condition in the Training Area in the former time and today. (4) What TD are needing for modern Russian conditions? (5) Some principles of TD Regulation in Russia. A Rational Training Conception is formulated. The keystone principles of this Conception are as follows: (1) The TD level must be essentially increased without major financial expense; (2) For the new Aircraft generation with planes numbering more 20, high level Training Centers must be organized; (3) For the rest of the aircraft types the preference must be given to the ”Low Cost - High Efficiency” Training Systems; (4) The Training profitability must be high. A modern TD Regulation System identical to the international level is absent in Russia currently and must be started. The propositions for it are given.
Author
Civil Aviation; Education; Flight Safety; Russian Federation; Training Devices; Low Cost; Aircraft Pilots

19990026967 Naval Research Lab., Washington, DC USA
Tests of Alternative Fire Protection Method for USAF Hangars
Hill, S. A.; Scheffey, J. L.; Walker, F.; Williams, F. W.; Feb. 08, 1999; 385p; In English
Report No.(s): AD-A359951; NRL/MR/6180--99-8337; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

The use of AFFF in overhead suppression systems in aircraft hangars continues to create problems as a result of false discharges and environmental concerns. Two replacement concepts are proposed: the use of water suppression systems to control JP-8 fires and limit fire growth to an acceptable level; and the use of a Mobile Compressed Air Foam Fire Suppression System (MCAFFSS) to protect aircraft in a hangar. Water suppression systems were tested to determine the impact on flame spread and fire growth of the spill fire. The variables investigated included sprinkler application rate and time of sprinkler water discharge. The results showed that the water sprinklers were not capable of preventing flame spread and fire growth on a JP-8 fuel spill. The MCAFFSS unit tested consisted of a premixed AFFF discharged through an oscillating monitor nozzle. Included was a combination UV/IR optical fire detector designed to sense a fuel fire when it is relatively small. Variables evaluated included actuation time, effect of foam aspiration, effect of discharge methods and effect of obstructions. The unit was able to detect and control/extinguish JP-8 spill fires. Tests conducted with obstructions, indicate that obstructions affect the performance of the unit. The technique of targeting the foam at an area in front of the hazard (aircraft) being protected and pushing the foam across the floor, was shown to be the most effective. Non-air aspirated foam was shown to be as effective as air aspirated foam. The location of the fire detector with respect to the fire and obstructions had an effect on detection time.
DTIC
Fire Prevention; Hangars; Foams; Extinguishing; Fires; Infrared Detectors

19990026995 Institute for Human Factors TNO, Soesterberg, Netherlands
Evaluation of the Training Value of Alternative Simulator Configurations for the Chinook and Cougar Transport Helicopters *Final Report Evaluatie van de trainingswaarde van alternatieve simulator configuraties voor de Chinook en Cougar transporthelikopters*
vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; Boot, E. W., Institute for Human Factors TNO, Netherlands; deVries, S. C., Institute for Human Factors TNO, Netherlands; Kappe, B., Institute for Human Factors TNO, Netherlands; Lig-

thart, V. H. M., Institute for Human Factors TNO, Netherlands; Marsman, A. P. L. A., Institute for Human Factors TNO, Netherlands; Jul. 17, 1998; 70p; In Dutch
Contract(s)/Grant(s): A97/KLu/307; TNO Proj. 730.1
Report No.(s): TD98-0251; TM-98-A042; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

In the context of the procurement of simulator capacity for training pilots of Chinook CH-47D and Cougar MK2 cargo helicopters, in a previous study a global training analysis has been conducted. Also, requirements for different possible simulator configurations have been formulated. On the basis of these requirements the Royal Netherlands Air Force (RNLAF) has formulated and issued a Request for Information (RFI) to potential suppliers. The aim of the RFI is to gather information about the technical and financial feasibility of the proposed simulator configurations. In order to evaluate the responses to the RFI on basis of their training value, a more detailed training analysis has been conducted and is reported here. Within the context of this analysis the minimally required level of simulator configuration and necessary training time for each training topic has been determined. On the basis of these results it is concluded that: 1 more than a quarter of all training hours can only be performed with the most advanced level of simulator configuration (about the same as FAA level D). These training hours are mostly concerned with training topics associated with flight safety (emergency procedures) and operating under maximum and special conditions; 2 given such a level of simulator configuration, the total training time for both helicopter types will be at least 1200 hours. If those training topics which could be trained in a helicopter are also trained on this simulator configuration, the total training time amount to 1660 hours for both types. There is reason to believe that these estimates are conservative. It is expected that once such a level of simulator configuration is available, the total training time for both types could exceed 2600 hours. to specify simulator requirements more accurately, training scenarios have been specified for each of the essential (level D) training topics. For each scenario, the minimum requirements have been determined. On the basis of these requirements RFI responses can be evaluated and compared. It appeared that a number of suppliers can meet the requirements. During subsequent phases of the procurement process, the training scenarios can be used to specify test scenario's for evaluating proposals. Ultimately the results reported can also be used for the development of the training programmes that are delivered on the simulator(s). The training analysis and the specification of the simulator requirements have been mainly focussed on the most important cost drivers, viz. the image systems and the moving base systems. It is recommended to pay also attention during subsequent phases to the requirements with respect to the instructional facilities. Although they are not the main cost drivers, they are Important benefit drivers, i.e. they are essential for effective and efficient use of the simulator facilities.
Author
Training Evaluation; Simulators; CH-47 Helicopter; Training Simulators; Estimates; Education

19990027153 Science Applications International Corp., Arlington, VA USA
Heliport Lighting: Configuration Research ***Final Report***
Fontaine, Scott A.; Cherry, Adina C.; McConkey, Edwin D.; Nov. 1998; 61p; In English
Report No.(s): AD-A359492; DTFA01-93-C-00030; DOT/FAA/ND-98/2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report develops a methodology for researching and designing heliport lighting systems with particular emphasis on lighting system configurations. The report also catalogs lighting system components, subsystems, and systems identified to date. The main objective of this effort is to develop a basis from which to form a more efficient lighting system for instrument approaches to heliports using the Global Positioning System (GPS). With the development of instrument approach procedures to heliports, the Federal Aviation Administration (FAA) is investigating the lighting requirements necessary to support these procedures. This report describes the initial efforts of this research and development activity.
DTIC
Heliports; Illuminating; Instrument Approach; Helicopters; Lighting Equipment; Instrument Landing Systems

19990027154 Science Applications International Corp., Arlington, VA USA
Heliport Lighting: US Park Police Demonstration ***Final Report***
Fontaine, Scott A.; McConkey, Edwin D.; Nov. 1998; 47p; In English
Contract(s)/Grant(s): DTFA01-93-C-00030
Report No.(s): AD-A359491; DOT/FAA/ND-98/4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This demonstration/evaluation of prototype heliport lighting system components was part of a larger effort to research the requirements for lighting systems to support precision approaches to heliports. Based on the success of a VFR prototype system demonstrated in conjunction with Operation Heli-STAR (DOT/FAA/AND-97/20), it was decided to continue the demonstration/evaluation at the USA (U.S.) Park Police Heliport in Washington D.C. The arrangement has proven to be extremely valuable, due

in large part to the cooperation and assistance of the officers, pilots, and aircrew of the U.S. Park Police Aviation Section. This reports documents the initial evaluation of a laser diode localizer, a laser diode glideslope indicator, a light pipe, cold cathode line-up and landing system, and a light bar ”alignment of elements” glideslope indicator. Some insights and lessons learned regarding the use of simulation in lighting system development are also presented.
DTIC
Lighting Equipment; Heliports; Fiber Optics; Illuminating; Landing Aids

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19990027766 Space Warfare Center, Schriever AFB, CO USA
Space Tactics Bulletin. Achieving America’s Victories Through Space Power
Space Tactics Bulletin; Jan. 1998; Volume 5, No. 3, pp. 1-49; In English
Report No.(s): AD-A359685; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Space Tactics Bulletin is an official, nondirective SW publication. Its purpose is to update warfighting staffs and units on SWC efforts to effectively employ space assets in support of operations, and provide a forum for information exchange to improve space tactics and procedures. This issue contains two articles about the use of multispectral imagery to enhance warfighting operations. The proliferation of commercial imaging systems and their subsequent improvements in timeliness and quality make this an ever-growing area in the intelligence communities. Imagery such as this is available to everyone. Adversaries can use commercial imagery and other products from space to enhance their own combat capabilities. The article on integrating a space-capable adversary into exercises advances the notion that the first time U.S. forces meet a space capable adversary should be during exercises, not actual combat.
DTIC
Images; Imaging Techniques; Space

13
ASTRODYNAMICS

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

19990027243 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Maneuvers with Two and Three Impulses for Artificial Satellites ***Variabilidade Interanual de Campos Atmosfericos Totais e Zonalmente Assimetricos***
Andreoli, Rita Valeria, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 122p; In Portuguese
Report No.(s): INPE-6776-TDI/637; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This paper deals with orbital transfer maneuvers. It studies the problem of transferring a spacecraft from an initial to a coplanar final orbit. The control available to perform this task is a sequence of two or three impulses. The main goal is to study what is the best approach for a large set of initial and final orbits. Two methods available in the literature (one for a two-impulse and one for a three-impulse maneuver) are selected and used for comparison. The results show the fuel consumption for each case and produces a map of the regions of optimality for both cases.
Author
Artificial Satellites; Transfer Orbits; Maneuverability

19990027425 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Optimization of Low Thrust Spacecraft Trajectories Using a Genetic Algorithm
Eisenreich, Jason C.; Jan. 1998; 79p; In English
Report No.(s): AD-A359932; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This thesis concerns the use of genetic algorithms in the optimization of the trajectories of low thrust spacecraft. Genetic algorithms are programming tools which use the principles of biological evolution and adaptation to optimize processes. These algorithms have been found to be very useful in many different engineering disciplines. The goal of this project is to determine their

applicability to the generation and optimization of low thrust spacecraft trajectories. This thesis describes the basic operating principles of genetic algorithms and then applies them to two different missions.
DTIC
Spacecraft Trajectories; Trajectory Optimization; Genetic Algorithms

16
SPACE TRANSPORTATION

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 18 Spacecraft Design, Testing and Performance. For space suits see 54 Man/System Technology and Life Support

19990026745 Burke (J. D.), Sierra Madre, CA USA
Ballistic Transport of Lunar Construction Materials
Burke, James D., Burke (J. D.), USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 4; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Moving lunar regolith materials will be necessary for both construction and resource extraction. Most illustrations show bulldozers, draglines, clamshell buckets, and other similar devices being used for this purpose. However, the Moon's gravity and its vacuum environment suggest another possibility: namely, ballistic transport such as is used on Earth in threshing machines, street sweepers, snow blowers, and ice-rink resurfacers. During the Apollo 15 mission, astronauts maneuvered the lunar rover in such a way that its spinning, bouncing, and skidding wheels threw up sizable "rooster tails" of Moon dirt, showing the ballistic transport possibility. Now what is needed is some effort to find out more about this process, so that it can be determined whether or not it should be considered seriously for lunar construction and resource operations. Simple experiments in 1 g and air, using a drill motor and various wire brushes, show some characteristics of the plume of sand that can be thrown. However, the results are of no quantitative value because of air drag and the wind induced by the wire wheel itself. to get a better handle on the real physics of the process, and to understand whether it would be useful on the Moon, more quantitative experiments are needed. to this end, a small model has been designed to illustrate and possibly to test the process, first in laboratory vacuum and then in vacuum in 1/6-g aircraft flight.
Author
Construction; Lunar Rocks; Lunar Soil; Regolith; Transportation

19990027972 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Spaceplane: The Catalyst for Resolution of the Boundary and 'Space Object' Issues in the Law of Outer Space?
Kelly, Elizabeth; Nov. 1998; 148p; In English
Contract(s)/Grant(s): AFIT-FY99-55
Report No.(s): AD-A359893; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The spaceplane could be the most desirable form of space transportation in the next century. However, accompanying it are questions of whether a boundary is needed between airspace and outer space, and whether the current definition of 'space object' in the outer space treaties is adequate to include these hybrid vehicles. This thesis concludes that the spaceplane does not portend the need for a boundary and that it will not require the development of a new definition. Chapter I describes some of the best known spaceplane initiatives. Chapter II and III, respectively discuss the air law and space law regimes and arguments made for and against establishing a boundary between airspace and outer space. Chapter IV describes debates regarding the sufficiency of the term 'space object' as it is defined in the space law regime. Chapter V analyzes the impact that spaceplanes will have on the boundary and 'space object' debates.
DTIC
Aerospace Planes; Space Shuttles; Space Law; Air Law; Airspace; Space Transportation

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. 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.

19990027920 NASA Marshall Space Flight Center, Huntsville, AL USA
An Environment Monitoring Package for the International Space Station
Carruth, M. Ralph, NASA Marshall Space Flight Center, USA; Clifton, Kenneth S., NASA Marshall Space Flight Center, USA; 1998; 6p; In English; Space Technology and Applications, 31 Jan. - 4 Feb. 1999, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The first elements of the International Space Station (ISS) will soon be launched into space and over the next few years ISS will be assembled on orbit into its final configuration. Experiments will be performed on a continuous basis both inside and outside the station. External experiments will be mounted on attached payload locations specifically designed to accommodate experiments, provide data and supply power from ISS. From the beginning of the space station program it has been recognized that experiments will require knowledge of the external local environment which can affect the science being performed and may impact lifetime and operations of the experiment hardware. Recently an effort was initiated to design and develop an Environment Monitoring Package (EMP). This paper describes the derivation of the requirements for the EMP package, the type of measurements that the EMP will make and types of instruments which will be employed to make these measurements.
Author
Environmental Monitoring; International Space Station; Mass Spectrometers; Pressure Gages; Microbalances; Earth Orbital Environments

20
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, 44 Energy Production and Conversion, and 15 Launch Vehicles and Space Vehicles.

19990027065 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA
A Numerical and Experimental Study of Arcjet Fluctuation ***Final Report***
Powell, Ken; Gallimore, Alec; Van Leer, Bram; Jan. 29, 1999; 24p; In English
Contract(s)/Grant(s): F49620-94-1-0399
Report No.(s): AD-A359642; 023222-FINAL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work described here is a combined numerical/experimental study of arcjets. The focus of the experimental work has been a parametric study of the onset of instability in arc thruster devices. The focus of the numerical work has been the development of numerical methods for solving the magnetohydrodynamic (MHD) equations in complex geometries.
DTIC
Magnetohydrodynamics; Numerical Analysis; Electrojets; Arc Jet Engines

19990027419 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Research into Resistojet Rockets for Small Satellite Applications
Lawrence, Timothy J.; Oct. 1998; 277p; In English
Report No.(s): AD-A359911; AFIT-FY99-57; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This effort investigated the use of resistojet rockets for small satellite stationkeeping missions. Small satellites create unique system constraints, compared to larger spacecraft, that have not been investigated thoroughly for stationkeeping missions. These constraints are: cost, power, volume, mass, safety, and thrust. Whilst all these constraints have been considered in off-the shelf-systems used through out the aerospace community, current systems may not be appropriate or affordable for cost-effective small satellite applications. Cold gas systems have low performance, hydrazine and ammonia systems use toxic propellants, and arcjets, electrostatic and electromagnetic electric propulsion systems have low thrust to input power ratios. Thus, electric propulsion using

resistojets operating at low power, 100W, and using liquid propellants, water and nitrous oxide, have re-emerged as attractive propulsion options for small satellites.
DTIC
Artificial Satellites; Resistojet Engines; Stationkeeping; Propulsion System Configurations; Liquid Rocket Propellants

19990027477 NASA, Washington, DC USA
Engineering design aspects of the heat-pipe power system
Capell, B. M., NASA, USA; Houts, M. G., NASA, USA; Poston, D. I., NASA, USA; Berte, M., NASA, USA; Oct. 31, 1997; 5p; In English, USA
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): DE98-003307; LA-UR-97-4364; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Heat-pipe Power System (HPS) is a near-term, low-cost space power system designed at Los Alamos that can provide up to 1,000 kWt for many space nuclear applications. The design of the reactor is simple, modular, and adaptable. The basic design allows for the use of a variety of power conversion systems and reactor materials (including the fuel, clad, and heat pipes). This paper describes a project that was undertaken to develop a database supporting many engineering aspects of the HPS design. The specific tasks discussed in this paper are: the development of an HPS materials database, the creation of finite element models that will allow a wide variety of investigations, and the verification of past calculations.
NTIS
Heat Pipes; Space Power Reactors; Spacecraft Power Supplies; Design Analysis; Reactor Design

19990027560 TRW Space Technology Labs., Redondo Beach, CA USA
Control of Propellant Lead/Lag to the LAE in the AXAF Propulsion System
Casillas, A. R., TRW Space Technology Labs., USA; Eninger, J., TRW Space Technology Labs., USA; Joseph, G., TRW Space Technology Labs., USA; Kenney, J., TRW Space Technology Labs., USA; Trinidad, M., TRW Space Technology Labs., USA; 1998; 11p; In English; 34th; Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-37710
Report No.(s): AIAA Paper 98-3204; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Control of the rate at which hypergolic propellants are supplied to a rocket engine prior to ignition is critically important. Potentially damaging explosions may result from excessive lead of either propellant into the combustion chamber. Because the injector fill process is governed by the engine as well as the propellant feed system design, proper management of this issue must take both into consideration. This was recognized early in the development of TRW's Advanced Columbium-Liquid Apogee Engine (LAE), which was flight-qualified in 1996 to maneuver the Advanced X-Ray Astrophysics Facility (AXAF) spacecraft into orbit. The LAE runs on hydrazine and nitrogen tetroxide (MON-3) at a nominal mixture ratio of 1.0. This paper describes the comprehensive test program conducted to ensure reliable startup operation of the LAE in the AYAF propulsion system. The most significant factors affecting chamber fuel lead were found to be: (1) engine location, (2) propellant saturation level, (3) amount of undissolved gas in the lines, and (4) off- nominal tank pressures. Hot-fire tests at a chamber fuel lead range over and above that expected for the LAEs in AXAF demonstrated extremely tolerant behavior of the engine. AY-AF is scheduled for launch on NASA's STS-93 in December 1998.
Author
Combustion Chambers; Feed Systems; Hypergolic Rocket Propellants; Injectors

19990027601 NASA Lewis Research Center, Cleveland, OH USA
Optical Evaluation of an As-Manufactured Compound Secondary Concentrator
Jaworske, Donald A., NASA Lewis Research Center, USA; Skowronski, Timothy J., Cleveland State Univ., USA; Miles, Barry J., BWX Technologies, Inc., USA; 1999; In English; Space Technology and Applications International Forum, 1999, USA; Sponsored by American Inst. of Physics, USA; ISBN 1-56396-846-0; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Secondary concentrators are needed in solar thermal propulsion to further concentrate the energy collected by large lightweight primary concentrators. Although the physics of secondary concentrators has been worked out in detail and the manufacturing has been successfully completed for a ground demonstration, there is a need to quantify the specific performance of as-manufactured concentrators. This paper summarizes the properties of a secondary concentrator manufactured for the Integrated

Solar Upper Stage engine ground demonstration in 1997 and presents data obtained from the optic that describe the performance of the as-manufactured component.
Author
Solar Thermal Propulsion; Concentrators

19990028196 NASA Lewis Research Center, Cleveland, OH USA
"2001: A Space Odyssey" Revisited--The Feasibility of 24 Hour Commuter Flights to the Moon Using NTR Propulsion with LUNOX Afterburners
Borowski, Stanley K., NASA Lewis Research Center, USA; Dudzinski, Leonard A., NASA Lewis Research Center, USA; Dec. 1998; 24p; In English; 33rd; Joint Propulsion, 6-9 Jul. 1997, Seattle, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 906-43-0A
Report No.(s): NASA/TM-1998-208830; E-11441; NAS 1.15:208830; AIAA Paper 97-2956; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The prospects for "24 hour" commuter flights to the Moon, similar to that portrayed in 2001: A Space Odyssey but on a more Spartan scale, are examined using two near term, "high leverage" technologies--liquid oxygen (LOX)-augmented nuclear thermal rocket (NTR) propulsion and "lunar-derived" oxygen (LUNOX) production. Ironrich volcanic glass, or "orange soil," discovered during the Apollo 17 mission to Taurus-Littrow, has produced a 4% oxygen yield in recent NASA experiments using hydrogen reduction. LUNOX development and utilization would eliminate the need to transport oxygen supplies from Earth and is expected to dramatically reduce the size, cost and complexity of space transportation systems. The LOX-augmented NTR concept (LANTR) exploits the high performance capability of the conventional liquid hydrogen (LH2)-cooled NTR and the mission leverage provided by LUNOX in a unique way, LANTR utilizes the large divergent section of its nozzle as an "afterburner" into which oxygen is injected and supersonically combusted with nuclear preheated hydrogen emerging front the engine's choked sonic throat--essentially "scramjet propulsion in reverse." By varying the oxygen-to-hydrogen mixture ratio, the LANTR engine can operate over a wide range of thrust and specific impulse (Isp) values while the reactor core power level remains relatively constant. The thrust augmentation feature of LANTR means that "big engine" performance can be obtained using smaller, more affordable, easier to test NTR engines. The use of high-density LOX in place of low-density LH2 also reduces hydrogen mass and tank volume resulting in smaller space vehicles. An implementation strategy and evolutionary lunar mission architecture is outlined which requires only Shuttle C or "in-line" Shuttle-derived launch vehicles, and utilizes conventional NTR-powered lunar transfer vehicles (LTVs), operating in an "expendable mode" initially, to maximize delivered surface payload on each mission. The increased payload is dedicated to installing "modular" LUNOX production units with the intent of supplying LUNOX to lunar landing vehicles (LLVS) and then LTVs at the earliest possible opportunity. Once LUNOX becomes available in low lunar orbit (LLO), monopropellant NTRs would be outfitted with an oxygen propellant module, feed system and afterburner nozzle for "bipropellant" operation. Transition to a "reusable" mission architecture now occurs with smaller, LANTR-powered LTVs delivering approximately 400% more payload on each piloted round trip mission than earlier expendable "all LH2" NTR systems. As initial lunar outposts grow to eventual lunar settlements and LUNOX production capacity increases, the LANTR concept can enable a rapid "commuter" shuttle capable of 24 hour "one way" trips to and from the Moon, A vast deposit of"iron-rich" volcanic glass beads identified at just one candidate site--located at the southeastern edge of Mare Serenitatis--could supply, sufficient LUNOX to support daily commuter flights to the Moon for the next 9000 years!
Author
Afterburning; Nuclear Rocket Engines; Nuclear Propulsion; Spacecraft Propulsion; Moon; Liquid Rocket Propellants; Space Transportation System; Space Missions; Oxygen Production; Oxygen Supply Equipment

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CHEMISTRY AND MATERIALS (GENERAL)

19990026894 Department of the Navy, Washington, DC USA
Optically Transparent, Optically Stimulable Glass Composites for Radiation Dosimetry
Huston, Alan L., Inventor; Justus, Brian L., Inventor; Sep. 22, 1998; 10p; In English; Supersedes , AD-D018541
Report No.(s): AD-D019200; PAT,APPL,848,259; PAT-5,811,822; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An optically transparent and optically stimulable glass composite includes a glass matrix that has both luminescent centers and trapping centers. The trapping centers store trapped charges and, in response to optical stimulation, release the charges result-

ing in recombination and light emission. In one embodiment, the invention is a glass matrix doped with an alkaline earth sulfide, Sm ions, and an additional dopant such as Eu ions and Ce ions. Alternatively, the dopants may be ZnS and Cu, Pb, or Mn ions. In another embodiment, Cu may be the sole dopant. Several different preparation methods, including diffusion techniques, are described for producing the doped glasses.
DTIC
Optical Properties; Dosimeters; Light Emission; Radiation Dosage; Doped Crystals

19990027557 National Inst. for Fusion Science, Toki, Japan
Molecular Dynamics of Structure Organization of Polyampholytes
Tanaka, Motohiko, National Inst. for Fusion Science, Japan; Tanaka, Toyoichi, Massachusetts Inst. of Tech., USA; Sep. 1998; ISSN 0915-633X; 12p; In English
Report No.(s): NIFS-558; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The dynamics and equilibrium of charged polymers of random co-polymerization (polyampholytes) are studied for both the single-chain and multichain cases with the use of molecular dynamics simulations. Nearly neutral single-chain polyampholyte has three temperature regimes, which are characterized by an elongated Gaussian coil, a transition between the coil and globular states, and a very dense globule for high, medium and low temperatures, respectively. The gyration radius of polyampholytes shows a hysteresis against slow cyclic temperature changes under the Coulomb and attractive short-range forces. The multichain polyampholyte forms a globule at low temperature and is composed of wall-bound separated chains at high temperature. The polyampholyte chains are overlapped above certain concentration or below a critical temperature due to the Coulomb force. Added salt ions screen the electric field between the monomers and make the polyampholyte soluble when density of the salt is comparable to that of the polyampholyte.
Author
Polymerization; Molecular Dynamics; Electric Fields; Temperature Distribution; Critical Temperature

19990027666 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Development of proton-conducting membranes for separating hydrogen from gas mixtures
Balachandran, U., Department of Energy, USA; Guan, J., Department of Energy, USA; Dorris, S. E., Department of Energy, USA; Liu, M., Department of Energy, USA; Sep. 30, 1997; 7p; In English; Sponsored by American Inst. of Chemical Engineers, USA
Report No.(s): DE98-050037; ANL/ET/CP-94627; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Thin and dense ceramic membranes fabricated from mixed protonic/electronic conductors can provide a simple, efficient means of separating hydrogen from gas streams and offer an alternative to existing methods of hydrogen recovery. Because mixed electronic/protonic conductors internally transport not only hydrogen (and thus provide the means to separate hydrogen from other gaseous components) but also electrons, hydrogen separation could be achieved in a non-Galvanic mode of operation (i.e., without the need for external electrodes, circuitry, and/or power supply). This paper summarizes results obtained in Argonne's effort to develop material for use as a hydrogen separation membrane. The transport properties of BaCe(0.95)Y(0.05)O(3-(alpha)) (5%-BCY) and SRCe(0.95)Y(0.05)O(3-(alpha)) (5%-SCY) were characterized by impedance spectroscopy, gas permeation, and open-cell voltage measurements. In this presentation, the authors describe the materials selection, synthesis, characterization, and performance evaluation of mixed conducting dense ceramic membranes for hydrogen separation applications.
NTIS
Hydrogen; Membranes; Conductors; Protons; Gas Mixtures; Gas Streams; Transport Properties

19990027855 Old Dominion Univ., Dept. of Civil and Environmental Engineering, Norfolk, VA USA
Evaluation of the Effects of AFFF Inputs on the VIP Biological Nutrient Removal Process and Pass-Through Toxicity
Erten-Unal, Mujde; Schafran, Gary C.; Jan. 1999; 214p; In English
Contract(s)/Grant(s): N00014-96-1-G021
Report No.(s): AD-A360364; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report discusses the results of a bench scale study conducted to evaluate the potential inhibitory effects of pretreated AFFF wastewater to the Virginia Initiative Plant (VIP) biological nutrient removal process. The pretreatment scenarios included use of defoamers and use of Fenton's reagent as a strong oxidant. Under this testing' bench-scale reactors simulating the nitrification process were loaded with three AFFF concentrations that were pretreated by defoamers and three AFFF concentrations treated with Fenton's reagent. The pretreatment results with defoamers demonstrated that effluent ammonia nitrogen concentrations for Defoamer # 8710 were higher than the effluent ammonia levels for the Defoamer AF 9020 indicating a better pretreatment and less nitrification inhibition for the latter defoamer. Fenton's reagent was used to pretreat AFFF at concentrations 60 ppm, 120 ppm, and 480 ppm. There were no nitrification inhibition at 60 ppm and 120 ppm AFFF wastewater pretreated with the Fenton's reagent

as compared to the controls. Oxidation with Fenton's reagent was more effective than the defoamers used in pretreating AFFF. The nitrification inhibition potential decreased at concentrations greater than 60 ppm however, nitrification inhibition occurred at 480 ppm AFFF pretreated with Fenton's reagent. In all of the pretreatment alternatives used, the inhibition reactor effluents exhibited pass-through toxicity to mysid shrimp at AFFF concentrations 60 ppm or greater, whereas the effluent was not toxic to the sheepshead minnows.
DTIC
Waste Water; Toxicity; Evaluation; Research; Fire Extinguishers; Flame Retardants

19990027864 National Inst. of Standards and Technology, Building Environment Div., Gaithersburg, MD USA
Enhancement of R123 Pool Boiling by the Addition of Hydrocarbons
Kedzierski, Mark A., National Inst. of Standards and Technology, USA; Oct. 1998; 56p; In English
Report No.(s): PB98--172596; NISTIR-6244; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the present study, five different hydrocarbons were tested as additives in various concentrations with R123 in an effort to investigate the enhancement mechanism of the excess layer. The various hydrocarbons were chosen for their wide range of properties: namely, normal boiling point, interfacial surface tension, molecular weight, and molecular structure. It was hypothesized that certain thermophysical and chemical properties of the hydrocarbon were favorable for the creation of an excess layer. Dilute solution of hydrocarbons with R123 and mixture of components with similar boiling points were unlikely to exhibit heat transfer degradations that can be associated with concentration gradients. It was also believed that a large difference between the surface tension of the additive and the refrigerant would create a large potential to reduce the surface energy of the liquid-solid interface via the excess layer. The stability of the excess layer may rely on the molecular structure of the hydrocarbon.
NTIS
Boiling; Hydrocarbons

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COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see 27 Nonmetallic Materials.

19990026816 Department of Energy, Office of Energy Research, Washington, DC USA
Compressive Creep Response of T1000G/RS-14: Graphite/Polycyanate Composite Materials
Starbuck, J. M., Department of Energy, USA; Jan. 31, 1998; 42p; In English
Report No.(s): DE98-058102; ORNL-6937; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The response of a T1000G/RS-14 graphite/polycyanate composite material system to transverse compressive loads is quantified via experimentation. The primary objective of the work was to quantify the effects of process environment and test environment on the T1000G/RS-14 compressive creep response. Tests were conducted on both the neat resin and the composite material system. In addition to the creep tests, static compressive strength tests were conducted to define the stress-strain response. The creep behavior for the RS-14 resin was quantified by conducting a series of tests to study the effects of different process environments (air and nitrogen), different cure temperatures, and different test environments (air and vacuum). The combined effect on the RS-14 resin compressive creep of processing in nitrogen and testing under vacuum versus processing in air and testing in air was a 47% decrease in the creep strain after 2177 hr. The test environment appeared to have a greater effect on the resin creep than the process environment. Following the conclusion of the resin creep tests, composite transverse compressive creep tests were conducted. The composite creep test cylinder was post-cured in a nitrogen environment prior to machining test specimens and all tests were conducted in a vacuum environment. The series of tests investigated the effects of initial stress level and test temperature on the creep behavior. At the end of the 2000-hr tests at 275 F on specimens stressed at 10,000 psi, the nitrogen-processed and vacuum-tested conditions reduced the composite transverse compressive creep strain by 19% compared to processing in air and testing in air. The effects of process and test environment on the creep behavior are not as great for the composite system as they were for the neat resin, primarily because of the low resin content in the composite material system. At the 275 F test temperature there was a significant increase in the composite transverse compressive creep strain between the 6000 psi and 10,000 psi stress levels. Despite the reduction in creep strains due to processing in a nitrogen environment, dimensional stability of the T1000G/RS-14 composite at high transverse compressive stress levels and high temperatures may still be an issue when selecting this system for future applications.
NTIS
Creep Properties; Creep Tests; Graphite; Composite Materials

19990026817 Department of Energy, Office of Energy Research, Washington, DC USA

Characterization and Process Development of Cyanate Ester Resin and Composite

Frame, B. J., Department of Energy, USA; Mar. 31, 1998; 179p; In English

Report No.(s): DE98-058103; ORNL-6938; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Cyanate ester (or polycyanate) resins offer advantages as composite matrices because of their high thermal stability, low outgassing, low water absorption and radiation resistance. This report describes the results of a processing study to develop high-strength hoop-wound composite by the wet-filament winding method using Toray T1000G carbon fiber and YLA RS-14A polycyanate resin as the constituent materials. Process trials, tests and analyses were conducted in order to gain insight into factors that can affect final properties of the cured cyanate ester resin and its composites. The study shows that the cyanate ester resin has a broad process envelope but that an inert-atmosphere cure is essential for obtaining optimum resin and composite properties. Minimizing moisture exposure prior to cure is also crucial as it affects the T(sub g) of the resin and composite. Recommendations for reducing moisture contact with the resin during wet-winding are presented. High fiber volume fraction approximately 80% composites wound and cured with these methods yielded excellent hoop tensile strengths (660 to 670 ksi average with individual rings failing above 700 ksi), which are believed to be the highest recorded strengths for this class of materials. The measured transverse properties were also exceptional for these high fiber fraction composites. Based on the available data, this cyanate ester resin system and its composites are recommended for space and vacuum applications only. Further testing is required before these materials can be recommended for long term use at elevated temperatures in an ambient air environment. The results of all analyses and tests performed as part of this study are presented as well as baseline process for fabricating thick, stage-cured composites. The manufacture of a 1 in. thick composite cylinder made with this process is also described.

NTIS

Cyanates; Esters; Resins; Fiber Composites

19990026837 Army Construction Engineering Research Lab., Champaign, IL USA

Non-Ductile Behavior of Reinforced Concrete Frames With Masonry Infill Panels Subjected to In-Plane Loading *Final Report*

Al-Chaar, Ghassan; Dec. 1998; 278p; In English

Report No.(s): AD-A360129; CERL-TM-99/18; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

Lessons learned from earthquakes in the last 50 years have spurred changes in building seismic code requirements, making it necessary to determine the seismic vulnerability of old military structures. This study addresses a popular type of building in high seismic zones that has lateral load-resisting systems constructed from reinforced concrete (R/C) frames with masonry infill panels. An experimental program was carried out to evaluate this structural system. Five single-story half-scale laboratory models with different numbers of bays were constructed. The five models represent: a single-bay bare frame, single-bay with concrete masonry unit (CMU) infill, single-bay with brick infill, double-bay with CMU infill, and triple-bay with brick infill. These models were fully instrumented and tested under lateral in-plane loading to failure. Non-linear finite element analyses were carried out on the experimental models. Load-deflection curves for finite element analysis (FEA) reasonably predicted experimental behavior of specimens in terms of deflection. Ultimate failure load corresponding to each specimen was predicted with accuracy. Finally, a new idealized analytical model was proposed to determine the capacity evaluation of this structural system. Post-yield behavior, residual strength, and the effects of bay multiplicity on structural behavior are also presented.

DTIC

Buildings; Structural Engineering; Loads (Forces); Composite Materials; Earthquakes; Finite Element Method; Failure; Masonry; Concretes

19990026891 Department of the Navy, Washington, DC USA

Method of Protecting a Structure

Dudt, Philip J., Inventor; Martin, John R., Inventor; Sep. 29, 1998; 8p; In English; Supersedes US-Patent-Appl-SN-710498, AD-D019001.

Patent Info.: Filed 18 Sep. 96,; US-Patent-Appl-SN-710,498

Report No.(s): AD-D019210; PATENT,5,814,250; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The invention is directed to a lightweight barrier and armor materials and, more particularly, to a method of using a syntactic foam for protecting a desired portion of a fixed structure (e.g., building) or movable structure (e.g., armored vehicle or ship) from ballistic impact. The method of the present invention includes the following steps: (1) providing a mold defining therein a predetermined shape or an enclosed space in a fixed or movable structure; (2) providing a mixture of between about 40 percent and about 80 percent by volume of microspheres and between about 60 percent and about 20 percent by volume of an uncured binder material; (3) pouring the mixture into the mold; (4) curing the mixture to form a syntactic foam barrier material in the form of the prede-

termined shape; and (5) placing the barrier material in a relationship with the structure to be protected wherein the desired portion of the structure is protected from ballistic impact. The resulting protective barrier material is adapted to absorb and contain bullets and other ballistic penetrators and to maintain structural integrity upon impact thereof. The present method may further include the steps of providing external reinforcement and/or internal ballistic impact absorbing components to the barrier material.
DTIC
Armor; Buildings; Foams; Curing

19990027136 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Microfabrication of membrane-based devices by HARSE and combined HARSE/wet etching
Manginell, R. P., Department of Energy, USA; Frye-Mason, G. C., Department of Energy, USA; Schubert, W. K., Department of Energy, USA; Shul, R. J., Department of Energy, USA; Willison, C. G., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Micromachining and Microfabrication, USA
Report No.(s): DE98-007249; SAND-98-1777C; CONF-980918; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Deep-reactive ion etching (DRIE) of silicon, also known as high-aspect-ratio silicon etching (HARSE), is distinguished by fast etch rates (approximately 3 (micro)m/min), crystal orientation independence, anisotropy, vertical sidewall profiles and CMOS compatibility. by using through-wafer HARSE and stopping on a dielectric film placed on the opposite side of the wafer, freestanding dielectric membranes were produced. Dielectric membrane-based sensors and actuators fabricated in this way include microhotplates, flow sensors, valves and magnetically-actuated flexural plate wave (FPW) devices. Unfortunately, low-stress silicon nitride, a common membrane material, has an appreciable DRI etch rate. to overcome this problem HARSE can be followed by a brief wet chemical etch. This approach has been demonstrated using KOH or HF/Nitric/Acetic etchants, both of which have significantly smaller etch rates on silicon nitride than does DRIE. Composite membranes consisting of silicon dioxide and silicon nitride layers are also under evaluation due to the higher DRIE selectivity to silicon dioxide.
NTIS
Fabrication; Membranes; Etching; High Aspect Ratio; Silicon

19990027155 Texas Univ., Inst. for Advanced Technology, Austin, TX USA
Fabrication and Structural Testing of the Second RTM Carbon Fiber Composite End Plate ***Interim Report, Jan. - Sep. 1998***
Oct. 1998; 18p; In English
Contract(s)/Grant(s): DAAA21-93-C-0101
Report No.(s): AD-A359488; IAT-R-0189; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In a previous report DR Technologies described the fabrication and testing of the first carbon fiber end plate for the subscale compulsator. The first end plate demonstrated the producibility of the carbon/epoxy composite concept using RTM technology and, following an unintentional overload during structural testing, provided coupon-level material properties. A second identical plate was fabricated in this reporting period, nondestructive structural stiffness measurements were made, and the plate was delivered to UT-CEM for further evaluation. This report summarizes the fabrication, testing, and analysis of the second end plate.
DTIC
Nondestructive Tests; Resin Transfer Molding; Plates (Structural Members); Fiber Composites; Epoxy Matrix Composites; Carbon Fibers; End Plates

19990027248 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Prediction of the Compressive Strength for Composite Honeycomb Core Sandwich Panels After Low Speed Impact
Kou, Changhe, Beijing Univ. of Aeronautics and Astronautics, China; Cheng, Xiaoquan, Beijing Univ. of Aeronautics and Astronautics, China; Li, Zhengneng, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 555-558; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Based on the experimental study of compressive failure mechanisms on composite honeycomb core sandwich panels after low speed impact previously, an equivalent delamination was used to replace the low speed impact damage of Nomex honeycomb core sandwich panels in this paper. It was postulated that the edge of sublaminate formed by the equivalent delamination is clamped. The load on which the sublaminate buckled was considered to be compressive failure load. Comparing the results of theory with experiment, it showed that the method of equivalent damage could be used to predict the residual compressive strength

of honeycomb core sandwich panels, in the case that the facesheet of sandwich panels had no obvious cracks after low speed impact.
Author
Sandwich Structures; Honeycomb Structures; Delaminating; Impact Damage; Compressive Strength

19990027249 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Compression of Composite Honeycomb Core Sandwich Panels after Low Velocity Impact
Cheng, Xiaoquan, Beijing Univ. of Aeronautics and Astronautics, China; Kou, Changhe, Beijing Univ. of Aeronautics and Astronautics, China; Li, Zhengneng, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 551-554; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Compressive tests after low velocity impact were carried out on Nomex honeycomb core sandwich specimens. Some methods were used to study the cause of damage development when the specimens were compressed to fail: X ray, deply, and visual inspection. Compressive failure mechanism was analyzed. The results showed that the residual compressive strength decreased while impact energy increased. The compressive failure of Nomex honeycomb core sandwich specimen was controlled by the front facesheet. The loads that caused the front facesheets to buckle was close to the load that made the planes fail. The glass cloth on surface not only could reduce impact damage, but also could show the damage within the plane on the surface so that it could been found easily. Key words honeycomb structure; injuries; compressive strength; low velocity impact
Author
Honeycomb Structures; Impact Damage; Sandwich Structures; Compression Tests; Compressive Strength; Damage Assessment; Failure Analysis

19990027251 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Effect of Material Nonlinearity on Progressive Damage of Laminated Composites
Xu, Chengdong, Beijing Univ. of Aeronautics and Astronautics, China; Yu, Hua, Beijing Univ. of Aeronautics and Astronautics, China; Li, Zhengneng, Beijing Univ. of Aeronautics and Astronautics, China; He, Qingzhi, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 546-548; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

A nonlinear finite element program in terms of the nonlinear shear stress-shear strain relation proposed by Hahn and Tsai is used to simulate the progressive damage of laminated composites with a circular hole subjected to remote tensile loading. Stress, strain and ultimate strength of laminates are analyzed by this program. Compared with the experimental data in earlier papers, the nonlinear approach is more accurate than the linear approach, especially for orthotropic laminates. The parametric study manifests that the variance of the nonlinearity coefficient has more serious effect on orthotropic plate than on quasi-isotropic plate.
Author
Orthotropic Plates; Laminates; Nonlinearity; Finite Element Method; Cumulative Damage; Stress-Strain Relationships

19990027461 NASA Lewis Research Center, Cleveland, OH USA
Pest Oxidation Regime in the Hi-Nicalon(Trademark)/BN/SiC Composite
Ogbuji, Linus U. J. T., NASA Lewis Research Center, USA; 1998; In English; CIMTEC-9: World Ceramic Congress 1998, 14-19 Jun. 1998, Florence, Italy; Sponsored by International Academy of Ceramics, Switzerland
Contract(s)/Grant(s): RTOP 523-21-13; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

SiC-SiC composites are prone to pest degradation at intermediate temperatures where the formation of a protective scale of silica by direct oxidation of SiC is too slow to offer effective protection from attack by ambient gases. The attack results in the removal of the BN interphase and its replacement by a borosilicate liquid (which dissolves and weakens the fiber) and finally by SiO2, (which embrittles the composite by bonding fiber to fiber or to matrix). This paper reports a study aimed at mapping out the temperature range of such pest degradation and the severity of its effect.
Author
Oxidation; Silicon Carbides; Borosilicate Glass; Dissolving; Degradation

19990027559 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
A Comparison of Normal and Accelerated Ageing of GRP Laminates Immersed in Seawater
Gellert, E. P., Defence Science and Technology Organisation, Australia; Turley, D. M., Defence Science and Technology Organisation, Australia; Apr. 1998; 32p; In English
Report No.(s): DSTO-TR-0668; DODA-AR-010-537; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001), Hardcopy, Microfiche

Glass fibre reinforced plastic (GRP) materials for marine applications undergo losses to mechanical properties during ageing. This study examined a polyester, a phenolic and two vinylester GRP materials. Specimens were immersed in seawater, unloaded or loaded at a high service temperature of 30 C, or at 50 C as an accelerated ageing condition. Water uptake was monitored. After ageing to near saturation the losses in flexural strength ranged from 15 to 25% for the unloaded specimens. Loading in flexure at 20% of the strain to fail while ageing did not significantly affect the water uptake or losses to mechanical properties. Greater losses in mechanical properties from the 50 C immersion were accompanied by indications of abnormal degradation. The accelerated ageing condition therefore appears unsuitable for the assessment of these materials.
Author
Glass Fiber Reinforced Plastics; Marine Technology; Submerging; Sea Water; Flexural Strength; Laminates; Abnormalities

19990027569 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Microscopic thermal diffusivity mapping using an infrared camera
Wang, H., Department of Energy, USA; Dinwiddie, R. B., Department of Energy, USA; Dec. 31, 1997; 10p; In English; 24th; Thermal Conductivity, USA
Report No.(s): DE98-004932; ORNL/CP-97540; CONF-9710119; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Standard flash thermal diffusivity measurements utilize a single-point infrared detector to measure the average temperature rise of the sample surface after a heat pulse. The averaging of infrared radiation over the sample surface could smear out the microscopic thermal diffusivity variations in some specimens, especially in fiber-reinforced composite materials. A high-speed, high-sensitivity infrared camera was employed in this study of composite materials. With a special microscope attachment, the spatial resolution of the camera can reach 5.4 (micro)m. The images can then be processed to generate microscopic thermal diffusivity maps of the material. SRM 1462 stainless steel was tested to evaluate the accuracy of the system. Thermal diffusivity micrographs of carbon-carbon composites and SCS-6/borosilicate glass were generated. Thermal diffusivity values of the carbon fiber bundles parallel to the heat flow were found to be higher than the matrix material. A thermal coupling effect between SCS-6 fiber and matrix was observed. The thermal coupling and measured thermal diffusivity value of the fiber were also dependent upon the thickness of the specimen.
NTIS
Thermal Diffusivity; Matrix Materials; Mapping; Infrared Detectors; Temperature Measurement; Carbon-Carbon Composites; Heat Transmission; Infrared Radiation

19990027614 Georgia Inst. of Tech., George W. Woodruff School of Mechanical Engineering, Atlanta, GA USA
Rapid Prototyping of Composite Structures ***Final Report, 14 Jul. 1997 - 30 Sep. 1998***
Colton, Jonathan S., Georgia Inst. of Tech., USA; Sep. 30, 1998; 11p; In English
Contract(s)/Grant(s): NAG1-1951
Report No.(s): GT-E25-A55; NLPN-97-620; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report for the project Rapid Production of Composite Structures covers the period from July 14, 1997 to September 30, 1998. It will present a short overview of the project, followed by the results to date and plans for the future. The goal of this research is to provide a minimum 100x reduction in the time required to produce arbitrary, laminated products without the need for a separate mold or an autoclave. It will accomplish this by developing the science underlying the rapid production of composite structures, specifically those of carbon fiber-epoxy materials. This scientific understanding will be reduced to practice in a demonstration device that will produce a part on the order of 12in. by 12in. by 6in. Work in the past year has focussed on developing an understanding of the materials issues and of the machine design issues. Our initial goal was to use UV cureable resins to accomplish full cure on the machine. Therefore, we have centered our materials work around whether or not UV cureable resins will work. Currently, the answer seems to be that they will not work, because UV light cannot penetrate the carbon fibers, and because no ”shadow” curing seems to occur. As a result, non-UV cureable resins are being investigated. This has resulted in a change in the machine design focus. We are now looking into a ”dip and place” machine design, whereby a prepreg layer would have one side coated with a curing agent, and then would be placed onto the previous layer. This would lead to cure at the interface, but not to the top of the layer. The formulation of the resins to accomplish this task at room or slightly elevated temperatures is being

investigated, as is the machine design needed to apply the curing agent and then cure or partially cure the part. A final, out-of-autoclave, post-cure may be needed with this strategy, as final cure on the machine may not be possible, as it was for the initial UV cure strategy. The remainder of this report details the progress in the materials and machine design areas.
Derived from text
Laminates; Composite Structures; Curing; Fiber Composites; Epoxy Matrix Composites; Carbon Fibers; Resins

19990027675 Tennessee Univ., Dept. of Materials Science and Engineering, Knoxville, TN USA
Continuous Fiber Reinforced Ceramic Composites
Liaw, Peter K., Tennessee Univ., USA; Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering; November 1998; Volume 21, No. 6, pp. 701-718; In English; See also 19990027670
Contract(s)/Grant(s): DE-AC05-84OR-21400; 11X-SL261V; 11X-SN191V; 11X-ST270V; 99732-PA64; 99732-PAT01; NSF EEC-95-27527; NSF DMI-97-24476; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The pertinent issues of woven fiber fabric reinforced ceramic composites, such as processing, interface engineering, mechanical behavior, and theoretical modeling, have been discussed. The continuous plain-weave Nicalon(R) fiber reinforced SiC composites have been successfully manufactured by a novel forced chemical vapor infiltration (FCVI) method. The FCVI technique can be modeled using a finite volume method to optimize the processing conditions, resulting in the savings of fabrication time and cost. Fiber fabric orientation and interface coating greatly influenced the mechanical behavior of the composites. Theoretical modeling is conducted to investigate the influence of fiber fabric orientation and coating thickness on the mechanical behavior of woven fabric reinforced composites. The predicted results were in good agreement with the experimental data.
Author
Ceramic Matrix Composites; Chemical Vapor Infiltration; Coating; Fabrication; Fiber Composites; Silicon Carbides; Woven Composites; Fabrics; Reinforcing Fibers

19990027825 Case Western Reserve Univ., Cleveland, OH USA
Modal Acoustic Emission of Damage Accumulation in Woven SiC/SiC at Elevated Temperatures
Morscher, G. N., Case Western Reserve Univ., USA; 1998; 9p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Ceramic matrix composites exhibit significant nonlinear stress-strain behavior that makes them attractive as potential materials for many high temperature applications. The mechanisms for this nonlinear stress-strain behavior are all associated with various types of damage in the composites, e.g. transverse matrix cracks and individual fiber failures. Modal acoustic emission has been employed to aid in discerning the damage accumulation that occurs during elevated temperature tensile stress-rupture of woven Hi-Nicalon fiber, BN interphase, SiC matrix composites. It is shown that modal acoustic emission is an effective monitor of the relative damage accumulation in the composites and locator of the damage and failure events as a function of strain (stress), time at temperature, and temperature gradients along the length of the elevated temperature test specimen.
Author
Acoustic Emission; Ceramic Matrix Composites; Cracks; Silicon Carbides; Tensile Stress; Ceramic Fibers; Tensile Tests

19990027854 Saphikon, Inc., Milford, NH USA
75 Micron YAG-Alumina Eutectic Fiber ***Final Report, 1 Oct. 1996 - 30 Sep. 1998***
Collins, Joseph M.; Jan. 14, 1999; 89p; In English
Contract(s)/Grant(s): F49620-96-C-0047; AF Proj. 3005
Report No.(s): AD-A360276; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Crystal growth experiments were conducted to test the application of the Edge-defined Film- fed Growth (EFG*) technique to the growth of 75 mm single crystal yttrium aluminum garnet - alumina eutectic fibers (YAE) as well as off-eutectic and additive-modified eutectic fibers. The additive modifiers were selected to weaken the interface between the YAG and alumina phases and toughen the material. In combination with the off eutectic composition, it was hoped that an in-situ composite would be formed. It was determined that PrAlO4 was the best modifier, of those examined, in regards to crack deflection at the alumina-YAG interface. The CeAl12O19 modified YAE also showed some crack deflection though not as much as the PrAlO4 system. It was also determined that the alumina rich side of the pseudo-binary eutectic produced superior tensile strengths over the YAG rich side but the YAG rich side may produce better creep properties.
DTIC
Ceramic Matrix Composites; Crystal Growth; Experimentation; Technology Assessment; Yttrium-Aluminum Garnet

19990027876 Materials Systems, Inc., Littleton, MA USA

Piezocomposites for Active Surface Control ***Final Report, Dec. 1994 - Jun. 1997***

Gentilman, Richard; Fiore, Daniel; Houston, Brian; Corsaro, Robert; Jan. 19, 1999; 673p; In English

Contract(s)/Grant(s): N00014-95-C-0005

Report No.(s): AD-A360515; MIS-111; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

This report summarizes the 30 month program to develop 1-3 piezocomposite SonoPanel transducers and SmartPanel transducers capable of pressure sensing, velocity sensing, and actuation. The program consisted of two technical tracks. Track 1 addressed the optimization, scale-up, and acoustic and environmental testing of SonoPanel transducers developed for underwater transmit and receive applications. Track 2 addressed the development of Smartpanels which combine net shape molded accelerometers and 1-3 pressure sensors co-located with a 1-3 actuator layer in a single device for active surface control applications. DTIC

Composite Materials; Piezoelectric Transducers; Product Development; Transducers; Surface Properties; Surfactants; Piezoelectric Crystals

19990027883 NASA Lewis Research Center, Cleveland, OH USA

Effects of Fiber/Matrix Interface and its Composition on Mechanical Properties of Hi Nicalon/Celsian Composites

Bansal, Narottam P., NASA Lewis Research Center, USA; Eldridge, Jeffrey I., NASA Lewis Research Center, USA; 1998; 2p; In English; 12th; Composite Materials, 5-9 Jul. 1999, Paris, France

Contract(s)/Grant(s): RTOP 523-21-13; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Fiber-reinforced ceramic matrix composites (CMC) are prospective candidate materials for high temperature structural applications in aerospace, energy conservation, power generation, nuclear, petrochemical, and other industries. At NASA Lewis, we are investigating celsian matrix composites reinforced with various types of silicon carbide fibers. The objective of the present study was to investigate the effects of fiber/matrix interface and its composition on the mechanical properties of silicon carbide (Hi-Nicalon) fiber-reinforced celsian matrix composites.

Derived from text

Fiber Composites; Fiber-Matrix Interfaces; Ceramic Matrix Composites; Mechanical Properties; Energy Conservation

19990027942 Johns Hopkins Univ., Dept. of Civil Engineering, Baltimore, MD USA

Mechanical Behavior of Granular/Particulate Media Reinforced with Fibers ***Final Report, 15 Feb. 1997 - 14 Nov. 1998***

Michalowski, Radoslw; Feb. 1999; 7p; In English

Contract(s)/Grant(s): F49620-97-1-0109; AF Proj. 2302

Report No.(s): AD-A360446; AFRL-SR-BL-TR-99-0054; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Fiber-reinforced granular composites (for instance, fiber-reinforced sand) are considered as construction materials for such applications as subgrades of airfields and roads, aircraft parking facilities, etc. An investigation into the mechanical behavior of granular/particulate media with fibrous inclusions was carried out. This investigation was built on the results of a previous study. Fiber-reinforced granular material was considered as a composite, and a mathematical homogenization scheme was used to arrive at its macroscopic properties. The issues related to micromechanics behavior, leading to anisotropy and hardening/softening at the macroscopic level of description, were at the core of this investigation. This research produced a material model which accurately describes the behavior of fiber-reinforced soils at failure. The research was terminated before its conclusion, because of the elimination of the Particulate Mechanics program at the AFOSR.

DTIC

Mechanical Properties; Granular Materials; Particulates; Reinforcing Materials; Fiber Composites; Media; Construction Materials

19990027950 NASA Langley Research Center, Hampton, VA USA

Lamb Wave Assessment of Fiber Volume Fraction in Composites

Seale, Michael D., College of William and Mary, USA; Smith, Barry T., Norfolk Academy, USA; Prosser, W. H., NASA Langley Research Center, USA; Zalameda, Joseph N., NASA Langley Research Center, USA; Journal of Acoustical Society of America; September 1998; ISSN 0001-4966; Volume 104, No. 3, Pt. 1, pp. 1399-1403; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Among the various techniques available, ultrasonic Lamb waves offer a convenient method of examining composite materials. Since the Lamb wave velocity depends on the elastic properties of a material, an effective tool exists to evaluate composites by measuring the velocity of these waves. Lamb waves can propagate over long distances and are sensitive to the desired in-plane elastic properties of the material. This paper discusses a study in which Lamb waves were used to examine fiber volume fraction

variations of approximately 0.40-0.70 in composites. The Lamb wave measurements were compared to fiber volume fractions obtained from acid digestion tests. Additionally, a model to predict the fiber volume fraction from Lamb wave velocity values was evaluated.
Author
Elastic Properties; Fiber Volume Fraction; Lamb Waves; Composite Materials; Ultrasonic Tests

19990027984 Department of Energy, Washington, DC USA
Free form fabrication of thermoplastic composites
Kaufman, S. G., Department of Energy, USA; Spletzer, B. L., Department of Energy, USA; Guess, T. R., Department of Energy, USA; Feb. 28, 1998; 37p; In English
Report No.(s): DE98-002891; SAND-98-0358; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report describes the results of composites fabrication research sponsored by the Laboratory Directed Research and Development (LDRD) program at Sandia National Laboratories. They have developed, prototyped, and demonstrated the feasibility of a novel robotic technique for rapid fabrication of composite structures. Its chief innovation is that, unlike all other available fabrication methods, it does not require a mold. Instead, the structure is built patch by patch, using a rapidly reconfigurable forming surface, and a robot to position the evolving part. Both of these components are programmable, so only the control software needs to be changed to produce a new shape. Hence it should be possible to automatically program the system to produce a shape directly from an electronic model of it. It is therefore likely that the method will enable faster and less expensive fabrication of composites.
NTIS
Composite Materials; Fabrication; Thermoplasticity; Research and Development

19990028010 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
Response and Failure of Composite Plates With a Bolt-Filled Hole ***Interim Report***
Yan, U. M.; Sun, H. T.; Wei, W. D.; Chang, F. K.; Jun. 1998; 79p; In English
Contract(s)/Grant(s): DEPT/95-G-012-0001
Report No.(s): AD-A359726; DOT/FAA/AR-97/85; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This progress report summarizes the activities that have been performed under the sponsorship of the Federal Aviation Administration (FAA) under contract no. DEPT/95-G-012-0001 from May 1, 1996 to June 1, 1997. This program is considered to be a part of a special joint project between the FAA and the Boeing Company on the design of composite bolted joints. The major effort of the joint project is to develop the most advanced computer code for the analysis and design of bolted composite joints for the Boeing Company and the FAA. The major focus of the FAA program is on net-tension failure of composites containing a circular cutout with or without a mechanically tightened bolt, while the Boeing program focuses on the bearing damage of bolted joints in both double and single lap joints. This report describes the activities under FAA funding. Both experimental and analytical work have been conducted.
DTIC
Failure; Composite Structures; Plates (Structural Members); Bolts

19990028173 Army Soldier and Biological Chemical Command, Natick, MA USA
Effect of Temperature on Water Vapor Transport Through Polymer Membrane Laminates ***Final Report, Feb. - Nov. 1998***
Gibson, Phillip; Feb. 1999; 50p; In English
Report No.(s): AD-A360426; NATICK/TR-99/015; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report determines the extent to which the water vapor transport properties of nine different polymer membranes and membrane/textile laminates are affected by temperature. A particular test method, the Dynamic Moisture Permeation Cell (DMPC), is ideally suited for this type of study, due to its complete control over the humidity and gas flow rate on the two sides of the test sample, and the ability to control the temperature of the test system. This allows temperature-dependent effects to be separated from concentration-dependent effects on mass transfer phenomena. The DMPC permits the experimenter to explore the temperature dependence of the diffusion behavior at different points on the vapor sorption isotherm of the hydrophilic polymer component of a polymer film or membrane laminate. Temperature effects are shown to be much less important than concentration-dependent effects in a hydrophilic polymer layer. Observed changes in water vapor flux at different temperatures are primarily due to the relationship between temperature and the saturation vapor pressure of water, and not to intrinsic changes in polymer permeability.
DTIC
Temperature Effects; Polymers; Water Vapor; Transport Properties; Permeability; Membranes; Laminates

19990028176 Department of Energy, Washington, DC USA

Electron beam curing of polymer matrix composites

Janke, C. J., Department of Energy, USA; Wheeler, D., Department of Energy, USA; Saunders, C., Department of Energy, USA; Jan. 08, 1998; 7p; In English

Report No.(s): DE98-054360; Y/AMT-606; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The purpose of the CRADA was to conduct research and development activities to better understand and utilize the electron beam PMC curing technology. This technology will be used to replace or supplement existing PMC thermal curing processes in Department of Energy (DOE) Defense Programs (DP) projects and American aircraft and aerospace industries. This effort involved Lockheed Martin Energy Systems, Inc./Lockheed Martin Energy Research Corp. (Contractor), Sandia National Laboratories, and ten industrial Participants including four major aircraft and aerospace companies, three advanced materials companies, and three electron beam processing organizations. The technical objective of the CRADA was to synthesize and/or modify high performance, electron beam curable materials that meet specific end-use application requirements. There were six tasks in this CRADA including: Electron beam materials development; Electron beam database development; Economic analysis; Low-cost Electron Beam tooling development; Electron beam curing systems integration; and Demonstration articles/prototype structures development. The contractor managed, participated and integrated all the tasks, and optimized the project efforts through the coordination, exchange, and dissemination of information to the project participants. Members of the Contractor team were also the principal inventors on several electron beam related patents and a 1997 R and D 100 Award winner on Electron-Beam-Curable Cationic Epoxy Resins. The CRADA achieved a major breakthrough for the composites industry by having successfully developed high- performance electron beam curable cationic epoxy resins for use in composites, adhesives, tooling compounds, potting compounds, syntactic foams, etc. UCB Chemicals, the world's largest supplier of radiation-curable polymers, has acquired a license to produce and sell these resins worldwide.

NTIS

Composite Materials; Electron Beams; Curing; Polymer Matrix Composites; Research and Development; Technology Assessment

19990028206 Department of Energy, Washington, DC USA

In situ reflectance and virtual interface analysis for compound semiconductor process control

Breiland, W. G., Department of Energy, USA; Hou, H. Q., Department of Energy, USA; Hammons, B. E., Department of Energy, USA; Klem, J. F., Department of Energy, USA; May 31, 1998; 11p; In English; 193rd, USA; Sponsored by Electrochemical Society, Inc., USA

Report No.(s): DE98-003343; SAND-98-0619C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors review the use of in situ normal incidence reflectance, combined with a virtual interface model, to monitor and control the growth of complex compound semiconductor devices. The technique is being used routinely on both commercial and research metal-organic chemical vapor deposition (MOCVD) reactors and in molecular beam epitaxy (MBE) to measure growth rates and high temperature optical constants of compound semiconductor alloys. The virtual interface approach allows one to extract the calibration information in an automated way without having to estimate the thickness or optical constants of the alloy, and without having to model underlying thin film layers. The method has been used in a variety of data analysis applications collectively referred to as ADVISOR (Analysis of Deposition using Virtual Interfaces and Spectroscopic Optical Reflectance). This very simple and robust monitor and ADVISOR method provides one with the equivalent of a real-time reflection high energy electron reflectance (RHEED) tool for both MBE and MOCVD applications.

NTIS

Semiconductors (Materials); Process Control (Industry); Spectral Reflectance

19990028226 North Atlantic Treaty Organization, Brussels, Belgium

Properties of boundaries and electron conductivity in mesoscopic polycrystalline silicon films for memory devices

Berman, G. P., North Atlantic Treaty Organization, Belgium; Doolen, G. D., North Atlantic Treaty Organization, Belgium; Mainieri, R., North Atlantic Treaty Organization, Belgium; Rehacek, J., North Atlantic Treaty Organization, Belgium; Campbell, D. K., North Atlantic Treaty Organization, Belgium; Feb. 28, 1998; 12p; In English; 2nd; Surfaces and interfaces of mesoscopic devices, USA

Report No.(s): DE98-003365; LA-UR-97-4750; CONF-971230; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present the results of MD modeling on the structural properties of grain boundaries (GB) in thin polycrystalline films. The transition from crystalline boundaries with low mismatch angle to amorphous boundaries is investigated. It is shown that the structures of the GBs satisfy a thermodynamical criterion suggested in a cited reference. The potential energy of silicon

atoms is closely related with a geometrical quantity -- tetragonality of their coordination with their nearest neighbors. A crossover of the length of localization is observed to analyze the crossover of the length of localization of the single electron states and properties of conductance of the thin polycrystalline film at low temperature. They use a two- dimensional Anderson localization model, with the random one site electron charging energy for a single grain (dot), random non-diagonal matrix elements, and random number of connections between the neighboring grains. The results on the crossover behavior of localization length of the single electron states and characteristic properties of conductance are presented in the region of parameters where the transition from an insulator to a conductor regimes takes place.
NTIS
Polycrystals; Thin Films; Silicon Films; Memory (Computers); Computer Storage Devices; Grain Boundaries

19990028251 NASA Lewis Research Center, Cleveland, OH USA
Prediction of Composite Laminate Fracture: Micromechanics and Progressive Fracture
Gotsis, P. K., NASA Lewis Research Center, USA; Chamis, C. C., NASA Lewis Research Center, USA; Minnetyan, L., Clarkson Univ., USA; Composites Science and Technology; Jan. 01, 1998; ISSN 0266-3538; Volume 58, pp. 1137-1149; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An investigation is described on the prediction of first-ply failure and fracture in selected composite laminates. The laminates are made from glass fibers and graphite fibers in epoxy matrices. Failure envelopes are generated for combined loading of these laminates on the basis of first-ply failure and laminate fracture. The evaluation is performed by a micromechanics-based theory and progressive fracture.
Author
Laminates; Graphite-Epoxy Composites; Glass Fibers; Epoxy Matrix Composites

19990028267 Department of Energy, Office of Energy Research, Washington, DC USA
Atomic structure of a polar ceramic/metal interface: (l-brace) 222(r-brace)MgO/Cu
Benedek, R., Department of Energy, USA; Shashkov, D. A., Department of Energy, USA; Seidman, D. N., Department of Energy, USA; Muller, D. A., Department of Energy, USA; Silcox, J., Department of Energy, USA; Feb. 28, 1998; 11p; In English, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE98-003391; ORNL/CP-97020; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

l-brace 222(r-brace)MgO/Cu is one of the most extensively characterized ceramic/metal interfaces, in view of the atom probe field ion microscopy, Z-contrast Scanning Transmission Electron Microscopy (STEM), and spatially resolved Electron energy loss spectroscopy (EELS) measurements performed by the present authors, as well as the high resolution electron microscopy (HREM) of this system by others. Atomistic simulations with local density functional theory (LDFT) and Molecular Dynamics (MD) have been performed to gain additional insight into the structure of this interface. This presentation describes an interface interatomic potential for (l-brace) 222(r-brace)MgO/Cu derived from LDFT total energy calculations, and its application to structural properties, including the terminating species, the absence of dislocation standoff, and the symmetry of the interfacial dislocation network.
NTIS
Atomic Structure; Ceramics; Magnesium Oxides; Copper; Interfaces

25
INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also 77 Thermodynamics and Statistical Physics.

19990026762 In-Space Propulsion Ltd., Sacramento, CA USA
Synthesis of Ethylene and Other Useful Products by Reduction of Carbon Dioxide
Rosenberg, Sanders D., In-Space Propulsion Ltd., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 15; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Advanced life-support systems are essential for the success of future human planetary exploration. Striving for self-sufficiency and autonomous operation, future life-support systems will integrate physical and chemical processes with biological processes, resulting in hybrid systems. A program is under way to demonstrate the synthesis of ethylene and other useful products, e.g., polyethylene and ethanol, from metabolic wastes, i .e., CO2 and water, as an adjunct to the life support systems required in

manned spacecraft, such as Space Station Freedom, and planetary bases, such as the Moon and Mars. These products will be synthesized using inorganic processes based on chemical engineering principles, making use of the major components of metabolic waste, C, H, and 0. The program focuses on two synthetic paths to produce ethylene in conversions greater than 95%: (1) direct catalytic reduction of CO2 with H and (2) catalytic reforming of methane. The benefits to be derived from the program are: (1) conversion of metabolic wastes to useful products for use on manned spacecraft and planetary bases; (2) weight savings that result from reduced onboard supply requirements; (3) manufacture of useful products based on efficient engineering principles, mass, volume and energy; and (4) reduced resupply from Earth.
Author
Carbon Dioxide; Chemical Engineering; Ethylene; Life Support Systems; Manned Spacecraft; Metabolic Wastes; Moon; Planetary Bases; Water; Catalytic Activity

19990026779 NASA Ames Research Center, Moffett Field, CA USA
Synthesis of Ethylene and Other Useful Products by Reduction of Carbon Dioxide
Rosenberg, Sanders D., In-Space Propulsion Ltd., USA; Makel, Darby B., Makel Engineering, Inc., USA; Finn, John E., NASA Ames Research Center, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 49; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The synthesis of ethylene and other useful products by reduction of carbon dioxide is discussed. The synthesis of ethylene from carbon dioxide has been undertaken. A few different chemical reactions are presented for the production of ethylene. This ethylene can then form the basis for the manufacture of a variety of useful products. It can be used in the preparation of a variety of plastics that can be used for the fabrication of structural materials, and can be used in creating life support systems, which can lead to the development of closed life support systems based on the use of inorganic processes and chemical engineering principles.
CASI
Carbon Dioxide; Ethylene; Fabrication; Catalytic Activity

19990026835 Colorado State Univ., Dept. of Chemistry, Fort Collins, CO USA
Molecular Filtration in Nanotubule Membranes: Sorting Molecules on the Basis of Size and Chemistry
Jirage, Kshama B.; Martin, Charles R.; Dec. 30, 1998; 9p; In English
Contract(s)/Grant(s): N00014-91-J-1201
Report No.(s): AD-A360126; TR-21; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Membrane based chemical separations is an emerging field of research. This is because membrane-based separations are potentially less energy intensive and more cost effective than competing separation methods. Polymeric membranes that contain a collection of monodisperse gold nanotubules with molecular dimensions were used to filter molecules based on their difference in size. Also, we will discuss how these tubules can be modified with thiols to separate molecules based on differences in their chemical properties.
DTIC
Molecules; Membranes; Filtration

19990026836 Colorado State Univ., Dept. of Chemistry, Fort Collins, CO USA
New Developments in Membrane-Based Chemical Separations ***Interim Report***
Jirage, Kshama B.; Martin, Charles R.; Dec. 30, 1998; 15p; In English
Contract(s)/Grant(s): N00014-91J-0201
Report No.(s): AD-A360127; TR-25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Membrane based chemical separations is an emerging field of research. This is because membrane-based separations are potentially less energy intensive and more cost effective than competing separation methods. Polymeric membranes that contain a collection of monodisperse gold nanotubules with molecular dimensions were used to filter molecules based on their difference in size. Also, we will discuss how these tubules can be modified with thiols to separate molecules based on differences in their chemical properties.
DTIC
Membranes; Filtration; Molecules

19990026838 Colorado State Univ., Dept. of Chemistry, Fort Collins, CO USA

Preparation and Stability of Template-Synthesized Metal Nanorod Sols in Organic Solvents ***Interim Report***

Cepak, VeVeronica M.; Martin, Charles R.; Dec. 01, 1998; 30p; In English

Contract(s)/Grant(s): N00014-91-J-1201

Report No.(s): AD-A360130; TR-23; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Gold and silver nanorods of diameter 40 and 90 nm, and having a variety of aspect ratios (length/diameter), were prepared using the template synthesis approach. The stability of these nanorod sol was monitored using visible absorption spectroscopy. For both the Au and Ag nanorods (in both solvents), sols prepared from the 90 nm-diameter nanorods were found to be less stable than sols prepared from the 40 nm-diameter nanorods. The addition of the polymeric stabilizers poly(vinylpyridine) or poly(vinylpyrrolidone) did not enhance the stability of these nanorod sols.

DTIC

Composite Materials; Synthesis (Chemistry); Rods; Gold; Silver; Solvents; Organic Compounds

19990026841 Gordon Research Conferences, Inc., Kingston, RI USA

1998 Gordon Research Conference on Electrodeposition Held in Colby-Sawyer College, New London, New Hampshire on August 9-14, 1998 ***Final Report, 1 Apr. 1998 - 30 Sep. 1999***

Stafford, Gery R.; Aug. 1998; 18p; In English

Contract(s)/Grant(s): F49620-98-1-0153; AF Proj. 2303

Report No.(s): AD-A360158; AFRL-SR-BL-TR-99-0047; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Conference was well-attended with 108 participants (attendees list attached). The attendees represented the spectrum of endeavor in this field coming from academia, industry, and government laboratories, both U.S. and foreign scientists, senior researchers, young investigators, and students.

DTIC

Conferences; Electrodeposition; Thin Films; Crystallization

19990026856 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Comparison of methods for separating small quantities of hydrogen isotopes from an inert gas

Willms, R. S., Department of Energy, USA; Tuggle, D., Department of Energy, USA; Birdsell, S., Department of Energy, USA; Parkinson, J., Department of Energy, USA; Price, B., Department of Energy, USA; Mar. 31, 1998; 8p; In English; 17th; Fusion Engineering, USA

Report No.(s): DE98-004357; LA-UR-97-4997; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

It is frequent within tritium processing systems that a small amount of hydrogen isotopes (Q(sub 2)) must be separated from an inert gas such as He, Ar and N2. Thus, a study of presently available technologies for effecting such a separation was performed. A base case and seven technology alternatives were identified and a simple design of each was prepared. These technologies included oxidation-adsorption-metal bed reduction, oxidation-adsorption- palladium membrane reactor, cryogenic adsorption, cryogenic trapping, cryogenic distillation, hollow fiber membranes, gettering and permeators. It was found that all but the last two methods were unattractive for recovering Q(sub 2) from N2. Reasons for technology rejection included (1) the method unnecessarily turns the hydrogen isotopes into water, resulting in a cumbersome and more hazardous operation, (2) the method would not work without further processing, and (3) while the method would work, it would only do so in an impractical way. On the other hand, getters and permeators were found to be attractive methods for this application. Both of these methods would perform the separation in a straightforward, essentially zero-waste, single step operation. The only drawback for permeators was that limited low-partial Q(sub 2) pressure data is available. The drawbacks for getters are their susceptibility to irreversible and exothermic reaction with common species such as oxygen and water, and the lack of long-term operation of such beds. More research is envisioned for both of these methods to mature these attractive technologies.

NTIS

Thermonuclear Reactions; Tritium; Membranes; Rare Gases; Recovery

19990026870 Department of Energy, Office of Energy Research, Washington, DC USA

Measurements of the Distribution of Solutes between Liquid Water and Steam

Palmer, D. A., Department of Energy, USA; Simonson, J. M., Department of Energy, USA; Ho, P. C., Department of Energy, USA; Aug. 31, 1997; 8p; In English; 16th; 38th; Meeting sponsored by International Association for the Advancement of High Pressure Science and Technology (AIRAPT) and HPCJ

Report No.(s): DE98-000129; CONF-9708104-1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Direct measurements of the concentration of solutes in both liquid and steam phases in equilibrium with each other have been made in a static mode utilizing a platinum-lined autoclave to a maximum of 350 C. Partitioning constants were derived from these measurements based on existing experimental or estimated values of the stoichiometric mean activity coefficients for the solutes in the liquid phase. Independent measurements of the conductance of some of the solutes in dilute aqueous solutions to 600 C and 300 MPa were also made. The combined results are discussed in terms of a speciated model and the implications of these results to industrial and natural hydrothermal processes are presented.
NTIS
Solutes; Water; Liquid Phases; Steam

19990026879 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Gas Chromatographic Analysis of Sulfur Mustard in Diethyl Phthalate
Lancaster, P. A., Defence Science and Technology Organisation, Australia; Aug. 1998; 29p; In English
Report No.(s): DSTO-TR-0703; DODA-AR-010-603; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001), Hardcopy, Microfiche

A gas chromatographic method for the analysis of 2,2'-dichlorodiethyl sulfide (commonly known as Sulfur Mustard or HD) that had been trapped in the solvent, diethyl phthalate (DEP) is described. The method utilizes the improved sensitivity and selectivity offered by the new Pulsed Flame Photometric Detector to detect routinely samples containing 0.25 micro g/mL of sulfur mustard in DEP. The method is capable of fast and reliable analysis of samples containing 0.25-5.0 micro g/mL of sulfur mustard in DEP. Quality control measures determined that the method calibration was still within 5% control limits after nearly 500 sample injections.
Author
Gas Chromatography; Chemical Analysis; Sulfur; Gas Analysis

19990027081 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Characterization of Cholera Toxin by Liquid Chromatography: Electrospray Mass Spectrometry ***Final Report***
vanBaar, B. L. M., Prins Maurits Lab. TNO, Netherlands; Hulst, A. G., Prins Maurits Lab. TNO, Netherlands; Wils, E. R. J., Prins Maurits Lab. TNO, Netherlands; July 1997; 34p; In English
Contract(s)/Grant(s): A93/KL/424; TNO Proj. 214498010
Report No.(s): TD98-0047; PML-1998-A7; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Cholera toxin (CT), generated by various strains of the bacterium Vibrio cholerae, is a substance possibly used in biological warfare. In the context of the working programme of NATO, AC225 Land Group 7, Sub Group 'Sampling and Identification of Biological and Chemical Agents' (SIBCA), the possibilities of characterizing CT by liquid chromatography electrospray mass spectrometry (LC-ES-MS) were investigated. The toxin can be detected by flow-injection (FIA) ES-MS of a dialysed solution and observation of the charge envelope signals of its A-unit and B-chain protein; sufficient information for identification by the molecular mass of either protein could be obtained for quantities in the order of 10 fmol. Confirmatory analysis was carried out by 2-mercaptoethanol reduction and FIA-ES-MS detection of the product proteins or by tryptic digest LC-ES-MS with ion chromatogram detection of most of the tryptic fragments of the A-unit and B-chain by their singly or multiply charged ion signals. The confirmatory tryptic digest LC-ES-MS analysis could be achieved with quantities as low as 1 pmol. Possible biovariations in the toxin can mostly be determined by sequencing, where the composition of tryptic fragments of the A1 -chain, T5 and T15, and of the B-chain, T1, T4 and T5, cover all known biovariations. Partial sequencing of CT (strain 01/569B) was achieved by LC-ES-MS with tandem mass spectrometric detection of most tryptic fragments larger than three amino acid residues.
Author
Cholera; Toxins and Antitoxins; Liquid Chromatography; Fragments; Bacteria

19990027149 Virginia Commonwealth Univ., School of Engineering, Richmond, VA USA
Fifth St. Louis Workshop on Wide Bandgap Nitrides ***Final Report, 15 May - 30 Nov. 1998***
Morkoc, Hadis; Nov. 1998; 13p; In English; 5th, 4-7 Aug. 1998, Saint Louis, MO, USA
Contract(s)/Grant(s): N00014-98-1-0613
Report No.(s): AD-A359513; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The fifth St. Luois Workshop in Wide Bandgap Nitrides was held August 4-7, 1998 in St. Louis, MO. The workshop was attended by some 80 researchers from mainly the USA and very topical and bottleneck type problems/issues were discussed. The workshop is unique in its approach in that short presentations on pertinent issues are followed by lengthy discussion. Following a group of somewhat related presentations, an overall discussion period involving the authors of that session and the audience is conducted. The forum provides a plenty of time for discussions of important and unresolved issues as opposed presenting polished

and finished results typically presented in standard/conventional meeting. The participants over the years have been and are still supportive of the role the workshop plays for the community. It should be mentioned that this workshop carries the distinction of being the first ever meeting in the field in the world.
DTIC
Conferences; Nitrides; Semiconductors (Materials); Electronic Equipment

19990027159 European Materials Research Society, Strasbourg France
European Materials Research Society Spring: Book of Abstracts ***Final Report***
Jun. 19, 1998; 335p; In English, 16-19 Jun. 1998, Strasbourg, France
Report No.(s): AD-A359475; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche; Abstracts Only; Abstracts Only

This document contains abstracts of the various symposiums held as part of the European Materials Research Society Spring Meeting held on 16-19 June 98 in Strasbourg, France. Some of the topics discussed were Light Emission from Silicon; Defects in Silicon: Hydrogen; Thin Films Epitaxial Growth and Nonstructures; Surface Processing; Microsystem Technologies; Rapid Thermal Processing; Ion Implantation into Semiconductors, Oxides and Ceramics; Carbon Based Materials; Nitrides and Related Wide Band Gap Materials; Molecular Photonics for Optical Telecommunications; and Material and Processes for Submicron Technologies.
DTIC
Semiconductors (Materials); Thin Films; Ion Implantation; Ceramics; Epitaxy

19990027199 Department of Energy, Office of Energy Research, Washington, DC USA
Possible mechanism of formation and stability of anomalous states of water
Wong, C. Y., Department of Energy, USA; Lo, S. Y., Department of Energy, USA; Jan. 31, 1998; 18p; In English; 1st; Current status of the physical, chemical and biological properties of stable water clusters, USA
Report No.(s): DE98-004064; ORNL/CP-96496; CONF-971226; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors examine the physical processes which are involved in the formation and stability of the anomalous states of water reported recently. The initial step of adding a small amount of ionic compound X(sup +)Y(sup -)) to pure water leads t the formation of water clusters X(sup +) (H2O)(sub n) and Y(sup -) (H2O)(sub n) with n (much-gt) 1. The structure of the cluster around the ion depends sensitively on the equation of state. The authors explore the consequences of possible polymorphic states of H2O in the liquid phase at room temperature. If there are low-lying polymorphic states, the local dipole moment and the local density will change discontinuously as a function of the radial distance from the ion, and regions of different polymorphic states will be found at different separations from the ion. Fragmentation of the cluster by vigorous shaking may break up the cluster into small domains to allow subsequent coalescence of these domains or the growth of the domains as seeds to form greater domains of polymorphic states. Further experimental and theoretical analyses are needed to study these pictures.
NTIS
Water; Stability; Liquid Phases

19990027441 NASA Lewis Research Center, Cleveland, OH USA
Durability of Mullite/YSZ-Coated SiC in 90% H2O/O2
Lee, Kang N., Cleveland State Univ., USA; Miller, Robert A., NASA Lewis Research Center, USA; 1998; In English; 34th; Joint Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 519-20-53; Copyright; Avail: Issuing Activity (NASA Lewis Research Center, Cleveland, OH 44135), Hardcopy, Microfiche

Plasma-sprayed mullite (3Al2O3 2SiO2) and mullite/yttria-stabilized- zirconia (YSZ) dual layer coatings have been developed to protect silicon-based ceramics from environmental attack. Mullite-based coating systems show excellent long-term durability under thermal cycling in air. These systems, however, suffer from water-vapor enhanced oxidation of SiC in high water vapor environment. Water vapor transports through the cracks in the mullite-based coatings and attacks the SiC along the interface. In an effort to improve the durability of mullite-based coating systems in water vapor, the mullite/SiC interface was modified by applying a thin layer (1-5 microns) of Mo which was subsequently annealed in inert atmosphere to form molybdenum silicide. Some areas of the mullite/SiC interface, where the molybdenum silicide was intact after water vapor exposure, showed significantly improved durability, suggesting the potential of interface modification for improving the water vapor resistance of mullite-based coating systems.
Author
Mullites; Yttria-Stabilized Zirconia; Coatings; Silicides; Ceramics; Water; Molybdenum; Zirconium Oxides

19990027469 NASA Lewis Research Center, Cleveland, OH USA

The Oxidation of AlN in Dry and Wet Oxygen

Opila, Elizabeth, Cleveland State Univ., USA; Humphrey, Donald, NYMA, Inc., USA; Jacobson, Nathan, NASA Lewis Research Center, USA; Yoshio, Tetsuo, Okayama Univ., Japan; Oda, Kohei, Yonago National Coll. of Technology, Japan; 1998; 10p; In English; 193rd, 3-8 May 1998, San Diego, CA, USA; Sponsored by Electrochemical Society, Inc., USA

Contract(s)/Grant(s): RTOP 523-21-13; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The oxidation kinetics of AlN containing 3.5 wt% Y2O3 were studied by thermogravimetric analysis in dry oxygen and 10% H2O/balance oxygen at temperatures between 1000 and 1200 C for times between 48 and 100 h. The oxidation kinetics for AlN in dry oxygen were parabolic and of approximately the same magnitude and temperature dependence as other alumina forming materials. In this case, diffusion of oxygen and/or aluminum through the alumina scale is the rate limiting mechanism. The oxidation kinetics for AlN in wet oxygen were nearly linear and much more rapid than rates observed in dry oxygen. Numerous micropores were observed in the alumina formed on AIN in wet oxygen. These pores provide a fast path for oxygen transport. The linear kinetics observed in this case suggest that the interface reaction rate of AlN with wet oxygen is the oxidation rate limiting step. Author

Aluminum Oxides; Oxidation; Temperature Dependence; Diffusion; Microporosity; Oxygen

19990027627 Department of Energy, Washington, DC USA

OMVPE growth and gas-phase reactions of AlGaN for UV emitters

Han, J., Department of Energy, USA; Figiel, J. J., Department of Energy, USA; Crawford, M. H., Department of Energy, USA; Banas, M. A., Department of Energy, USA; Bartram, M. E., Department of Energy, USA; Jun. 30, 1998; 21p; In English; 9th; Metal Organic Vapor Phase Exitaxy, USA

Report No.(s): DE98-005535; SAND-98-0304C; CONF-980658; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Gas-phase parasitic reactions among TMG, TMA, and NH3, are investigated by monitoring of the growth rate/incorporation efficiency of GaN and AlN using an in-situ optical reflectometer. It is suggested that gas phase adduct (TMA: NH3) reactions not only reduce the incorporation efficiency of TMA but also affect the incorporation behavior of TMGa. The observed phenomena can be explained by either a synergistic gas-phase scavenging effect or a surface site- blocking effect. Relatively low reactor pressures (30--50 Torr) are employed to grow an AlGaN/GaN QW p-n diode structure. The UV emission at 354 nm (FWHM (approximately) 6 nm) represents the first report of LED operation from an indium-free GaN QW diode.

NTIS

Gallium Nitrides; Research; Ammonia; Vapor Phases

19990027645 Department of Energy, Office of Energy Research, Washington, DC USA

He-3 neutral current detectors at SNO

Elliott, S. R., Department of Energy, USA; Browne, M. C., Department of Energy, USA; Doe, P. J., Department of Energy, USA; Dec. 31, 1998; 6p; In English; New era in neutrino physics, USA

Report No.(s): DE98-006292; DOE/ER/41020-42; CONF-980689; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The flux of solar neutrinos measured via charged and neutral current interactions can provide a model independent test of neutrino oscillations. Since the Sudbury Neutrino Observatory uses heavy water as a target, it has a large sensitivity to both interactions. A technique for observing the neutral current breakup of the deuteron using He-3 proportional counters is described.

NTIS

Helium Isotopes; Neutral Currents; Detection; Solar Neutrinos

19990027671 Exxon Research and Engineering Co., Annandale, NJ USA

Studies of Local Bonding and Chemistry at Internal Interfaces using Electron Energy Loss Spectroscopy

Subramanian, Shanthi, Exxon Research and Engineering Co., USA; Sass, Stephen L., Cornell Univ., USA; Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering; November 1998; Volume 21, No. 6, pp. 633-643; In English; See also 19990027670; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Changes in the structure, chemistry, and bonding at internal interfaces often have a great influence on the properties of materials. High resolution imaging and Energy Dispersive X-ray Spectroscopy in the Transmission Electron Microscope have been used extensively to study the structure and composition at interfaces. Spatially resolved Electron Energy Loss Spectroscopy (EELS) in the Scanning Transmission Electron Microscope (STEM) offers a new probe to explore the effect of structure and chemistry changes on the local bonding at interfaces. This paper reviews the relationship between EELS and electronic structure and illus-

trates the insights obtained from this technique with the help of examples which include: (a) The effect of B segregation on grain boundaries in Ni3Al and Ni3Si. (b) The effect of Bi segregation on grain boundaries in Cu. (c) Bonding changes at two metal-ceramic interfaces: Nb-Al2O3 and Cu-Al2O3.
Author
Interfaces; Microstructure; Bonding; Atomic Structure; Spectroscopic Analysis; Intermetallics

19990027730 Dayton Univ., Dept. of Physics, OH USA
Measurement of Heterogeneous Deactivation of Vibrationally Excited Homonuclear Molecules at Solid Surfaces ***Final Report, 30 Jun. 1994 - 29 Jun. 1998***
Parish, John W.; Yaney, Perry P.; Jan. 29, 1999; 59p; In English
Contract(s)/Grant(s): F49620-94-1-0370
Report No.(s): AD-A360052; AFRL-SR-BL-TR-99-0043; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Deactivation coefficients, gamma(v), of vibrationally-excited N2X(1)sigmag(+),v on alloys of aluminum, stainless steel alloys, a titanium alloy, gold, Pyrex glass and Teflon were determined from measurements of the wall relaxation rate coefficients for the v = 1 to 4 or 5 hot bands using CARS. A water-cooled positive column discharge was used to populate the vibrational states. The nitrogen gas flow rate was adjusted to optimize the observed decay of the populations. The excited gas was exposed to the tubular specimen surface for precisely controlled residence times. The BOXCARS configuration was used to measure only the gas that was exposed to the specimen surface. Extensive measurements on Pyrex gave gamma(1) values between 2.4 x 10(exp -4) and 6.7 x 10(exp -4) depending on the treatment history of the surface. The values for gamma(4) ranged from 2.9 x 10(exp -4) for the AMS 4943D alloy of titanium to approximately unity for the AMS 312 stainless steel alloy. The low value for titanium can be attributed to the oxide layer. The variation of k(v) with v was linear or nearly linear in all cases with slopes lower in most cases than the rate of increase of the vibrational-translational exchange rate with v.
DTIC
Nitrogen; Vibrational States; Relaxation (Mechanics); Gas Flow; Plasmas (Physics); Molecules; Solid Surfaces; Walls

19990027777 National Inst. of Standards and Technology, Optoelectronics Div., Gaithersburg, MD USA
Hydrogen Cyanide H13C14N Absorption Reference for 1530 nm to 1560 nm Wavelength Calibration-SRM-2519. Standard Reference Materials
Gilbert, S. L., National Inst. of Standards and Technology, USA; Swann, W. C., National Inst. of Standards and Technology, USA; Wang, C. M., National Inst. of Standards and Technology, USA; Nov. 1998; 36p; In English
Report No.(s): PB99--111544; NIST/SP-260/137; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Standard Reference Material (SRM) 2519 is an optical-fiber-coupled absorption cell containing hydrogen cyanide (H13C14N) gas. It is intended for use in calibrating the wavelength scale of wavelength measuring instruments in the 1500 nm region. About 50 accurately measured absorption lines of the R and P branch of the 2(nu(sub 3)) rotational-vibrational band of H13C14N are located in the 1530-1560 nm region. The authors have measured the line centers and pressure-induced shifts of 21 lines and certify their wavelengths with an expanded uncertainty (coverage factor k=2) of +/- 0.0006 nm. The remainder of the lines in the band are certified with an expanded uncertainty of +/- 0.003 nm. This publication describes the SRM, the NIST measurement procedure, and the uncertainty determination for SRM certification.
NTIS
Absorption Spectra; Wavelength Division Multiplexing; Calibrating; Hydrocyanic Acid

19990027779 Department of Energy, Washington, DC USA
Chemical kinetics models for semiconductor processing
Coltrin, M. E., Department of Energy, USA; Creighton, J. R., Department of Energy, USA; Meeks, E., Department of Energy, USA; Grcar, J. F., Department of Energy, USA; Houf, W. G., Department of Energy, USA; Dec. 31, 1997; 12p; In English, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE98-002574; SAND-97-1828C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Chemical reactions in the gas-phase and on surfaces are important in the deposition and etching of materials for microelectronic applications. A general software framework for describing homogeneous and heterogeneous reaction kinetics utilizing the Chemkin suite of codes is presented. Experimental, theoretical and modeling approaches to developing chemical reaction mechanisms are discussed. A number of TCAD application modules for simulating the chemically reacting flow in deposition and etching reactors have been developed and are also described.
NTIS
Chemical Reactions; Reaction Kinetics; Semiconductors (Materials)

19990027781 Department of Energy, Washington, DC USA
Validation of the BEPLATE code
Giles, G. E., Department of Energy, USA; Bullock, J. S., Department of Energy, USA; Nov. 30, 1997; 10p; In English; American electroplating and surface finishers electroforming, USA
Report No.(s): DE98-001914; ORNL/CP-95628; CONF-9710148; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The electroforming simulation code BEPLATE (Boundary Element-PLATE) has been developed and validated for specific applications at Oak Ridge. New areas of application are opening up and more validations are being performed. This paper reports the validation experience of the BEPLATE code on two types of electroforms and describes some recent applications of the code. NTIS

Boundaries; Electrochemistry; Electroplating; Computerized Simulation

19990027837 Pennsylvania Univ., Dept. of Chemistry, Philadelphia, PA USA
Structural Aspects of Protein-Metal Recognition and Discrimination ***Final Report, 1 Jul. 1995 - 30 Jun. 1998***
Christianson, David W.; Jun. 30, 1998; 5p; In English
Contract(s)/Grant(s): N00014-95-1-0957
Report No.(s): AD-A360597; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project utilized the zinc enzyme human carbonic anhydrase II (CAII) as a paradigm for dissecting and understanding the structural basis of protein-transition metal recognition and discrimination. We have successfully redesigned the zinc binding site of CAII so that protein-metal affinity can be modulated by design, by factors of 10 from micromolar to femtomolar affinity. We have explored the binding of zinc and copper to engineered CAIIs using high resolution X-ray crystallographic methods, and we have developed a zinc-sensing scheme using fluorescence anisotropy and a designed sulfonamide inhibitor.
DTIC

X Rays; Anisotropy; Crystallography; Carbonic Anhydrase; Proteins; Zinc; Detection

19990027860 Stanford Univ., Dept. of Chemistry, Stanford, CA USA
Theory and Experiments on Chemical Instabilities ***Final Report, 15 Mar. 1997 - 31 Dec. 1998***
Ross, John; Feb. 10, 1999; 12p; In English
Contract(s)/Grant(s): F49620-97-1-0237; AF Proj. 2303
Report No.(s): AD-A360437; AFRL-SR-BL-TR-99-0051; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research accomplished and published on deterministic and stochastic behavior of systems far from equilibrium is summarized. Topics treated include: Long term variations of chemical systems with time-dependent rate coefficients; transit time distributions for such systems; stochastic potential for oscillatory systems; Anderson localization for reaction-convection systems; dynamics and dissipation in externally forced systems; rate processes with dynamic disorder; and linear free energy relations for systems with static and dynamic disorder.
DTIC

Chemical Properties; Chemical Equilibrium; Numerical Analysis; Experimentation; Research; Stability

19990027861 Auburn Univ., AL USA
Photoreductions in Aqueous Semiconductor Suspensions and Properties of Modified Polyacrylonitrile Films
Calhoun, Robert L., Jr.; Dec. 14, 1998; 78p; In English
Report No.(s): AD-A359760; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Particles of the semiconductor titanium dioxide have been shown to heterogeneously catalyze the destruction of chlorofluorocarbons (CFCs) in both air saturated and degassed aqueous suspensions. The photoreduction of CFC-11 or R-11 (CCl3F) in this manner was studied over a range of initial R-11 concentrations, and Ultraviolet (UV) light intensities. Kinetic determinations of the reduction progress were performed via ion-selective electrodes. The reduction takes place via radical chain mechanism which is eventually slowed by product poisoning of the catalyst. Polyacrylonitrile (PAN) materials treated with methoxide ions exhibit properties typical of polymeric semiconductors. PAN-based semiconducting materials were made from textile fibers. The photochemical activity of the modified fibers was tested by attempting the photoreduction of CH3Cl in aqueous degassed suspensions of ground fibers and sodium perchlorate. The photo-experiment was conducted similar to the experiments involving R-11 and TiO2. Unfortunately, a byproduct of the process that forms the semiconducting fibers, OH(-), proved inseparable from the fibers and is a confirmed interference ion to determination of reaction products. Therefore, only qualitative evidence on the phototransformation of CH3Cl and R-11 initiated by the PAN fibers was obtained in this study. If preparation of PAN-based semiconductors is feasible, then thin films of converted PAN could lend themselves for the development of novel small scale electronic devices.

In pursuit of this goal, the electrical properties of solvent cast films of solution converted PAN were studied. Preliminary results show the conductivity is in the range of high resistance semiconductors, but further improvements seemed possible by manipulations of the synthetic parameters.
DTIC
Aqueous Solutions; Semiconductors (Materials); Polyacrylonitrile; Thin Films; Photochemical Reactions

19990027863 Environmental Protection Agency, Sustainable Technology Div., Cincinnati, OH USA
Substitution Reactions for the Detoxification of Hazardous Chemicals ***Topical Report***
Kawahara, Fred K., Environmental Protection Agency, USA; Sep. 1998; 44p; In English
Report No.(s): PB98--177876; EPA/600/R-98/124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This publication reports on the literature findings for the chemistry of superoxide ion radical; it relates the methods of preparation, and its detection and reactions with chloroaromatics. The literature findings on the destruction of PCBs, etc., with polyethylene glycol are examined; and the role of polyethylene glycol as a phase transfer agent in a basic medium and as a nucleophilic agent is discussed. In addition, a reaction mechanism for the BCD process of the EPA is given. Effects of various reaction parameters are noted. Finally, assessments of various processes are given.
NTIS
Hazardous Materials; Chemical Compounds; Chloroaromatics; Substitutes

19990027951 NASA Lewis Research Center, Cleveland, OH USA
Surface Area, and Oxidation Effects on Nitridation Kinetics of Silicon Powder Compacts
Bhatt, R. T., NASA Lewis Research Center, USA; Palczer, A. R., NASA Lewis Research Center, USA; 1998; 12p; In English, 3-6 May 1998, Cincinnati, OH, USA; Sponsored by American Chemical Society, USA
Contract(s)/Grant(s): RTOP 505-63-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Commercially available silicon powders were wet-attrition-milled from 2 to 48 hr to achieve surface areas (SA's) ranging from 1.3 to 70 sq m/g. The surface area effects on the nitridation kinetics of silicon powder compacts were determined at 1250 or 1350 C for 4 hr. In addition, the influence of nitridation environment, and preoxidation on nitridation kinetics of a silicon powder of high surface area (approximately equals 63 sq m/g) was investigated. As the surface area increased, so did the percentage nitridation after 4 hr in N2 at 1250 or 1350 C. Silicon powders of high surface area (greater than 40 sq m/g) can be nitrided to greater than 70% at 1250 C in 4 hr. The nitridation kinetics of the high-surface-area powder compacts were significantly delayed by preoxidation treatment. Conversely, the nitridation environment had no significant influence on the nitridation kinetics of the same powder. Impurities present in the starting powder, and those accumulated during attrition milling, appeared to react with the silica layer on the surface of silicon particles to form a molten silicate layer, which provided a path for rapid diffusion of nitrogen and enhanced the nitridation kinetics of high surface area silicon powder.
Author
Silicon Dioxide; Powder (Particles); Reaction Kinetics; Diffusion; Accumulations; Nitriding

19990028021 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Modeling Primary Atomization Processes ***Final Report, 1 Jul. 1996 - 30 Nov. 1999***
Heister, Stephen D.; Feb. 01, 1999; 127p; In English
Contract(s)/Grant(s): F49620-91-1-0239
Report No.(s): AD-A360433; AFRL-SR-BL-TR-99-0050; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The contributions of atomization processes to combustion instabilities in liquid rocket engines has been assessed via a series of analytic/numerical models. Simulations of high-speed injection of a viscous jet have revealed a jet "swelling" phenomenon for the first time. Modeling of F-1 fuel injectors reveals a potential instability of the fuel columns to transverse acoustic modes in injector designs which showed large instabilities. Limited experimental work relevant to hybrid rocket injection has also been accomplished under the subject program. A new consumable, catalytic igniter has shown to provide reliable, reproducible ignition in hydrogen peroxide/polyethylene hybrid engines. Currently, a complete dense spray simulation tool is under development to assess spray dynamics under time-varying chamber conditions.
DTIC
Mathematical Models; Atomizing

19990028172 Stanford Univ., Dept. of Chemistry, Stanford, CA USA

Theory and Experiments on Chemical Instabilities ***Final Report, 15 Mar. 1997 - 31 Dec. 1998***

Ross, John; Feb. 10, 1999; 12p; In English

Contract(s)/Grant(s): F49620-97-1-0237

Report No.(s): AD-A360427; SPO-18382; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research accomplished and published on deterministic and stochastic behavior of systems far from equilibrium is summarized. Topics treated include: Long term variations of chemical systems with time-dependent rate coefficients; transit time distributions for such systems; stochastic potential for oscillatory systems; Anderson localization for reaction-convection systems; dynamics and dissipation in externally forced systems; rate processes with dynamic disorder; and linear free energy relations for systems with static and dynamic disorder.

DTIC

Reaction Kinetics; Irreversible Processes; Stochastic Processes

19990028241 Notre Dame Univ., Dept. of Chemistry and Biochemistry, IN USA

Investigation of Hyperthermal Energy Ion/Surface Reactions ***Final Report, 1 Jun. 1995 - 31 Oct. 1998***

Jacobs, Dennis C.; Jan. 31, 1999; 3p; In English

Contract(s)/Grant(s): F49620-95-1-0370; AF Proj. 3484

Report No.(s): AD-A360522; AFRL-SR-BL-TR-99-0065; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This research focuses on measuring the momentum transfer of energetic Ne(+) ions impinging on a Si(100) surface. Scattering experiments and classical - trajectory calculations were utilized to determine the energy and angular distribution of the scattered projectiles. This work is relevant to predicting and reducing spacecraft drag in a low-earth orbit environment.

DTIC

Neon; Silicon; Momentum Transfer; Surface Reactions; Ions; Impingement

19990028243 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

Characterization of the Surface Film Growth During the Electrochemical Process: Part 2, Pt. 2, 90 % Copper - 10 % Nickel System

Rao, A. S.; Jun. 1998; 57p; In English

Report No.(s): AD-A360533; CARDIVNSWC-TR-61-98-21-Pt-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In order to understand the resistance of passive films formed during corrosion processes, an analytical technique using x-ray diffraction was developed to examine the structure of metal in closest proximity to the metal / liquid interface. The in-situ structure at the metal liquid interface was examined for 90 % copper and 10% nickel (90-10 Cu-Ni) in KOH solution at room temperature and at four different potentistatically controlled potentials (-0.5 V, -0.1 V, +0.5 V and +0.10 V versus Ni/NiO). The chemical changes at the metal interface were studied over a period of 48 hours. It was found that the integrity of the 90-10 Cu-Ni foil in KOH was lost after a continued application of the potential over 48 hours. The x-ray diffraction results indicated that the structure of both the inner and the outer passive layers, at -0.5V and -0.1 V (versus Ni/NiO), is comprised of Ni(OH)2, Cu(OH)2, NiOOH and Cu2O NiO. Similarly the structure of the interfaces at +0.5 V and +0.10 V (versus Ni/NiO) contains NiO, Ni2O3, Cu2O NiO and Ni2CuO3. XPS analysis of the surface structure (primarily of the outer passive layer) suggests that at -0.50 V (versus Ni/NiO) the structure consists of Ni(OH)2, Cu(OH)2 and CuO. The structure at +0.50 V (versus Ni/NiO) consists of NiO, Ni2O3, Ni(OH)2, Cu(OH)2 and CuO. It is therefore possible that the structure of inner passive layer may be NiOOH at -0.5 V and -0.10 V and Ni(OH)2 at +0.50 V and +0.1 V.

DTIC

Copper Alloys; Thin Films; Electrochemistry; Corrosion Resistance; Nickel Alloys; Potassium Hydroxides; Copper Oxides

26
METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

19990026245 Department of Energy, Office of Administration and Human Resource Management, Washington, DC USA
Computer modeling of electromagnetic edge containment in twin-roll casting
Chang, F. C., Department of Energy, USA; Turner, L. R., Department of Energy, USA; Hull, J. R., Department of Energy, USA; Wang, Y. H., Department of Energy, USA; Blazek, K. E., Department of Energy, USA; Dec. 31, 1998; 12p; In English; 57th; 2nd; Steelmaking
Report No.(s): DE98-057598; ANL/ET/CP-95108; CONF-980387; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents modeling studies of magnetohydrodynamics (MHD) analysis in twin-roll casting. Argonne National Laboratory (ANL) and Inland Steel Company have worked together to develop a 3-D computer model that can predict eddy currents, fluid flows, and liquid metal containment for an electromagnetic (EM) edge containment device. This mathematical model can greatly shorten casting research on the use of EM fields for liquid metal containment and control. It can also optimize the existing casting processes and minimize expensive, time-consuming full-scale testing. The model was verified by comparing predictions with experimental results of liquid-metal containment and fluid flow in EM edge dams designed at Inland Steel for twin-roll casting. Numerical simulation was performed by coupling a three-dimensional (3-D) finite- element EM code (ELEKTRA) and a 3-D finite-difference fluids code (CaPS-EM) to solve Maxwell's equations, Ohm's law, Navier-Stokes equations, and transport equations of turbulence flow in a casting process that uses EM fields. ELEKTRA is able to predict the eddy-current distribution and electromagnetic forces in complex geometry. CaPS-EM is capable of modeling fluid flows with free-surfaces and dynamic rollers. The computed 3-D magnetic fields and induced eddy currents in ELEKTRA are used as input to flow-field computations in CaPS-EM. Results of the numerical simulation compared well with measurements obtained from both static and dynamic tests.
NTIS
Casting; Computerized Simulation; Magnetohydrodynamics; Containment; Roll

19990026871 Department of Energy, Office of Energy Research, Washington, DC USA
Monte Carlo simulation of spatial resolution for electron backscattered diffraction (EBSD) with application to two-phase materials
Ren, S. X., Department of Energy, USA; Kenik, E. A., Department of Energy, USA; Alexander, K. B., Department of Energy, USA; Oct. 31, 1997; 3p; In English; Microscopy and Microanalysis 1997
Report No.(s): DE98-000122; ORNL/CP-94583; CONF-970834; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The study of texture and grain boundary misorientation in multiphase materials has been greatly benefited from the recent automation of the electron backscattered diffraction (EBSD) technique. With this technique, each phase in a multiphase material can be individually sampled and analyzed. This is of great significance and interest in the study of thin films, inclusions and multiphase alloys. Spatial resolution, which depends on experimental conditions such as beam energy and specimen tilt, and the material being studied, is critical in order to determine the orientation of different phases in multiphase materials. The Monte Carlo (MC) method has been effectively used to investigate spatial resolution in single phase materials. In this paper, the MC simulation is modified and applied to two-phase geometries, specifically an Al/Au specimen, and a 750 nm thick Au film on a SiO2 substrate.
NTIS
Monte Carlo Method; Backscattering; Spatial Resolution; Electron Diffraction

19990026956 Department of Energy, Office of Energy Research, Washington, DC USA
Mechanical properties of S-65C grade beryllium at elevated temperatures
Goods, S. H., Department of Energy, USA; Dombrowski, D. E., Department of Energy, USA; Nov. 30, 1997; 15p; In English, USA; Sponsored by International Energy Agency, France
Report No.(s): DE98-050609; SAND-98-8400C; CONF-9710153; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tensile property measurements and fractographic analysis of S-65C beryllium are reviewed. Tests were performed on specimens oriented in the longitudinal and transverse directions with respect to the direction of vacuum hot pressing. Specimens were tested in air at RT, 100 C, 200 C, 300 C, 415 C and 500 C at an initial strain rate of 1.1 x 10(exp -4) per second. Ductility of the material was strongly affected by the test temperature, exhibiting a peak ductility at 300 C. The material displayed a yield point

phenomenon which was most pronounced at this same temperature. Scanning electron microscopy was performed on the resulting fracture surfaces and observations are reported.
NTIS
Mechanical Properties; Beryllium; Temperature Dependence; Conferences

19990027049 Department of Energy, Washington, DC USA
Experimental and numerical study of E-beam evaporation of titanium
McClelland, M. A., Department of Energy, USA; Westerberg, K. W., Department of Energy, USA; Meier, T. C., Department of Energy, USA; Braun, D. G., Department of Energy, USA; Berrins, L. V., Department of Energy, USA; Nov. 26, 1997; 15p; In English; 13th; Electron Beam Melting and Refining: State of the Art, 1996, USA
Report No.(s): DE98-050869; UCRL-JC-125100; CONF-961079; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An experimental and numerical study is performed for the electron- beam evaporation of pure titanium from a bottom fed vapor source. In the experiments, an electron beam operating in the nominal range of 30-40 (kW) was used to evaporate metal from the top of a 3 inch diameter rod. Variations were made in the e-beam power, sweep pattern, and sweep frequency, and the total evaporation rate was measured from feed consumption and laser absorption. The solid-pool interface was obtained from metallographic cross sections of the metal rod. A two-dimensional finite element model was developed for the melt which includes the effect of fluid flow and energy transport in the pool and conduction in the solid. The deformation of the liquid-vapor and solid-liquid interfaces are tracked using a mesh which stretches along spines parallel to the axis of the rod. For the cases considered, high evaporative fluxes and vapor pressures generate significant depressions in the top surface of the pool. Predicted and measured evaporation rates are in good agreement for moderate evaporation fluxes, but discrepancies are larger for the case involving the highest flux and deepest depression.
NTIS
Titanium; Electron Beams; Conferences; Numerical Analysis; Mathematical Models; Evaporation Rate; Liquid-Vapor Interfaces

19990027052 Department of Energy, Washington, DC USA
Crevice corrosion (ampersand) pitting of high-level waste containers: the integration of deterministic (ampersand) probabilistic models (II)
Farmer, J. C., Department of Energy, USA; Oct. 01, 1997; 151p; In English; Total System Performance Analysis (TSPA), USA
Report No.(s): DE98-051065; UCRL-JC-127980-PT.2; CONF-9711108; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An integrated predictive model is being developed to account for the effects of localized environmental conditions in crevices on the initiation and propagation of pits. A deterministic calculation is used to estimate the accumulation of hydrogen ions (pH suppression) in the crevice solution due to the hydrolysis of dissolved metals. Pit initiation and growth within the crevice is then dealt with by either a probabilistic model, or an equivalent deterministic model. Ultimately, the role of intergranular corrosion will have to be considered. While the strategy presented here is very promising, the integrated model is not yet ready for precise quantitative predictions. Empirical expressions for the rate of penetration based upon experimental crevice corrosion data can be used in the interim period, until the integrated model can be refined. Bounding calculations based upon such empirical expressions can provide important insight into worst-case scenarios.
NTIS
Mathematical Models; Hydrogen Ions; Pitting; pH; Intergranular Corrosion; Corrosion

19990027125 Department of Energy, Office of Energy Research, Washington, DC USA
Slip, twinning, and transformation in Laves phases ***Final Report, 1 Aug. 1990 - 31 Jan. 1997***
Allen, S. M., Department of Energy, USA; Jun. 01, 1998; 9p; In English
Report No.(s): DE98-006509; DOE/ER/45426-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Currently, intermetallic compounds are being studied as potential high-temperature structural materials. Most of these studies are on phases such as Ni3Al, TiAl, NiAl, and Ti3Al, which have structures that are crystallographic derivatives of fcc, bcc, or hcp structures. However, most intermetallics have more complex crystal structures, and little is known about their deformation mechanisms and mechanical properties. by far the largest class of such compounds is that of the Laves phases, AB2 compounds having three different crystal structures: C15 (cubic), C14 (hexagonal), and C36 (dihexagonal). This research program explored room-temperature compressive deformation of two-phase alloys containing substantial amounts of Laves phase, and, by transmission electron microscopy, characterized the deformation-induced defects in these alloys. The results include: transmission electron microscopy analysis of defect structures to determine deformation mechanisms, use of indentation experiments to gain deeper

understanding of deformation mechanisms, systematic study of effects of ternary alloying additions on mechanical properties, and assessment of effects of departure from stoichiometry on phase stability and mechanical properties of Laves phases.
NTIS
Twinning; Transmission Electron Microscopy; Laves Phases; Deformation; Structural Analysis; Intermetallics

19990027131 Department of Energy, Washington, DC USA
Damage mechanics characterization on fatigue behavior of a solder joint material
Chow, C. L., Department of Energy, USA; Yang, F., Department of Energy, USA; Fang, H. E., Department of Energy, USA; Dec. 31, 1998; 15p; In English; Mechanical Engineering, 1998, USA
Report No.(s): DE98-007193; SAND-98-1206C; CONF-981107; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents the first part of a comprehensive mechanics approach capable of predicting the integrity and reliability of solder joint material under fatigue loading without viscoplastic damage considerations. A separate report will be made to present a comprehensive damage model describing life prediction of the solder material under thermomechanical fatigue loading. The method is based on a theory of damage mechanics which makes possible a macroscopic description of the successive material deterioration caused by the presence of microcracks/voids in engineering materials. A damage mechanics model based on the thermodynamic theory of irreversible processes with internal state variables is proposed and used to provide a unified approach in characterizing the cyclic behavior of a typical solder material. With the introduction of a damage effect tensor, the constitutive equations are derived to enable the formulation of a fatigue damage dissipative potential function and a fatigue damage criterion. The fatigue evolution is subsequently developed based on the hypothesis that the overall damage is induced by the accumulation of fatigue and plastic damage. This damage mechanics approach offers a systematic and versatile means that is effective in modeling the entire process of material failure ranging from damage initiation and propagation leading eventually to macro-crack initiation and growth. As the model takes into account the load history effect and the interaction between plasticity damage and fatigue damage, with the aid of a modified general purpose finite element program, the method can readily be applied to estimate the fatigue life of solder joints under different loading conditions.
NTIS
Damage; Fatigue (Materials); Solders; Fatigue Life; Crack Propagation; Soldered Joints

19990027194 Department of Energy, Office of Energy Research, Washington, DC USA
Interfacial properties and mechanical behavior of titanium aluminides
Yoo, M. H., Department of Energy, USA; Fu, C. L., Department of Energy, USA; Jan. 31, 1998; 14p; In English, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE98-004056; ORNL/CP-96254; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The role of various interfaces in deformation and fracture behavior of two phase TiAl-Ti3Al alloys is analyzed on the basis of the specific interfacial and surface energies determined from ab initio calculations. The propensity of twinning observed in these alloys is consistent with the low true twin boundary energy. The strong plastic anisotropy reported in TiAl polysynthetically twinned (PST) crystals is attributed partly to the localized slip along lamellar interfaces, thus lowering the yield stress for soft orientations. Interfacial fracture energies are estimated to be the highest for the (alpha)(sub 2)/(gamma) lamellar boundary and the lowest for the 120 deg rotational (gamma)/(gamma) boundary. The fracture mode mixity plays an important role in the crack-tip plasticity by ordinary slip and true twinning, leading to translamellar and interfacial fracture.
NTIS
Titanium Aluminides; Fracture Mechanics; Plastic Properties

19990027345 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA
EBR-2 materials-surveillance program, Report 5, Results of SURV-5
Ruther, W. E., Department of Energy, USA; Staffon, J. D., Department of Energy, USA; Carlson, B. G., Department of Energy, USA; Allen, T. R., Department of Energy, USA; Jan. 31, 1998; 33p; In English
Report No.(s): DE98-004589; ANL-98/4; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In March of 1965, a set of surveillance (SURV) samples was placed in the EBR-II reactor to determine the effect of irradiation, thermal aging, and sodium corrosion on reactor materials. Eight subassemblies were placed into row 12 positions of EBR-II to determine the effect of irradiation at 370 C. Two subassemblies were placed into the primary sodium basket to determine the effect of thermal aging at 370 C. One half of all samples were exposed to primary system sodium while one half were sealed in capsules with a helium atmosphere. Fifteen different structural materials were tested in the SURV program. In this work, the properties of these materials irradiated at 370 C to a total fluence of 3.2 x 10(exp 22) n/sq cm were determined. These materials are the fifth

set of irradiated subassemblies to be examined as part of the SURV program (SURV-5). The properties analyzed were weight, density, microstructure, hardness, tensile and yield strength, and fracture resistance. of all the alloys examined in SURV-5, only Berylco-25 showed any significant weight loss. Stainless steel (both 304 and 347) had the largest density decrease, although the density decrease from irradiation for all alloys was less than 0.4 percent. The microstructure of both Berylco-25 and the aluminum-bronze alloy was altered significantly. Iron- and nickel-base alloys showed little change in microstructure. Austenitic steels (304 and 347) harden with irradiation. The hardness of Inconel X750 did not change significantly with irradiation. The ultimate tensile strength of Inconel X750, 304 stainless steel, 420 stainless steel and welded 304 changed little due to a fluence increase from 2.2 x 10(exp 22) n/sq cm (the maximum fluence of the SURV-4 samples) to 3.2 x 10(exp 22) n/sq cm.
NTIS
Radiation Effects; Surveillance; Radiation Damage; Experimental Breeder Reactor 2

19990027351 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Pack cementation diffusion coatings for Fe-base and refractory alloys ***Final Report***
Rapp, R. A., Department of Energy, USA; Mar. 10, 1998; 25p; In English
Report No.(s): DE98-006093; ORNL/SUB-87-SB1154/04; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

With the aid of computer-assisted calculations of the equilibrium vapor pressures in halide-activated cementation packs, processing conditions have been identified and experimentally verified for the codeposition of two or more alloying elements in a diffusion coating on a variety of steels and refractory metal alloys. A new comprehensive theory to treat the multi-component thermodynamic equilibria in the gas phase for several coexisting solid phases was developed and used. Many different processes to deposit various types of coatings on several types of steels were developed: Cr-Si codeposition for low- or medium-carbon steels, Cr-Al codeposition on low-carbon steels to yield either a Kanthal-type composition (Fe-25Cr-4Al in wt.%) or else a (Fe, Cr)(sub 3)Al surface composition. An Fe3Al substrate was aluminized to achieve an FeAl surface composition, and boron was also added to ductilize the coating. The developmental Cr-lean ORNL alloys with exceptional creep resistance were Cr- Al coated to achieve excellent oxidation resistance. Alloy wires of Ni-base were aluminized to provide an average composition of Ni(sub 3)Al for use as welding rods. Several different refractory metal alloys based on Cr-Cr2Nb have been silicided, also with germanium additions, to provide excellent oxidation resistance. A couple of developmental Cr-Zr alloys were similarly coated and tested.
NTIS
Cementation; Diffusion; Coatings; Alloying; Low Carbon Steels; Corrosion Prevention

19990027352 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Weldability and joining techniques for advanced fossil energy system alloys
Lundin, C. D., Department of Energy, USA; Qiao, C. Y. P., Department of Energy, USA; Liu, W., Department of Energy, USA; Yang, D., Department of Energy, USA; Zhou, G., Department of Energy, USA; May 31, 1998; 213p; In English
Report No.(s): DE98-006099; ORNL/SUB-88-07685/05; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The efforts represent the concerns for the basic understanding of the weldability and fabricability of the advanced high temperature alloys so necessary to affect increases in the efficiency of the next generation Fossil Energy Power Plants. The effort was divided into three tasks with the first effort dealing with the welding and fabrication behavior of 310HCbN (HR3C), the second task details the studies aimed at understanding the weldability of a newly developed 310TaN high temperature stainless (a modification of 310 stainless) and Task 3 addressed the cladding of austenitic tubing with Iron- Aluminide using the GTAW process. Task 1 consisted of microstructural studies on 310HCbN and the development of a Tube Weldability test which has applications to production welding techniques as well as laboratory weldability assessments. In addition, the evaluation of ex-service 310HCbN which showed fireside erosion and cracking at the attachment weld locations was conducted. Task 2 addressed the behavior of the newly developed 310 TaN modification of standard 310 stainless steel and showed that the weldability was excellent and that the sensitization potential was minimal for normal welding and fabrication conditions. The microstructural evolution during elevated temperature testing was characterized and the second phase particles evolved upon aging were identified. Task 3 details the investigation undertaken to clad 310HCbN tubing with Iron Aluminide and developed welding conditions necessary to provide a crack free cladding. The work showed that both a preheat and a post-heat was necessary for crack free deposits and the effect of a third element on the cracking potential was defined together with the effect of the aluminum level for optimum weldability.
NTIS
Weldability; Technology Assessment; Fossils; Fabrication

19990027403 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Ion Beam Modification of Ti-Alloys

Hu, Zhengqiong, Beijing Univ. of Aeronautics and Astronautics, China; Ying, Zhang, Beijing Univ. of Aeronautics and Astronautics, China; Wang, Yihua, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 596-598; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Titanium alloys are very useful in the area of aeronautics and astronautics. They have good performance of light weight, high intensity and corrosion resistance, but have poor wear resistance. In order to improve their abrasion resistance, the specimens of TC4, TA7 titanium alloys were titanium-plated by sputtering, and then Ti atoms were implanted into the surface of specimens by (N(+) + N2(+)) ion beam. On the basis of the above ion implantation, some specimens were implanted by C(+) ion beam additionally. The results of tests of friction and wear shows that the coefficient of kinetic friction of specimens is decreased by 64-77%, and the wear rate of specimens is decreased by 22-48%. The measurement of microhardness show that the surface microhardness of specimens is increased by a factor of 0.3-1.4. After ion implantation, the mechanical performance are improved effectively. Analysis of X-ray photoelectron spectroscopy shows that the metal compounds of TiO2 , TiN and TiC were formed in the layer of Ti-alloys, which are the primary factor of decreasing the friction coefficient and increasing the wear resistance. For the specimens of additional C(+) ion implantation, the mechanical performance can not improve more than other, the reason will be analyzed later.

Author

Ion Implantation; Abrasion Resistance; Corrosion Resistance; Titanium Alloys; Wear Resistance; Microhardness

19990027426 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Visual Computer Simulation of Material Microstructure Changes Due to Manufacturing Processes

Morris, Lanny J.; Nov. 1998; 104p; In English

Report No.(s): AD-A359933; AFIT-FY99-61; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis focuses on the design, algorithm development, and demonstration of a computer program that visually simulates the results of manufacturing processes on the microstructure of metals. The visual simulation program presents an image of grain structure similar to images of etched grains visible in a microscope. The program simulates the response of single-phase pure metals that undergo the processes of grain deformation, grain recrystallization, or grain growth. The computer program is designed to be integrated into any Windows 95/NT program that requires simulation of the microstructure of metals. Object-oriented methods are used in the design of the program to separate the information into objects that the computer can manipulate. Microstructure simulations generated by the program are compared with microstructures generated by other proven programs and with microstructures found in the literature. The results show that a computer program generates simulations of micro structures to the computer screen that visually approximate real microstructures and are equivalent to microstructures generated by other programs. Conclusions are drawn and possible future work is outlined.

DTIC

Computerized Simulation; Computer Programs; Manufacturing; Metals; Microstructure; Algorithms

19990027466 NASA Lewis Research Center, Cleveland, OH USA

Toward Optimum Scale and TBC Adhesion on Single Crystal Superalloys

Smialek, James L., NASA Lewis Research Center, USA; 1998; 12p; In English; High Temperature Materials Chemistry, 3-8 May 1998, San Diego, CA, USA; Sponsored by Electrochemical Society, Inc., USA

Contract(s)/Grant(s): RTOP 523-36-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Single crystal superalloys exhibit excellent cyclic oxidation resistance if their sulfur content is reduced from typical impurity levels of approximately 5 ppmw to below 0.5 ppmw. Excellent alumina scale adhesion was documented for PWA 1480 and PWA 1484 without yttrium additions. Hydrogen annealing produced effective desulfurization of PWA 1480 to less than 0.2 ppmw and was also used to achieve controlled intermediate levels. The direct relationship between cyclic oxidation behavior and sulfur content was shown. An adhesion criterion was proposed based on the total amount of sulfur available for interfacial segregation, e.g., less than or equal to 0.2 ppmw S will maximize adhesion for a 1 mm thick sample. PWA 1484, melt desulfurized to 0.3 ppmw S, also exhibited excellent cyclic oxidation resistance and encouraging TBC lives (10 mils of 8YSZ, plasma sprayed without a bond coat) in 1100 C cyclic oxidation tests.

Author

Heat Resistant Alloys; Single Crystals; Adhesion; Oxidation Resistance; Hydrogen; Plasmas (Physics); Annealing; Aluminum Oxides

19990027471 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Some effects of metallic substrate composition on degradation of thermal barrier coatings
Wright, I. G., Department of Energy, USA; Pint, B. A., Department of Energy, USA; Lee, W. Y., Department of Energy, USA; Alexander, K. B., Department of Energy, USA; Pruessner, K., Department of Energy, USA; Dec. 31, 1997; 20p; In English; High temperature surface engineering, USA
Report No.(s): DE98-001909; ORNL/CP-95674; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Comparisons have been made in laboratory isothermal and cyclic oxidation tests of the degradation of oxide scales grown on single crystal superalloy substrates and bond coating alloys intended for use in thermal barrier coatings systems. The influence of desulfurization of the superalloy and bond coating, of reactive element addition to the bond coating alloy, and of oxidation temperature on the spallation behavior of the alumina scales formed was assessed from oxidation kinetics and from SEM observations of the microstructure and composition of the oxide scales. Desulfurization of nickel-base superalloy (in the absence of a Y addition) resulted in an increase in the lifetime of a state-of-the-art thermal barrier coating applied to it compared to a Y-free, non-desulfurized version of the alloy. The lifetime of the same ceramic coating applied without a bond coating to a non-desulfurized model alloy that formed an ideal alumina scale was also found to be at least four times longer than on the Y-doped superalloy plus state-of-the-art bond coating combination. Some explanations are offered of the factors controlling the degradation of such coatings.
NTIS
Substrates; Degradation; Thermal Control Coatings; Ceramic Coatings

19990027476 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA
Defect distributions in weld-deposited cladding
Li, Y. Y., Department of Energy, USA; Mabe, W. R., Department of Energy, USA; Dec. 31, 1998; 18p; In English; Pressure vessel and piping (PVP), 1998; Sponsored by American Society of Mechanical Engineers, USA
Report No.(s): DE98-003187; WAPD-T-3176; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Defect distributions in stainless steel and nickel-chromium alloy weld-deposited cladding over a low alloy steel base were characterized by destructive evaluation (DE). An evaluation of the observed defects was conducted to characterize the defects by type or classification. Size distributions of cladding defect types were developed from the information obtained. This paper presents the results of the cladding evaluation.
NTIS
Cladding; Defects; Metallography

19990027486 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Steel penetration in sand molds ***Final Report, Sep. 1994 - Sep. 1997***
Hayes, K. D., Department of Energy, USA; Owens, M., Department of Energy, USA; Barlow, J., Department of Energy, USA; Stefanescu, D. M., Department of Energy, USA; Lane, A. M., Department of Energy, USA; Dec. 01, 1997; 74p; In English, USA
Report No.(s): DE98-004027; DOE/ID/13324-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The research program was successful in identifying the major factors that influence penetration. This was done first through a case study of penetration samples. The study revealed that both chemical and mechanical penetration were present in carbon and high manganese steels. It also found that only mechanical penetration is found in stainless steel samples. It should be noted that when mechanical penetration does occur, there is a greater risk of chemical reactions with the mold. Therefore, it is common to confuse mechanical penetration with chemical. Sessile drop experiments were run to discover the effect of steel chemistry on the contact angle for different substrates. These experiments revealed the best substrates for each type of metal. Bauxite, , and mullite were discovered to be the best materials for resisting mechanical penetration. It was also shown that high manganese steels cannot be poured into silica molds and that stainless steel should not be poured in chromite molds. The sessile drop data was used to develop a mechanical penetration model which correctly predicted penetration in sixteen of twenty castings poured at the University of Alabama. Mold/metal atmosphere tests were run to understand the effects of the atmosphere on chemical penetration. It was found that the chemistry affecting penetration has its greatest effect as the casting is just poured. Chemical penetration for low carbon steels cannot be completely eliminated by adding carbon (seacoal) to green sand molds although a marked decrease is obtained in its severity. Extremely high carbon concentrations might be able to totally eliminate the penetration but are not used because of their possible diffusion into the steel causing carburization. A chemical penetration model was produced and its results agree well with the experimental results.
NTIS
Penetration; Steels; Sand Casting; Molds

19990027570 Department of Energy, Office of Energy Research, Washington, DC USA

Cube-textured nickel substrates for high-temperature superconductors

Specht, E. D., Department of Energy, USA; Goya. A., Department of Energy, USA; Lee, D. F., Department of Energy, USA; List, F. A., Department of Energy, USA; Kroeger, D. M., Department of Energy, USA; Feb. 28, 1998; 19p; In English; Processing and Critical Current of HTS, USA

Report No.(s): DE98-004902; ORNL/CP-97500; CONF-980234; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The biaxial textures created in metals by rolling and annealing make them useful substrates for the growth of long lengths of biaxially textured material. The growth of overlayers such as high-temperature superconductors (HTS) require flat substrates with a single, sharp texture. A sharp cube texture is produced in high-purity Ni by rolling and annealing. The authors report the effect of rolling reduction and annealing conditions on the sharpness of the cube texture, the incidence of other orientations, the grain size, and the surface topography. A combination of high reduction, and high temperature annealing in a reducing atmosphere leads to > 99% cube texture, with mosaic of 9.0(degree) about the rolling direction (RD), 6.5(degree) about the transverse direction (TD), and 5.0(degree) about the normal direction (ND) .

NTIS

Nickel; Substrates; High Temperature Superconductors; Textures; Grain Size

19990027632 Department of Energy, Washington, DC USA

Transformation kinetics in controlled-power and controlled-temperature cycle testing

Robino, C. V., Department of Energy, USA; Knorovsky, G., Department of Energy, USA; Dykhuizen, R. C., Department of Energy, USA; MacCallum, D. O., Department of Energy, USA; Damkroger, B. K., Department of Energy, USA; Jun. 30, 1998; 8p; In English; 5th; Trends in Welding Research, USA

Report No.(s): DE98-005521; SAND-98-1269C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

On-heating transformation kinetics were investigated for several steels by using a Gleeble capable of programmable power input as well as programmable temperature cycling. Transformation kinetics determined in both modes are reported. The temperature cycles are significantly different between the two modes due to the latent heat associated with the phase transformations. Both diffusion rates and transformation driving force increase with temperature above the eutectoid temperature, therefore the latent heat can potentially have a significant impact on the transformation kinetics. Experiments with plain carbon steels illustrate that the latent heat of austenite formation causes an appreciable temperature arrest during transformation, and the dilatation response is similarly altered. A kinetic transformation model, based on the decomposition of pearlite and the diffusional growth of austenite, reproduced the transient dilatation data obtained from both control modes reasonably well using the same kinetic parameter values.

NTIS

Research; Heat of Formation; Phase Transformations; Crystal Structure

19990027634 Department of Energy, Office of Energy Research, Washington, DC USA

Tritium retention in tungsten exposed to intense fluxes of 100 eV tritons

Causey, R., Department of Energy, USA; Wilson, K., Department of Energy, USA; Venhaus, T., Department of Energy, USA; Wampler, W. R., Department of Energy, USA; May 31, 1998; 20p; In English; 13th; Plasma Surface Interactions, USA

Report No.(s): DE98-005508; SAND-98-1294C; CONF-980560; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tungsten is a candidate material for ITER as well as other future magnetic fusion energy devices. Tungsten is well suited for certain fusion applications in that it has a high threshold for sputtering as well as a very high melting point. As with all materials to be used on the inside of a tokamak or similar device, there is a need to know the behavior of hydrogen isotopes embedded in the material. With this need in mind, the Tritium Plasma Experiment (TPE) has been used to examine the retention of tritium in tungsten exposed to very high fluxes of 100 eV tritons. Both tungsten and tungsten containing 1% lanthanum oxide were used in these experiments. Measurements were performed over the temperature range of 423 to 973 K. After exposure to the tritium plasma, the samples were transferred to an outgassing system containing an ionization chamber for detection of the released tritium. The samples were outgassed using linear ramps from room temperature up to 1,473 K. Unlike most other materials exposed to energetic tritium, the tritium retention in tungsten reaches a maximum at intermediate temperatures with low retention at both high and low temperatures. For the very high triton fluences used (alpha amp; greater than 10(exp 25) T/sq m), the fractional reten-

tion of the tritium was below 0.02% of the incident particles. This report presents not only the results of the tritium retention, but also includes the modeling of the results and the implication for ITER and other future fusion devices where tungsten is used.
NTIS
Reactor Materials; Tritium; Tungsten; Hydrogen Isotopes; Embedding; Thermonuclear Explosions

19990027662 Department of Energy, Office of Energy Research, Washington, DC USA
US Department of Energy integrated manufacturing predoctoral fellowships ***Annual Report, 1997-1998***
May 22, 1998; 3p; In English
Report No.(s): DE98-006447; DOE/ER/14370-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the uniform droplet spray (UDS) process, a jet of liquid metal is broken up into uniform droplets by applying a periodic perturbation to the jet at a specific frequency and amplitude. The droplets are electrically charged to the same polarity to prevent in-flight merging. As a result of the uniform droplet size distribution, the dynamic and thermal states of the droplets can be precisely controlled in the UDS process. Before the UDS process can be applied to the production of aluminum sheets, the thermal history of the droplets must be understood. The incoming thermal state of the droplets at impact with the substrate significantly affects the degree of droplet consolidation as well as the microstructural grain size, which in turn determine the final material properties of the sprayed part. Therefore, the first step in this research was to simulate and measure the droplet thermal state during flight. The thermal state of a solidifying droplet is defined by its temperature and volume fraction of solid. to predict the temperature and solid fraction of the droplets as functions of flight distance, a thermal model was developed for aluminum binary alloy droplets by assuming Newtonian cooling, no undercooling, and local equilibrium at the solid/liquid interface during solidification. Experiments to validate the droplet thermal model were made with Al-4.5 wt% Cu and Al-4.3 wt% Fe droplets, 275 (micro)m and 250 (micro)m in diameter, respectively. The droplets were quenched at different flight distances and their microstructures were examined metallographically using SEM analysis. by observing the change in microstructure from a fully liquid droplet to a fully solid powder, the solid fraction of the droplet as a function of flight distance can be measured.
NTIS
Coating; Drops (Liquids); Manufacturing; Sprayers

19990027780 Department of Energy, Office of Energy Research, Washington, DC USA
Modeling the Ferrite-Austenite Transformation in the Heat-Affected Zone of Stainless Steel Welds
Vitek, J. M., Department of Energy, USA; David, S. A., Department of Energy, USA; Dec. 31, 1997; 24p; In English; Numerical analysis of weldability, USA
Report No.(s): DE98-001916; ORNL/CP-95656; CONF-9709120; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The diffusion-controlled ferrite-austenite transformation in stainless steel welds was modeled. An implicit finite-difference analysis that considers multi-component diffusion was used. The model was applied to the Fe-Cr-Ni system to investigate the ferrite-austenite transformation in the heat-affected zone of stainless steel weld metal. The transformation was followed as a function of time as the heat-affected zone was subjected to thermal cycles comparable to those experienced during gas-tungsten arc welding. The results showed that the transformation behavior and the final microstructural state are very sensitive to the maximum temperature that is experienced by the heat- affected zone. For high maximum exposure temperatures approximately 1300 C, the ferrite formation that occurs at the highest temperatures is not completely offset by the reverse ferrite dissolution at lower temperatures. As a result, for high temperature exposures there is a net increase in the amount of ferrite in the microstructure. It was also found that if compositional gradients are present in the initial ferrite and austenite phases, the extent of the transformation is impacted.
NTIS
Ferrites; Austenite; Heat Affected Zone; Welded Joints; Austenitic Stainless Steels; Phase Transformations

19990027838 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Attenuated total reflection of dielectric/metal interfaces
Clemen, L. L., Department of Energy, USA; Strunk, M. R., Department of Energy, USA; Niemczyk, T. M., Department of Energy, USA; Haaland, D. M., Department of Energy, USA; Aug. 31, 1997; 6p; In English; 11th; Fourier transform spectroscopy, USA
Report No.(s): DE98-002591; SAND-98-0068C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An experimental system for the characterization of metal/dielectric interfaces has been developed. Attenuated Total Reflection (ATR) spectroscopy of a dielectric on a thin metal film, deposited on a multiple reflection ATR element, yields information about the bonding, or lack thereof, at the metal/dielectric interface. At a certain metal thickness, the absorbance due to molecules at the interface, relative to the signal from the bulk dielectric, is at a maximum. A model which uses the Fresnel equations in matrix

form, has been used to predict the best metal thickness for each dielectric/metal/ATR element system. The ATR element may be placed in an environmental chamber in which the temperature, humidity etc. can be varied, in order to test the integrity of the interface to hostile environments. Chemometric analysis of the IR spectral data maximizes our ability to measure small changes in the interface properties. Preliminary results from polyimide/metal samples are presented.
NTIS
Dielectrics; Metal Films; Reflection; Interfaces; Attenuation

19990027986 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Perforation of HY-100 steel plates with 4340 R(sub c) 38 and T-250 maraging steel rod projectiles
Forrestal, M. J., Department of Energy, USA; Hanchak, S. J., Department of Energy, USA; May 25, 1998; 15p; In English; Transient Loading and Response of Structures, USA
Report No.(s): DE98-002896; SAND-98-0064C; CONF-980530; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors conducted perforation experiments with 4340 Rc 38 and T-250 maraging steel, long rod projectiles and HY-100 steel target plates at striking velocities between 80 and 370 m/s. Flat-end rod projectiles with lengths of 89 and 282 mm were machined to nominally 30-mm-diameter so they could be launched from a 30-mm-powder gun without sabots. The target plates were rigidly clamped at a 305-mm-diameter and had nominal thicknesses of 5.3 and 10.5 mm. Four sets of experiments were conducted to show the effects of rod length and plate thickness on the measured ballistic limit and residual velocities. In addition to measuring striking and residual projectile velocities, they obtained framing camera data on the back surfaces of several plates that showed clearly the plate deformation and plug ejection process. They also present a beam model that exhibits qualitatively the experimentally observed mechanisms.
NTIS
Impact Tests; Projectiles; Steels; Experimentation; Rods; Metal Plates; Deformation

19990027992 Department of Energy, Office of Energy Research, Washington, DC USA
Atom probe field ion microscopy of high resistivity materials
Sibrandij, S. J., Department of Energy, USA; Larson, D. J., Department of Energy, USA; Miller, M. K., Department of Energy, USA; Feb. 28, 1998; 4p; In English; Microscopy and Microanalysis 1998, 1998, USA
Report No.(s): DE98-005023; ORNL/CP-96507; CONF-980713; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Over the last 30 years the atom probe has proved to be a powerful tool for studying nanometer-sized compositional fluctuations in a wide range of metallic alloys but has had only limited applications to semiconductors and ceramics. One of the primary reasons for this difference is the higher resistivity of semiconducting and ceramic specimens. Because of this high resistivity, the high voltage field evaporation pulse is attenuated before it reaches the apex of the specimen thereby making the pulse ineffective for field evaporation. Experiments have demonstrated that both variants of the voltage-pulsed atom probe (i.e., those instruments in which the field evaporation pulse is applied directly to the specimen and those in which the negative pulse is applied to a counter electrode in front of the specimen) are equally affected. In this overview, the limits of applicability of the voltage-pulsed atom probe to high resistivity materials are examined. In this study, a wide range of materials have been examined to determine whether field ion microscopy and voltage-pulsed field evaporation can be achieved and the results are summarized in the report. Field ion microscopy including dc field evaporation was possible for all materials except bulk ceramic insulators and glasses. Field ion microscopy requires some conductivity both to achieve a high electric field at the apex of the specimen, and also to support the field ion current. In contrast, voltage- pulsed field evaporation requires transmission of the pulse to the apex of the specimen. All metallic alloys including high resistance alloys and metallic glasses were successfully field evaporated with a voltage pulse. Specimens that were produced from bulk material of several conducting ceramics including MoSi, TiB and TiC were also successfully field evaporated with a voltage pulse.
NTIS
Ceramics; Ion Microscopes; Semiconductors (Materials); Metallic Glasses

19990027993 Department of Energy, Office of Energy Research, Washington, DC USA
Atom probe field ion microscopy of titanium aluminides
Larson, D. J., Department of Energy, USA; Miller, M. K., Department of Energy, USA; Jan. 31, 1998; 4p; In English; Microscopy and Microanalysis 1998, 1998, USA
Report No.(s): DE98-005024; ORNL/CP-96540; CONF-980713; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Titanium aluminides have a number of potential high temperature applications due to their good elevated-temperature mechanical properties, low density, and good creep and oxidation resistance. However, fabrication of commercial components of these materials has been impeded by their poor mechanical properties at ambient temperatures. Significant efforts with various degrees of success have been made to improve the mechanical properties of these TiAl alloys by doping them with a variety of different elements including B, C, Cr, Er, Fe, Mn, Mo, Ni, Nb, P, Si, Ta, V and W. One of the optimum analytical tools for investigating the effects of these additions on the microstructure is the atom probe field ion micro scope. However, relatively few studies of titanium aluminides, compared to some other intermetallic compounds, have performed by atom probe field ion microscopy. This lack of attention can be attributed to the brittle nature of the material, in-situ transformations that occur during the field ion microscopy and preferential evaporation problems that were encountered in some of the early studies. The atom probe field ion microscope used for the current experiments has a low base pressure ((approximately) 2 (times) 10(sup 9) Pa) and careful attention was paid to optimizing the experimental parameters. All the examples shown were obtained from specimens prepared by standard electropolishing techniques. to demonstrate the suitability of the technique to these materials, several different titanium aluminides have been characterized in the atom probe.
NTIS
Intermetallics; Microstructure; Titanium Aluminides

19990027994 Department of Energy, Office of Energy Research, Washington, DC USA
Digital field ion microscopy
Sijbrandij, S. J., Department of Energy, USA; Russell, K. F., Department of Energy, USA; Miller, M. K., Department of Energy, USA; Thomson, R. C., Department of Energy, USA; Jan. 31, 1998; 4p; In English; Microscoy and Microanalysis 1998, 1998, USA
Report No.(s): DE98-005026; ORNL/CP-96446; CONF-980713; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Due to environmental concerns, there is a trend to avoid the use of chemicals needed to develop negatives and to process photographic paper, and to use digital technologies instead. Digital technology also offers the advantages that it is convenient, as it enables quick access to the end result, allows image storage and processing on computer, allows rapid hard copy output, and simplifies electronic publishing. Recently significant improvements have been made to the performance and cost of camera-sensors and printers. In this paper, field ion images recorded with two digital cameras of different resolution are compared to images recorded on standard 35 mm negative film. It should be noted that field ion images exhibit low light intensity and high contrast. Field ion images were recorded from a standard microchannel plate and a phosphor screen and had acceptance angles of (approximately) 60(degree). Digital recordings were made with a Digital Vision Technologies (DVT) MICAM VHR1000 camera with a resolution of 752 x 582 pixels, and a Kodak DCS 460 digital camera with a resolution of 3,060 x 2,036 pixels. Film based recordings were made with Kodak T-MAX film rated at 400 ASA. The resolving power of T-MAX film, as specified by Kodak, is between 50 and 125 lines per mm, which corresponds to between 1,778 x 1,181 and 4,445 x 2,953 pixels, i.e. similar to that from the DCS 460 camera. The intensities of the images were sufficient to be recorded with standard fl:1.2 lenses with exposure times of less than 2 s. Many digital cameras were excluded from these experiments due to their lack of sensitivity or the inability to record a full frame image due to the fixed working distance defined by the vacuum system. The digital images were output on a Kodak Digital Science 8650 PS dye sublimation color printer (300 dpi). All field ion micrographs presented were obtained from a Ni-Al-Be specimen.
NTIS
Digital Cameras; Image Processing; Ion Microscopes; Photographic Processing

19990027997 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Near Net Shape production of metal components using LENS
Schlienger, E., Department of Energy, USA; Dimos, D., Department of Energy, USA; Griffith, M., Department of Energy, USA; Michael, J., Department of Energy, USA; Oliver, M., Department of Energy, USA; Mar. 31, 1998; 8p; In English; 3rd; Pacific Rim: Advanced Materials and Processing, USA
Report No.(s): DE98-005030; SAND-98-0664C; CONF-980716; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Rapid Prototyping and Near Net Shape manufacturing technologies are the subject of considerable attention and development efforts. At Sandia National Laboratories, one such effort is Laser Engineered Net Shaping (LENS). The LENS process utilizes a stream of powder and a focused Nd YAG laser to build near net shape fully dense metal parts. In this process, a 3-D solid model is sliced, then an X-Y table is rastered under the beam to build each slice. The laser 1 powder head is incremented upward with each slice and the deposition process is controlled via shuttering of the laser. At present, this process is capable of producing fully dense metal parts of iron, nickel and titanium alloys including tool steels and aluminides. Tungsten components have also been

produced. A unique aspect of this process is the ability to produce components wherein the composition varies at differing locations in the part. Such compositional variations may be accomplished in either a stepped or graded fashion. In this paper, the details of the process will be described. The deposition mechanism will be characterized and microstructures and their associated properties will be discussed. Examples of parts which have been produced will be shown and issues regarding dimensional control and surface finish will be addressed.
NTIS
Computer Aided Manufacturing; Computer Aided Design; Neodymium Lasers; YAG Lasers; Laser Deposition

19990028187 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Synthesis and design of silicide intermetallic materials
Petrovic, J. J., Department of Energy, USA; Castro, R. G., Department of Energy, USA; Butt, D. P., Department of Energy, USA; Park, Y., Department of Energy, USA; Hollis, K. J., Department of Energy, USA; Dec. 31, 1998; 18p; In English; High Temperature Structural Silicide, USA
Report No.(s): DE99-000699; LA-UR-98-1980; CONF-9805119; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The overall objective of this program is to develop structural silicide- based materials with optimum combinations of elevated temperature strength/creep resistance, low temperature fracture toughness, and high temperature oxidation and corrosion resistance for applications of importance to the U.S. processing industry. A further objective is to develop silicide- based prototype industrial components. The ultimate aim of the program is to work with industry to transfer the structural silicide materials technology to the private sector in order to promote international competitiveness in the area of advanced high temperature materials and important applications in major energy-intensive U.S. processing industries.
NTIS
Product Development; Corrosion Resistance; Intermetallics; Oxidation Resistance; Refractory Materials

19990028191 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Melting and casting of FeAl-based cast alloy
Sikka, V. K., Department of Energy, USA; Wilkening, D., Department of Energy, USA; Liebetrau, J., Department of Energy, USA; Mackey, B., Department of Energy, USA; Dec. 31, 1998; 25p; In English; Sponsored by Minerals, Metals and Materials Society, USA
Report No.(s): DE99-000372; ORNL/CP-98931; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The FeAl-based intermetallic alloys are of great interest because of their low density, low raw material cost, and excellent resistance to high- temperature oxidation, sulfidation, carburization, and molten salts. The applications based on these unique properties of FeAl require methods to melt and cast these alloys into complex-shaped castings and centrifugal cast tubes. This paper addresses the melting-related issues and the effect of chemistry on the microstructure and hardness of castings. It is concluded that the use of the Exo-Melt(trademark) process for melting and the proper selection of the aluminum melt stock can result in porosity-free castings. The FeAl alloys can be melted and cast from the virgin and revert stock. A large variation in carbon content of the alloys is possible before the precipitation of graphite flakes occurs. Titanium is a very potent addition to refine the grain size of castings. A range of complex sand castings and two different sizes of centrifugal cast tubes of the alloy have already been cast.
NTIS
Melting; Chemical Composition; Intermetallics; Iron Alloys; Aluminum Alloys

19990028270 Department of Energy, Office of Energy Research, Washington, DC USA
Monte Carlo model of Zener pinning which shows f(sup -1) dependence
Miodownik, M., Department of Energy, USA; Dec. 31, 1998; 6p; In English; 3rd; Grain Growth, USA
Report No.(s): DE98-004757; SAND-98-0951C; CONF-980645; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A novel Monte Carlo (MC) model of Zener pinning has been developed. It differs from previous MC models in that it does not simulate polycrystalline grain growth. Instead a single boundary moving through an array of particles is simulated. The boundary curvature defines the driving force acting on the boundary; this is constant throughout the simulation. by incrementally increasing the volume fraction of particles, the pinning force is gradually increased. The boundary is eventually pinned when driving force equals the pinning force. This defines the Zener criterion and enables the volume fraction dependence of the model to be determined. The value of this approach is that there is no limit imposed on either the volume fraction of particles or their size. Simulations have been carried out over a range of volume fractions, from 0 less than f less than 0.25 for particles with volumes

of 27 sites. The pinning force exerted by particles on a boundary is related to the characteristic shape during bypass, the so-called dimple. When the simulation temperature is T(prime) = 0, dimples are not formed, the boundaries experience an artificially strong pinning force and the model exhibits an f(sup -1/2) dependence. When T(prime) is greater than a critical value dimples are formed and the model shows an f(sup -1) volume fraction dependence. The implications of this result for previously MC models of Zener pinning is discussed.
NTIS
Monte Carlo Method; Grain Boundaries; Mathematical Models; Pinning; Crystal Growth

19990028278 Department of Energy, Washington, DC USA
Dosimetry in mixed neutron-gamma fields
Remec, I., Department of Energy, USA; Apr. 30, 1998; 11p; In English; Radiation Protection and Shielding: Technologies for the New Century, USA
Report No.(s): DE98-003384; ORNL/CP-96967; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The gamma field accompanying neutrons may, in certain circumstances, play an important role in the analysis of neutron dosimetry and even in the interpretation of radiation induced steel embrittlement. At the High Flux Isotope Reactor pressure vessel the gamma induced reactions dominate the responses of Np-237 and U-238 dosimeters, and Be-9 helium accumulation fluence monitors. The gamma induced atom displacement rate in steel is higher than corresponding neutron rate, and is the cause of 'accelerated embrittlement' of HFIR materials. In a large body of water, adjacent to a fission plate, photofissions contribute significantly to the responses of fission monitors and need to be taken into account if the measurements are used for the qualification of the transport codes and cross-section libraries.
NTIS
Neutrons; Gamma Rays; Dosimeters

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.

19990026852 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Self-assembled multilayers and photoluminescence properties of a new water- soluble poly(para-phenylene)
Shi, X., Department of Energy, USA; Li, D. Q., Department of Energy, USA; Luett, M., Department of Energy, USA; Fitzsimmons, M. R., Department of Energy, USA; VanPatten, G. P., Department of Energy, USA; Mar. 31, 1998; 8p; In English
Report No.(s): DE98-004389; LA-UR-97-4930; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This paper reports the synthesis and characterizations of a new water-soluble poly(para-phenylene) (PPP) and its applications in preparing self-assembled multilayer films. This new water-soluble conducting polymer was prepared through the sulfonation reaction of poly(p-quarterphen ylene-2,2'- dicarboxylic acid). The incorporation of sulfonate groups has dramatically improved PPP's solubility in water at a wide pH range, whereas previous PPP is only slightly soluble in basic solutions. Dilute aqueous solutions of this polymer with acidic, neutral or basic pH emit brilliant blue light while irradiated with UV light. The sulfonated PPP emits from 350 nm to 455 nm with a maximum intensity at 380 nm. Self-assembled multilayers of this sulfonated PPP were constructed with a positively charged polymer poly(diallyl dimethyl ammonium chloride) and characterized with various surface analyses. Conductive (RuO2) and ITO), semiconductive (Si wafer), and non-conductive (SiO2)) substrates were used in the preparation of self-assembled multilayers. Electrical, optical and structural properties of these novel self-assembled thin films will be discussed.
NTIS
Synthesis (Chemistry); Photoluminescence; Polyphenyls; Aqueous Solutions; Conducting Polymers; Thin Films

19990026892 Department of the Navy, Washington, DC USA
Thermoset Polymers from Inorganic Arylacetylenic Monomers
Bucca, Daniel, Inventor; Keller, teddy M., Inventor; Sep. 15, 1998; 11p; In English
Patent Info.: Filed 26 Jul. 96,; US-Patent-Appl-SN-687,700; US-Patent-5,807,953
Report No.(s): AD-D019204; No Copyright; Avail: US Patent and Trademark Office, Microfiche
The present invention is a thermoset having the repeating unit: R'- (Ae' -Ar'-M- Ar"-Ae")-R" where R' and R" are independently selected from the group consisting of hydrogen, unsubstituted alkyl groups, substituted alkyl groups, unsubstituted aryl

groups, and substituted aryl eroups, where Ae' and Ae" are independently selected groups with one or more unsaturated carbon-carbon bond and at least two crosslinking moieties, where Ar' and Ar" are independently selected substituted or unsubstituted aromatic diradicaLs, and where M has the structure containing silane, siloxane groups
DTIC
Polymerization; Plastics; Alkyl Compounds; Hydrocarbons; Molecular Structure; Carbon; Monomers

19990026994 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Investigation into the Presence of Fibre Materials in Ceramic Plates ***Final Report Onderzoek naar de Aanwezigheid van Vezelmaterialen in een Kogelwerende Plaat***
Duvalois, W., Prins Maurits Lab. TNO, Netherlands; Eerligh, R., Prins Maurits Lab. TNO, Netherlands; November 1998; 28p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A97/KL/498; TNO Proj. 214097376
Report No.(s): TD98-0295; PML-1998-A54; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., P.O. Box 45, 2280 AA Rijswiijk, The Netherlands), Hardcopy, Microfiche

The composition and morphology of the fibre material used in a ceramic plate were investigated. It proved to be made of aramide. Aramide belongs to a new generation of super strong fibre materials. However, under influence of mechanical forces, very small fibres are formed which can be inhaled. Because of the sizes, these small fibres are potential carcinogenic for humans. In this respect there is some resemblance with as- best fibres. With a normal use of the ceramic plates there is no danger for inhalation of aramide fibres. When the plates are damaged, it is possible. However it is unknown how much fibres will be present in the air after damaging the plate.
Author
Research; Fibers; Ceramics

19990027066 American Chemical Society, Washington, DC USA
Microstructure and Microtribology of Polymer Surfaces ***Final Report, 1 Apr. - 30 Nov. 1998***
Wahl, Kathryn; Nov. 30, 1998; 3p; In English
Contract(s)/Grant(s): F49620-98-1-0160; AF Proj. 2303
Report No.(s): AD-A359621; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The symposium provided for the latest results from investigations of micromechanical and tribological properties of polymeric materials: polymers, polymer composites, coatings, ultrathin films, and molecular layers. The major focus of this symposium was on the relationship between microstructural, micromechanical, and tribological properties of polymeric materials and on bridging the gap between microstructural and macroscopic surface properties. Industrial applications of polymeric materials in wear intensive processes were considered in several invited talks.
DTIC
Conferences; Polymers; Tribology; Microstructure; Micromechanics

19990027124 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
CFCC working group meeting: Proceedings
Dec. 31, 1997; 368p; In English, USA
Report No.(s): DE98-006501; DOE/ORO-2060; ORNL/M-6538; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report is a compilation of the vugraphs presented at this meeting. Presentations covered are: CFCC Working Group; Overview of study on applications for advanced ceramics in industries for the future; Design codes and data bases: The CFCC program and its involvement in ASTM, ISO, ASME, and military handbook 17 activities; CFCC Working Group meeting (McDermott Technology); CFCC Working Group meeting (Textron); CFCC program for DMO materials; Developments in PIP-derived CFCCs; Toughened Silcomp (SiC-Si) composites for gas turbine engine applications; CFCC program for CVI materials; Self-lubricating CFCCs for diesel engine applications; Overview of the CFCC program's supporting technologies task; Life prediction methodologies for CFCC components; Environmental testing of CFCCs in combustion gas environments; High-temperature particle filtration ORNL/DCC CRADA; HSCT CMC combustor; and Case study -- CFCC shroud for industrial gas turbines.
NTIS
Conferences; Ceramic Matrix Composites; Computer Aided Design; Computer Programs

19990027142 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Geothermal heat pump grouting materials

Allan, M., Department of Energy, USA; Dec. 31, 1998; 9p; In English; 16th; Geothermal Program Review, USA

Report No.(s): DE98-007303; BNL-65676; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The thermal conductivity of cementitious grouts has been investigated in order to determine suitability of these materials for grouting vertical boreholes used with geothermal heat pumps. The roles of mix variables such as water/cement ratio, sand/cement ratio and superplasticizer dosage were measured. The cement-sand grouts were also tested for rheological characteristics, bleeding, permeability, bond to HDPE pipe, shrinkage, coefficient of thermal expansion, exotherm, durability and environmental impact. This paper summarizes the thermal conductivity, permeability, bonding and exotherm data for selected cementitious grouts. The theoretical reduction in bore length that could be achieved with the BNL-developed cement-sand grouts is examined. Finally, the FY 98 research and field trials are discussed.

NTIS

Grout; Thermal Conductivity; Heat Pumps; Geothermal Technology; Cements; Boreholes

19990027190 Department of Energy, Washington, DC USA

Thin teflon-like films for MEMS: Film properties and reliability studies

Smith, B. K., Department of Energy, USA; LaVigne, G., Department of Energy, USA; Sniegowski, J. J., Department of Energy, USA; Brown, C. D., Department of Energy, USA; Dec. 31, 1998; 11p; In English; Micromachining and microfabrication, USA

Report No.(s): DE98-003931; SAND-98-0109C; CONF-980918; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This work presents film properties and initial reliability studies for thin Teflon-like films applied to a unique test vehicle, the Sandia-designed and fabricated microengine. Results on microengines coated with the film show a factor of three improvement in their lifetime and an order of magnitude reduction in the coefficient of friction when compared to uncoated samples. Coefficients of Friction (COF) of 0.07 for the Teflon-like film and 1.0 for uncoated samples are extracted from models which match the measured behavior of working microengines. These films, deposited form a plasma source, exhibit the ability to penetrate into very narrow, deep channels common to many MEMS devices. For as-deposited film, both the refractive index at 1.4 and the contact angle with water at 108 deg show the film to be very similar to bulk Teflon PTFE. Film stability as a function of temperature has been examined using Fourier Transformation Infrared (FTIR) spectroscopy. The film structure as observed by the fluorine-carbon (F-C) peak is stable up to 200 C, but starts decomposing above 250 C. Film composition has been examined using X-ray surfaces compared with deep, narrow channels where the deposition process is diffusion limited.

NTIS

Thin Films; Teflon (Trademark); Microelectromechanical Systems; Reliability; Test Vehicles

19990027191 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Polymerization of bis(triethoxysilyl)ethenes. The impact of substitution geometry on the formation of ethenyl- and vinylidene-bridged polysilsesquioxanes

Carpenter, J. P., Department of Energy, USA; Yamanaka, S. A., Department of Energy, USA; McClain, M. D., Department of Energy, USA; Loy, D. A., Department of Energy, USA; Greaves, J., Department of Energy, USA; Dec. 31, 1998; 3p; In English; Sponsored by American Chemical Society, USA

Report No.(s): DE98-003932; SAND-98-0539C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Preparation of organically-bridged polysilsesquioxanes has been achieved by polymerizing organic monomers with two or more trialkoxysilyl groups per monomer repeat unit. The nature of the organic bridging group has been shown to strongly impact the final properties (surface area, pore size, and thermal stability) of the end product. For example, rigid arylene bridging groups have been shown to give rise to materials with high surface areas with a relatively large contribution from micropores (< 20 (angstrom)). The length of alkylene- bridging groups can be used to control the size and dispersity of pores in hydrocarbon-bridged xerogels. In this study, the authors have examined the preparation of ethylene-bridged polysilsesquioxanes from the E-(1) and Z-(2) isomers of 1,2-bis(triethoxysilyl)ethene and vinylidene-bridged polysilsesquioxanes from 1,1-bis(triethoxysilyl)ethene-(3). This study was intended to determine the effects of substitution geometry about the carbon-carbon double bond on the condensation chemistry of the monomers and on the resulting architectures of the final materials.

NTIS

Polymerization; Ethylene; Vinylidene; Chemical Bonds

19990027216 Department of Energy, Washington, DC USA

Safe epoxy encapsulant for high voltage magnetics

Sanchez, R. O., Department of Energy, USA; Archer, W. E., Department of Energy, USA; Jan. 31, 1998; 9p; In English; 18th; Capacitor and resistor technology, USA

Report No.(s): DE98-002729; SAND-98-0217C; CONF-980324; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes the use of Formula 456, an aliphatic amine cured epoxy for impregnating coils and high voltage transformers. Sandia has evaluated a number of MDA-free epoxy encapsulants which relied on either anhydride or other aromatic amine curing agents. The use of aliphatic amine curing agents was more recently evaluated and has resulted in the definition of Formula 456 resin. Methylene dianiline (MDA) has been used for more than 20 years as the curing agent for various epoxy formulations throughout the Department of Energy and much of industry. Sandia National Laboratories began the process of replacing MDA with other formulations because of regulations imposed by OSHA on the use of MDA. OSHA has regulated MDA because it is a suspect carcinogen. Typically the elimination of OSHA-regulated materials provides a rare opportunity to qualify new formulations in a range of demanding applications. It was important to take full advantage of that opportunity, although the associated materials qualification effort was costly. Small high voltage transformers are one of those demanding applications. The successful implementation of the new formulation for high reliability transformers will be described. The test results that demonstrate the parts are qualified for use in DOE weapon systems will be presented.

NTIS

Epoxy Resins; Encapsulating; Magnetic Materials; High Voltages; Transformers

19990027350 Department of Energy, Office of Energy Research, Washington, DC USA

X-ray induced insulator-metal transitions in CMR manganites

Kiryukhin, V., Department of Energy, USA; Casa, D., Department of Energy, USA; Keimer, B., Department of Energy, USA; Hill, J. P., Department of Energy, USA; Vigliante, A., Department of Energy, USA; Dec. 31, 1997; 14p; In English; Sponsored by Materials Research Society, USA

Report No.(s): DE98-004628; BNL-65316; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this work the authors report a study of the photoinduced insulator-to- metal transition in manganese oxide perovskites of the formula Pr(1-x) Ca(x)MnO3. The transition is closely related to the magnetic field induced insulator-to-metal transition (CMR effect) observed in these materials. It is accompanied by a dramatic change in the magnetic properties and lattice structure: the material changes from an insulating charge-ordered canted antiferromagnet to a ferromagnetic metal. The authors present an investigation of the transport and structural properties of these materials over the course of the transition (which usually takes about an hour to complete). The current- voltage characteristics exhibited by the material during the transition are highly nonlinear, indicating a large inhomogeneity of the transitional state. Possible practical applications of this novel type of transition are briefly discussed. They also report a high resolution X-ray diffraction study of the charge ordering in these materials. The temperature dependent charge ordering structure observed in these compounds is more complex than previously reported.

NTIS

Calcium Oxides; Manganese Oxides; Phase Transformations; X Rays; Insulators; Research; Ferromagnetic Materials; Inhomogeneity; Metal Oxides; Perovskites

19990027440 NYMA, Inc., Brook Park, OH USA

Joining of Silicon Carbide-Based Ceramic Materials for High Temperature Applications

Singh, Mrityunjay, NYMA, Inc., USA; Journal of Thermal Technology: Industrial Heating; September 1997; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-27186; RTOP 274-00-00; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Joining of high temperature silicon carbide-based ceramics has been a critical issue for their successful application. An affordable, robust technique for joining silicon carbide-based ceramics has been developed and is capable of producing joints that can be tailored for thickness and composition. These joints maintain their mechanical strength up to 1350 C (2462 F) in air. This technique is suitable for the joining of large and complex shaped ceramic components and can be extended to the repair of these materials.

Author

Silicon Carbides; High Temperature; Ceramics

19990027467 NASA Lewis Research Center, Cleveland, OH USA

Diffusion Barriers to Increase the Oxidative Life of Overlay Coatings

Nesbitt, James A., NASA Lewis Research Center, USA; Lei, Jih-Fen, Army Research Lab., USA; 1999; 14p; In English; 3rd; High Temperature Coatings, 28 Feb. - 4 Mar. 1999, San Diego, CA, USA; Sponsored by Metallurgical Society, USA

Contract(s)/Grant(s): RTOP 523-21-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Currently, most blades and vanes in the hottest section of aero gas turbine engines require some type of coating for oxidation protection. Newly developed single crystal superalloys have the mechanical potential to operate at increasingly higher component temperatures. However, at these elevated temperatures, coating/substrate interdiffusion can shorten the protective life of the coating. Diffusion barriers between overlay coatings and substrates are being examined to extend the protective life of the coating. A previously- developed finite-difference diffusion model has been modified to predict the oxidative life enhancement due to use of a diffusion barrier. The original diffusion model, designated COSIM, simulates Al diffusion in the coating to the growing oxide scale as well as Al diffusion into the substrate. The COSIM model incorporates an oxide growth and spalling model to provide the rate of Al consumption during cyclic oxidation. Coating failure is predicted when the Al concentration at the coating surface drops to a defined critical level. The modified COSIM model predicts the oxidative life of an overlay coating when a diffusion barrier is present eliminating diffusion of Al from the coating into the substrate. Both the original and the modified diffusion models have been used to predict the effectiveness of a diffusion barrier in extending the protective life of a NiCrAl overlay coating undergoing cyclic oxidation at 1100 C.

Author

Diffusion; Oxidation; Protective Coatings; Heat Resistant Alloys; Gas Turbine Engines

19990027558 National Inst. for Fusion Science, Toki, Japan

Boronization in Future Devices Protecting Layer Against Tritium and Energetic Neutrals

Noda, N., National Inst. for Fusion Science, Japan; Tsuzuki, K., National Inst. for Fusion Science, Japan; Sagara, A., National Inst. for Fusion Science, Japan; Inoue, N., National Inst. for Fusion Science, Japan; Muroga, T., National Inst. for Fusion Science, Japan; Jul. 1998; ISSN 0915-633X; 12p; In English; 13th; Plasma Surface Interactions in Controlled Fusion Devices, May 1998, San Diego, CA, USA

Report No.(s): NIFS-553; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A thin boron film is attractive as a deuterium/tritium free wall, and as a protecting layer against impact of energetic charge-exchange neutrals in future fusion devices with a long-time operation. New experimental evidences are given for desorption of hydrogen isotopes at relatively low temperature. All hydrogen atoms in a boron-coated layer are reemitted to the plasma side below 400 C without their penetration into substrate of stainless steel. A problem is maintainability of a thin boron layer during a long-time operation. Boron atoms are hardy removed by pumping because its hydrides are easily disintegrated and redeposited. Gross immigration of boron atoms inside the vessel is a concern. A condition required for avoiding the immigration is discussed.

Author

Boron; Tritium; Plasmas (Physics); Deuterium; Charge Transfer; Hydrogen Atoms; Hydrogen Isotopes; Hydrides

19990027573 NASA Lewis Research Center, Cleveland, OH USA

Tailoring Silicon Oxycarbide Glasses for Oxidative Stability

Hurwitz, F. I., NASA Lewis Research Center, USA; Meador, M. A. B., NASA Lewis Research Center, USA; Journal of Sol Gel Science and Technology; [1997]; 26p; In English

Contract(s)/Grant(s): RTOP 523-21-13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Blackglas(Trademark) polysiloxane systems produce silicon oxycarbide glasses by pyrolysis in inert atmosphere. The silicon oxycarbides evidence oxidative degradation that limits their lifetime as composite matrices. The present study characterizes bonding rearrangements in the oxycarbide network accompanying increases in pyrolysis temperature. It also addresses the changes in susceptibility to oxidation due to variations in the distribution of Si bonded species obtained under different processing conditions. The study is carried out using Si-29 nuclear magnetic resonance (NMR) spectroscopy and a design of experiments approach to model the oxidation behavior. The NMR results are compared with those obtained by thermogravimetric analysis (TGA). Samples pyrolyzed under inert conditions are compared to those pyrolyzed in reactive ammonia environments.

Author

Silicon Isotopes; Glass; Oxidation; Polysiloxanes; Stability; Thermogravimetry; Silicon

19990027624 Department of Energy, Office of Energy Research, Washington, DC USA

Enhanced supercurrents above 100 K in mercury cuprates via fission of mercury

Krusin-Elbaum, L., Department of Energy, USA; Petrov, D. K., Department of Energy, USA; Lopez, D., Department of Energy, USA; Thompson, J. R., Department of Energy, USA; Wheeler, W., Department of Energy, USA; May 31, 1998; 12p; In English; 8th; US/Japan High Temperature Superconductivity, USA

Report No.(s): DE98-005582; ORNL/CP-98138; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Large-scale technological success of high-temperature superconductors will ultimately be decided by their capacity to sustain large critical current densities J(sub c) in high magnetic fields. There are two principal factors controlling current conduction. One is regions of weaker superconductivity (weak links) at the grain boundaries in polycrystalline materials. Another is easy motion of magnetic vortices in the bulk -- the result being energy dissipation and losses. Each of these factors is a challenge to overcome, for their origin is intrinsic: i.e. short superconducting coherence length (xi), large anisotropy, large thermal fluctuations (related to high transition temperature T(sub c)), and perhaps even a d-wave character of the superconducting ground state. For these reasons, in spite of the highest T(sub c)'s (alpha amp; amp greater than 130 K), mercury cuprates HgBa2Ca(n-1)Cu(n)O(2n + 2) + (delta) with n = 1, 2 or 3 adjacent CuO layers (Hg-1201, 01212, or -1223) still have relatively low-lying irreversibility lines (suppressed by a strong 2- D nature of the vortex structure), above which J(sub c) vanishes. Here, the authors demonstrate a method by which they expand the useful range to T > 100 K (higher than in Y-, Bi-, or Tl-based materials) and boost J(sub c) by orders of magnitude in fields of several Tesla -- namely fission of Hg nuclei within Hg- cuprates with energetic (0.8 GeV) protons. This technologically viable process allows doping these cuprates with strongly pinning columnar defects.

NTIS

Mercury Oxides; Fission; Full Scale Tests; High Temperature Superconductors; Superconductivity

19990027636 Department of Energy, Washington, DC USA

Atomic-scale properties of semiconductor heterostructures probed by scanning tunneling microscopy

Yu, E. T., Department of Energy, USA; Zuo, S. L., Department of Energy, USA; Bi, W. G., Department of Energy, USA; Tu, C. W., Department of Energy, USA; Biefeld, R. M., Department of Energy, USA; May 31, 1998; 11p; In English; Innovative materials in advanced energy technologies, USA

Report No.(s): DE98-005465; SAND-98-1035C; CONF-980604; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The engineering of advanced semiconductor heterostructure materials and devices requires a detailed understanding of, and control over, the structure and properties of semiconductor materials and devices at the atomic to nanometer scale. Cross-sectional scanning tunneling microscopy has emerged as a unique and powerful method to characterize structural morphology and electronic properties in semiconductor epitaxial layers and device structures at these length scales. The basic experimental techniques in cross-sectional scanning tunneling microscopy are described, and some representative applications to semiconductor heterostructure characterization drawn from recent investigations in the authors laboratory are discussed. Specifically, they describe some recent studies of InP/InAsP and InAsP/InAsSb heterostructures in which nanoscale compositional clustering has been observed and analyzed.

NTIS

Atomic Physics; Characterization; Control Systems Design; Scanning Tunneling Microscopy; Semiconductors (Materials)

19990027637 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Continuous fiber ceramic composites for energy related applications ***Final Report***

Apr. 07, 1998; 95p; In English

Report No.(s): DE98-006281; DOE/CE/40992-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The US Department of Energy has established the Continuous Fiber Ceramic Composites (CFCC) program to develop technology for the manufacture of CFCC's for use in industrial applications where a reduction in energy usage or emissions could be realized. As part of this program, the Dow Chemical Company explored the manufacture of a fiber reinforced/self reinforced silicon nitride for use in industrial chemical processing. In Dow's program, CFCC manufacturing technology was developed around traditional, cost effective, tape casting routes. Formulations were developed and coupled with unique processing procedures which enabled the manufacture of tubular green laminates of the dimension needed for the application. An evaluation of the effect of various fibers and fiber coatings on the properties of a fiber reinforced composites was also conducted. Results indicated that fiber coatings could provide composites exhibiting non-catastrophic failure and substantially improved toughness. However, an evaluation of these materials in industrial process environments showed that the material system chosen by Dow

did not provide the required performance improvements to make replacement of current metallic components with CFCC components economically viable.
NTIS
Ceramic Matrix Composites; Fiber Composites

19990027674 Northwestern Univ., Dept. of Materials Science and Engineering, Evanston, IL USA
Recent Advances in the Synthesis and Properties of Amorphous and Crystalline Carbon Nitride
Zhou, Beizhi, Northwestern Univ., USA; Chung, Yip-Wah, Northwestern Univ., USA; Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering; November 1998; Volume 21, No. 6, pp. 691-700; In English; See also 19990027670
Contract(s)/Grant(s): F49620-95-1-0384; NSF CMS-95-20636; NSF DMR-96-32472; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

As a result of the prediction by Liu and Cohen that crystalline beta-C3N4 has mechanical properties similar to diamond, many research groups have attempted to synthesize carbon nitride using various deposition techniques. Most groups succeeded in producing amorphous carbon nitride coatings. These coatings, though softer than diamond, display excellent tribological properties and are now used as protective overcoats for computer hard drive systems. The lack of success to make crystalline coatings, suggests that beta-C3N4 is metastable. Using TiN(111) and ZrN(111) as seeding layers (which have similar lattice symmetry and commensurate unit cell dimensions as beta-C3N4(0001), we were able to synthesize fully crystalline carbon nitride composite coatings with hardness in the 50 GPa range, which is in the low end of diamond films.
Author
Amorphous Materials; Crystallinity; Mechanical Properties; Coatings; Synthesis (Chemistry); Carbon Compounds; Nitrides; Thin Films; Magnetron Sputtering

19990027828 NYMA, Inc., Cleveland, OH USA
Microstructure and Mechanical Properties of Reaction-Formed Joints in Reaction Bonded Silicon Carbide Ceramics
Singh, M., NYMA, Inc., USA; Journal of Materials Science; 1998; ISSN 0022-2461; Volume 33, pp. 5781-5787; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A reaction-bonded silicon carbide (RB-SiC) ceramic material (Carborundum's Cerastar RB-SIC) has been joined using a reaction forming approach. Microstructure and mechanical properties of three types of reaction-formed joints (350 micron, 50-55 micron, and 20-25 micron thick) have been evaluated. Thick (approximately 350 micron) joints consist mainly of silicon with a small amount of silicon carbide. The flexural strength of thick joints is about 44 plus or minus 2 MPa, and fracture always occurs at the joints. The microscopic examination of fracture surfaces of specimens with thick joints tested at room temperature revealed the failure mode to be typically brittle. Thin joints (less than 50-55 micron) consist of silicon carbide and silicon phases. The room and high temperature flexural strengths of thin (less than 50-55 micron) reaction-formed joints have been found to be at least equal to that of the bulk Cerastar RB-SIC materials because the flexure bars fracture away from the joint regions. In this case, the fracture origins appear to be inhomogeneities inside the parent material. This was always found to be the case for thin joints tested at temperatures up to 1350C in air. This observation suggests that the strength of Cerastar RB-SIC material containing a thin joint is not limited by the joint strength but by the strength of the bulk (parent) materials.
Author
Flexural Strength; High Temperature; Microstructure; Silicon Carbides; Reaction Bonding; Ceramics; Joints (Junctions); Fractures (Materials)

19990027847 Texas Univ., Dept. of Botany, Austin, TX USA
Atomic and Molecular Imaging of Adhesive Molecules ***Final Report, 1 May 1995 - 30 Apr. 1998***
Brown, Malcom, Jr.; Jan. 29, 1999; 6p; In English
Contract(s)/Grant(s): N00014-95-1-0933
Report No.(s): AD-A359782; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We developed new approaches with high resolution transmission electron microscopy in order to image beam-labile molecular structures which are important to the Navy in biofouling. In particular, we studied the adhesive components of two important marine biofoulers, Achnanthes and Stauronesis. We found interesting molecular structures which may contribute to the attachment of these diatoms to substrates such as ship and submarine surfaces. We produced a dichotomous key to help assess and describe in an objective way the complex molecular structures observed. We studied the effects of electron beam irradiation of the samples and learned that the uranyl acetate negative stain "protects" the samples from degradation during irradiation. These

studies will augment x-ray crystallographic investigations in understanding the structural basis for unwanted molecular adhesion which is so common in the marine environment.
DTIC
Adhesives; Molecules; Imaging Techniques; Molecular Structure; Fouling; Atomic Structure; Atoms

19990027885 NASA Ames Research Center, Moffett Field, CA USA
Advanced Porous Coating for Low-Density Ceramic Insulation Materials
Leiser, Daniel B., NASA Ames Research Center, USA; Churchward, Rex, NASA Ames Research Center, USA; Katvala, Victor, NASA Ames Research Center, USA; Stewart, David, NASA Ames Research Center, USA; Balter, Aliza, Eloret Corp., USA; Journal of the American Ceramic Society; 1998; Volume 72, No. 6, pp. 1003-1010; In English; 12th; Composites and Advanced Ceramics, 19 Jan. 1988, Cocoa Beach, FL, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The need for improved coatings on low-density reusable surface insulation (RSI) materials used on the space shuttle has stimulated research into developing tougher coatings. The processing of a new porous composite ”coating” for RST called toughened unipiece fibrous insulation Is discussed. Characteristics including performance in a simulated high-speed atmospheric entry, morphological structure before and after this exposure, resistance to Impact, and thermal response to a typical heat pulse are described. It is shown that this coating has improved impact resistance while maintaining optical and thermal properties comparable to the previously available reaction-cured glass coating.
Author
Ceramics; Glass Coatings; Insulation; Reusable Heat Shielding; Space Shuttles; Temperature Effects; Thermodynamic Properties; Ceramic Matrix Composites; Impact Resistance; Thermal Insulation

19990027915 NASA Marshall Space Flight Center, Huntsville, AL USA
Photonic and Opto-Electronic Applications of Polydiacetylene Films Photodeposited from Solution and Polydiacetylene Copolymer Networks
Paley, Mark S., Universities Space Research Association, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; Smith, David D., NASA Marshall Space Flight Center, USA; Witherow, William K., NASA Marshall Space Flight Center, USA; Addeldeyem, Hossin A., Universities Space Research Association, USA; Wolfe, Daniel B., Rice Univ., USA; 1998; 8p; In English, 16 Apr. 1998, Orlando, FL, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Polydiacetylenes (PDAS) are attractive materials for both electronic and photonic applications because of their highly conjugated electronic structures. They have been investigated for applications as both one-dimensional (linear chain) conductors and nonlinear optical (NLO) materials. One of the chief limitations to the use of PDAs has been the inability to readily process them into useful forms such as films and fibers. In our laboratory we have developed a novel process for obtaining amorphous films of a PDA derived from 2-methyl4-nitroaniline using photodeposition with Ultraviolet (UV) light from monomer solutions onto transparent substrates. Photodeposition from solution provides a simple technique for obtaining PDA films in any desired pattern with good optical quality. This technique has been used to produce PDA films that show potential for optical applications such as holographic memory storage and optical limiting, as well as third-order NLO applications such as all-optical refractive index modulation, phase modulation and switching. Additionally, copolymerization of diacetylenes with other monomers such as methacrylates provides a means to obtain materials with good processibility. Such copolymers can be spin cast to form films, or drawn by either melt or solution extrusion into fibers. These films or fibers can then be irradiated with UV to photopolymerize the diacetylene units to form a highly stable cross-linked PDA-copolymer network. If such films are electrically poled while being irradiated, they can achieve the asymmetry necessary for second-order NLO applications such as electro-optic switching. On Earth, formation of PDAs by the above mentioned techniques suffers from defects and inhomogeneities caused by convective flows that can arise during processing. by studying the formation of these materials in the reduced-convection, diffusion-controlled environment of space we hope to better understand the factors that affect their processing, and thereby, their nature and properties. Ultimately it may even be feasible to conduct space processing of PDAs for technological applications.
Author
Copolymerization; Deposition; Polyacetylene; Space Processing; Amorphous Materials; Langmuir-Blodgett Films; Polymeric Films

19990027941 New Mexico Univ., Dept. of Mechanical Engineering, Albuquerque, NM USA

Experimental and Numerical Investigations on Failure Mechanisms in Fiber-Reinforced Ceramics ***Final Report, 1 Aug. 1996 - 30 Jun. 1998***

Schreyer, H. L.; Wang, M. L.; Jan. 29, 1999; 51p; In English

Contract(s)/Grant(s): F49620-95-1-0262; AF Proj. 2302

Report No.(s): AD-A360445; AFRL-SR-BL-TR-99-0056; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The primary focus on this research was to model the evolution of microcracks at the interfaces of grains and inclusions in quasibrittle materials. Several unique aspects have been developed as part of the research. These include the application of the material point method to a new class of problems and the formulation of a thermodynamically-based decohesion constitutive equation. In addition, numerical algorithms were formulated to handle three-dimensional problems, to include the effects of randomness of grain sizes and of the strength of cement paste, and to take into account boundary constraints. Each of these aspects represent new or extensive improvements to the approaches available at the time the research was initiated.

DTIC

Failure; Fiber Composites; Ceramic Matrix Composites; Microcracks; Numerical Analysis

19990027946 NASA Lewis Research Center, Cleveland, OH USA

Surface Design and Engineering Toward Wear Resistant Self Lubricating Diamond Films and Coatings

Miyoshi, Kazuhisa, NASA Lewis Research Center, USA; Surface Engineering: Science and Technology I; 1999, pp. 307-317; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The tribological properties of chemical-vapor-deposited (CVD) diamond films vary with the environment, possessing a Jekyll-and-Hyde character. CVD diamond has low coefficient of friction and high wear resistance in air but high coefficient of friction and low wear resistance in vacuum. Improving the tribological functionality of materials (such as achieving low friction and good wear resistance) was an aim of this investigation. Three studies on the surface design, surface engineering, and tribology of CVD diamond have shown that its friction and wear are significantly reduced in ultrahigh vacuum. The main criteria for judging whether diamond films are an effective wear-resistant, self-lubricating material were coefficient of friction and wear rate, which must be less than 0.1 and on the order of 10(exp -6) cubic mm/ N*m, respectively. In the first study the presence of a thin film (less than 1 micron thick) of amorphous, nondiamond carbon (hydrogenated carbon, also called diamondlike carbon or DLC) on CVD diamond greatly decreased the coefficient of friction and the wear rate. Therefore, a thin DLC film on CVD diamond can be an effective wear-resistant, lubricating coating in ultrahigh vacuum. In the second study the presence of an amorphous, nondiamond carbon surface layer formed on CVD diamond by ion implantation significantly reduced the coefficient of friction and the wear rate in ultrahigh vacuum. Therefore, such surface layers are acceptable for effective self-lubricating, wear-resistant applications of CVD diamond. In the third study CVD diamond in contact with cubic boron nitride exhibited low coefficient of friction in ultrahigh vacuum. Therefore, this materials combination can provide an effective self-lubricating, wear-resistant couple in ultrahigh vacuum.

Author

Carbon; Diamond Films; Diamonds; Lubrication; Self Lubricating Materials; Thin Films; Tribology; Ultrahigh Vacuum; Vapor Deposition; Wear Resistance; Sliding Friction

19990027947 NASA Lewis Research Center, Cleveland, OH USA

Determination of Creep Behavior of Thermal Barrier Coatings Under Laser Imposed High Thermal and Stress Gradient Conditions

Zhu, Dongming, NASA Lewis Research Center, USA; Miller, Robert A., NASA Lewis Research Center, USA; Journal of Materials Research; January 1999; Volume 14, No. 1, pp. 146-161; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A laser sintering/creep technique has been established to determine the creep behavior of thermal barrier coatings under steady-state high heat flux conditions. For a plasma sprayed zirconia-8 wt. % yttria coating, a significant primary creep strain and a low apparent creep activation energy were observed. Possible creep mechanisms involved include stress induced mechanical sliding and temperature and stress enhanced cation diffusion through the splat and grain boundaries. The elastic modulus evolution, stress response, and total accumulated creep strain variation across the ceramic coating are simulated using a finite difference approach. The modeled creep response is consistent with experimental observations.

Author

Activation Energy; Ceramic Coatings; Creep Properties; Finite Difference Theory; Modulus of Elasticity; Thermal Control Coatings; Zirconium Oxides; Yttrium Oxides; Plasma Spraying; Stress Distribution; Cracking (Fracturing); Sintering

19990028171 Indiana Univ., Indianapolis, IN USA

Fluid Mechanics and Rheology of Fluid Fiber Flows: Fundamental Science and Technological Applications ***Final Report, 1 Apr. 1996 - 31 Dec. 1998***

Wang, Qi; Jan. 03, 1999; 7p; In English

Contract(s)/Grant(s): F49620-96-1-0131

Report No.(s): AD-A360428; AFRL-SR-BL-TR-99-0058; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research activities are focused on modeling of polymeric liquid crystal (LCP) flows. We first summarizes our comprehensive studies on the shear and elongational flow with an imposed velocity field. This includes a complete characterization of the orientational equilibrium and their bifurcation behavior as well as the detailed study on the orientation dynamics with respect to both types of flows. In particular, biaxial patterns and their dynamics are treated carefully. We then report on the work on the modeling of fiber spinning processes of thermotropic liquid crystal polymers, where new models along with an extensive study for fiber flows of thermotropic liquid crystals are presented. The study on the influence of microstructure on the capillary instability of liquid crystal jets follows. Finally, we report on some long wave stability analysis for ideal liquid jets of LCPs and the progress on some ongoing projects.

DTIC

Fluid Flow; Fluid Jets; Gas Jets; Ideal Gas; Liquid Crystals; Rheology; Stability Tests

19990028186 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Production of strontium sulfide coatings by metal organic chemical vapor deposition

Moss, T. S., Department of Energy, USA; Dye, R. C., Department of Energy, USA; Tuenge, R. T., Department of Energy, USA; Dec. 31, 1998; 7p; In English; Sponsored by Materials Research Society, USA

Report No.(s): DE99-000704; LA-UR-98-1974; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This work was focused on the MOCVD of the cerium-doped strontium sulfide (SRS:Ce) phosphor for use in thin film electroluminescent displays (TFELs). Following previous research on a small scale reactor, a feasibility scale-up using a commercially available reactor enlarged the size of the deposition area to a 4 in. diameter wafer or a 2 in x 2 in. glass slide. Films were deposited from the reaction of SR(thd)(sub 2), Ce(thd)(sub 4), and H2S at 450 C and 5 torr. This system employed a liquid delivery system for the accurate and repeatable delivery of the metal organic reagents. The deposition from this reactor was shown to be crystalline-as-deposited SRS with a (200) orientation, possibly a result of the thin nature of the coating and the involvement of (200) grains in the initial nucleation process. The wafers showed good uniformity, but had some thickness variation near the outer radius of the wafer resulting from the addition of H(sub 2)S from the outer edge. There were eighteen total deposition experiments, of which nine were characterized for EL performance. The highest brightness observed was 5 fL.. The samples were exceedingly thin as a result of the fifteen fold increase in the surface area between the deposition reactors. Increasing the sample thickness to 7,000 A or higher will dramatically increase the brightness of the emission.

NTIS

Strontium Sulfides; Coating; Manufacturing; Deposition; Doped Crystals; Metalorganic Chemical Vapor Deposition

19990028189 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA

Heterogeneous oxidative and polymerization processes

Tumas, W., Department of Energy, USA; Ott, K., Department of Energy, USA; Baker, R. T., Department of Energy, USA; Dec. 31, 1998; 5p; In English

Report No.(s): DE99-000553; LA-UR-98-1873; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). We performed experiments directed at understanding novel catalysts and the use of supercritical carbon dioxide as a reaction medium for catalytic reactions. We participated in program development activities with individual companies and with trade organizations to develop research and funding strategies for catalysis on a national level. This work has helped to identify scientific and technological opportunities for catalysis research in industry and for large national initiatives such as global climate change. Our work has poised the Laboratory to participate in a spectrum of activities where catalysis science and technology will play a role.

NTIS

Research and Development; Technologies; Experimentation; Carbon Dioxide; Catalysts

19990028204 Department of Energy, Washington, DC USA

Chemical solution deposition of SRBi2Ta2O9 SBT films for non-volatile memory applications

Lakeman, C. D. E., Department of Energy, USA; Boyle, T. J., Department of Energy, USA; Ruffner, J. A., Department of Energy, USA; Rodriguez, M. A., Department of Energy, USA; Mar. 31, 1998; 11p; In English; 10th; Integrated ferroelectrics, USA
Report No.(s): DE98-003352; SAND-98-0708C; CONF-980344; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

SRBi2Ta2O9 SBT films have received considerable attention for use as non-volatile memory elements. The authors have developed a process to prepare SBT films with good ferroelectric properties at low temperatures. In this paper, they will present strategies used to optimize the properties of the films including film composition, the nature of the substrate (or bottom electrode) used, and the thermal processing cycle. Under appropriate conditions, approximately 1,700 angstrom films can be prepared which have a large switchable polarization (2P(sub r) > 10(micro)C/sq cm, and an operating voltage (le) 2.0 V.
NTIS

Deposition; Memory (Computers); Strontium Compounds; Bismuth Compounds; Tantalum Oxides; Computer Storage Devices

19990028207 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Comparison of three work of adhesion measurements

Emerson, J. A., Department of Energy, USA; O'Toole, E., Department of Energy, USA; Zamora, D., Department of Energy, USA; Poon, B., Department of Energy, USA; Feb. 28, 1998; 5p; In English; 21st, USA; Sponsored by Adhesion Society, Inc., USA
Report No.(s): DE98-003341; SAND-98-0617C; CONF-980222; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Practical work of adhesion measurements are being studied for several types of polymer/metal combinations in order to obtain a better understanding of the adhesive failure mechanisms for systems containing encapsulated and bonded components. The primary question is whether studies of model systems can be extended to systems of technological interest. The authors report on their first attempts to obtain the work of adhesion between a PDMS polymer and stainless steel. The work of adhesion measurements were made using three techniques -- contact angle, adhesive fracture energy at low deformation rates and JKR. Previous work by Whitesides' group show a good correlation between JKR and contact angle measurements for PDMS. Their initial work focused on duplicating the PDMS measurements of Chaudury. In addition, in this paper the authors extend the work of adhesion measurement to third technique -- interfacial failure energy. The ability to determine the reversible work of adhesion for practical adhesive joints allows understanding of several issues that control adhesion: surface preparation, nature of the interphase region, and bond durability.
NTIS

Adhesion; Adhesive Bonding; Adhesives; Comparison

19990028247 DYNACS Engineering Co., Inc., Brook Park, OH USA

Affordable, Robust Ceramic Joining Technology (ARCJoinT) for High Temperature Applications

Singh, M., DYNACS Engineering Co., Inc., USA; 1998; 5p; In English; Joining of Advanced and Specialty Materials, 12-15 Oct. 1998, Rosemont, AL, USA; Sponsored by American Society for Microbiology, USA
Contract(s)/Grant(s): RTOP 274-00-00; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Ceramic joining is recognized as one of the enabling technologies for the successful utilization of silicon carbide-based monolithic ceramic and fiber reinforced composite components in a number of demanding and high temperature applications in aerospace and ground-based systems. An affordable, robust ceramic joining technology (ARCJoinT) for joining of silicon carbide-based ceramics and fiber reinforced composites has been developed. This technique is capable of producing joints with tailorable thickness and composition. A wide variety of silicon carbide-based ceramics and composites, in different shapes and sizes, have been joined using this technique. The room and high temperature mechanical properties and fractography of ceramic joints have been reported. In monolithic silicon carbide ceramics, these joints maintain their mechanical strength up to 1350 C in air. There is no change in the mechanical strength of joints in silicon carbide matrix composites up to 1200 C in air. In composites, simple butt joints yield only about 20% of the ultimate strength of the parent materials. This technology is suitable for the joining of large and complex shaped ceramic and composite components, and with certain modifications, can be applied to repair of ceramic components damaged in service.
Author

Ceramics; Composite Materials; Butt Joints; Aerospace Systems; Fractography; Silicon Carbides

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PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

19990026840 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Data Transfer Report - 30-mm Enhanced Alternate High-Energy Propellant Program (EAHEP): Test Fixture and Propellant Evaluation ***Final Report, May 1996 - Feb. 1997***
Ridgley, Melvin B.; Colburn, Joseph W.; Jan. 1999; 32p; In English
Contract(s)/Grant(s): Proj-1L162618AH30
Report No.(s): AD-A360156; ARL-SR-88; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Measurements in support of the 30-mm Enhanced Alternate High-Energy Propellant Program (EAHEP) were taken at the Building 390 recording facility. Propellants evaluated for this series of tests were M30, U.S. Army Armament Research, Development, and Engineering Center (ARDEC) 7994, BAMO-AMMO/CL20, BAMO-AMMO/CL20/NQ, and BAMO-AMMO-RDX. This facility, the central data acquisition network for the Propulsion and Flight Division (PFD) of the U.S. Army Research Laboratory (ARL), was operated by the Experimental Ballistics Team (EBT) of the Propulsion Branch (PB). The testing was conducted in support of an ongoing Army effort to further investigate high-energy gun propellants that promise enhanced performance from existing tank and artillery systems.
DTIC
Gun Propellants; Propellant Tests; High Energy Propellants; Fixtures; Ballistics; Artillery

19990026845 Advanced Fuel Research, Inc., East Hartford, CT USA
Thermal Stability Enhancement of JP-5 ***Final Report, 28 Sep. 1997 - 26 Mar. 1998***
Serio, Michael A.; Kroo, Erik; Malhotra, Ripudaman; McMillen, Donald F.; Sep. 15, 1998; 38p; In English; Prepared in cooperation with SRI International, Menlo Park, CA.
Contract(s)/Grant(s): N68335-97-C-0324
Report No.(s): AD-A360085; AFR-531003-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this work was to determine if C60 or its derivatives could enhance the oxidative thermal stability of JP-5 and similar aviation fuels. Two derivatives of C60 were prepared, n-hexyl amine and di-isopropylamine. Several conventional thermal stressing experiments were also performed: oxygen overpressure (OOP), isothermal corrosion oxidation test (ICOT), quartz crystal microbalance (QCM), and hot liquid process simulator (HLPS). In addition, a fuel stability test system (FSTS) developed at Advanced Fuel Research, Inc. (AFR) was also used. The FSTS includes fiber optic infrared transmission cells to assess fuel thermal stability during thermal stressing up to 500 C. The low temperature data from OOP, ICOT, QCM and HPLS show that pure C60 generally reduces the deposit formation, although the amount of this reduction is only modest (between 5 and 30%). The beneficial effects are larger under more severe conditions (higher temperatures, longer oxidation times, higher oxygen concentrations). The FSTS results were consistent with this trend, although at the highest temperatures (425-500 C), some potentially deleterious effects of C60 also appear to be enhanced. The effects of reactor tube activation were important for the FSTS. Additional work is warranted on exploring the beneficial effects of C60 addition which could serve to extent the operating range of common jet fuels.
DTIC
Thermal Stability; Fuel Systems; JP-5 Jet Fuel; Fuel Tests

19990027178 Department of Energy, Washington, DC USA
Salvaging pyrotechnic data with minor overloads and offsets
Smallwood, D. O., Department of Energy, USA; Cap, J. S., Department of Energy, USA; Jan. 27, 1998; 8p; In English; Sponsored by Institute of Environmental Sciences, USA
Report No.(s): DE98-003146; SAND-97-2283C; CONF-980413; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors are sometimes presented with data with serious flaws, like saturation, over-range, zero shifts, and impulsive noise, including much of the available pyrotechnic data. Obviously, these data should not be used if at all possible. However, they are sometimes forced to use these data as the only data available. A method to salvage these data using wavelets is discussed. The results must be accepted with the understanding that the answers are credible, not necessarily correct. None of the methods will

recover information lost due to saturation and over-range with the subsequent nonlinear behavior of the data acquisition system. The results are illustrated using analytical examples and flawed pyrotechnic data.
NTIS
Pyrotechnics; Data Acquisition

19990027310 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Investigation of syngas interactions in alcohol synthesis catalyst
Akundi, M. A., Department of Energy, USA; Apr. 15, 1998; 78p; In English
Report No.(s): DE98-057982; DOE/MT/93010-16; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The primary objectives of the project are to (a) synthesize, by controlled sequential and co-impregnation techniques, three distinct composition metal clusters (consisting of Cu-Co-Cr and Cu-Fe-Zn): rich in copper (Methanol selective), rich in ferromagnetic metal (Co or Fe-Hydrocarbon selective) and intermediate range (mixed alcohol catalysts); (b) investigate the changes in the magnetic character of the systems due to interaction with CO, through Zero- field Nuclear Magnetic Resonance (ZFNMR) study of cobalt and Magnetic character (saturation magnetization and coercive field) analysis of the composite catalyst of Vibrating Sample Magnetometry (VSM); (c) examine the changes in syngas adsorption character of the catalyst as the composition changes, by FTIR Spectroscopic analysis of CO stretching frequencies; (d) determine the nature and size of these intermetallic clusters by Scanning Electron Microscopy (SEM); and (e) perform catalytic runs on selected samples and analyze the correlations between the physical and chemical characteristics. The catalysts chosen have a greater promise for industrial application than the Rh and Mo based catalysts. Several groups preparing catalysts by synthetic routes have reported divergent results for activity and selectivity. Generally the research has followed an empirical path and less effort is devoted to analyze the mechanisms and the scientific basis. The primary intent of this study is to analyze the nature of the intermetallic and gasmetal interactions and examine the correlations to catalytic properties.
NTIS
Synthesis (Chemistry); Metals; Adsorption; Catalysts; Ferromagnetic Materials; Magnetic Properties; Nuclear Magnetic Resonance; Spectroscopic Analysis; Alcohols

19990027554 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA
Indirect sensing technique for diesel fuel quantity contro ***Progress Report, 1 Apr. - 30 Jun. 1998***
MacCarley, C. A., Department of Energy, USA; Aug. 31, 1998; 3p; In English
Report No.(s): DE98-006423; DOE/CE/15583-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This reports on a project to develop an indirect sensing technique for diesel fuel quantity control. Development has continued on a vehicle-installed prototype for Environmental Protection Agency (EPA) certification and demonstration. Focus of development is on the use of this technology for retrofitting existing diesel vehicles to reduce emissions rather than exclusively upon deployment in the OEM market. Technical obstacles that have been encountered and their solutions and remaining project tasks are described.
NTIS
Diesel Engines; Diesel Fuels; Fuel Control; Environment Protection

19990027593 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
A Forensic Workshop Report Concerning (1) The Measurement and Analysis of Energetic Materials and (2) Databasing ***Final Report, Jan. - Jul. 1996***
Heimerl, Joseph M.; Jan. 1999; 111p; In English
Contract(s)/Grant(s): Proj-1L161102AH43
Report No.(s): AD-A360674; ARL-SR-77; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

On Thursday, 20 June 1996, this workshop was convened at BRL Hall (Bldg. 330), located at the U.S. Army Research Laboratory (ARL), Aberdeen Proving Ground (APG), MD. The purposes of this workshop were: (1) to define the critical problems that cut across forensic agencies; (2) to provide an open, multidisciplinary forum in which these problems could be addressed and better defined; and (3) to lay the foundation for practical, timely, and cost-effective solutions. The technical focus of the workshop pivoted on two questions: (1) What is required for a sample to be traceable to a unique compound (or unique class of compounds)? (2) How can the present databases be made into user-friendly, complete, and current databases, accessible by all forensic laboratories? This report documents the background leading up to the calling for a workshop, the manuscripts of the talks given, and the discussion held.
DTIC
Raman Spectroscopy; Trace Elements; Explosives Detection

19990027853 National Inst. of Standards and Technology, Office weights and measures program, Gaithersburg, MD USA
Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality: as Adopted by the 83rd National Congress on Weights and Measures, 1998. 1999 Edition
Coleman, Thomas, Editor, National Inst. of Standards and Technology, USA; Grimes, Terry L., Editor, National Inst. of Standards and Technology, USA; Nov. 1998; 1p; In English, USA
Report No.(s): PB99--102592; NIST-HB-130; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This handbook compiles the latest Uniform Laws and Regulations and related interpretation and guidelines adopted by the National Conference on Weights and Measures, Inc. (NCWM). At the 1983 Annual Meeting, the NCWM voted to change the title of Handbook 130 and the titles of the Laws and Regulations compiled in this handbook. The former title of the handbook was 'Model State Laws and Regulations'. 'Model State' was to be changed to 'Uniform' in the titles to refect that these Laws and Regulations are (1) intended to be standards rather than just guidelines, and (2) intended for adoption by political subdivisions other than States when deemed appropriate.
NTIS
Metrology; Regulations; Laws

29
MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications. For biological materials see 55 Space Biology.

19990027434 Clarkson Univ., International Center for Gravity Materials Science and Applications, Potsdam, NY USA
Use of Microgravity to Control the Microstructure of Eutectics ***Progress Report, 1 Mar. 1998 - 28 Feb. 1999***
Wilcox. William R., Clarkson Univ., USA; Regel, Liya L., Clarkson Univ., USA; 1999; 43p; In English
Contract(s)/Grant(s): NAG8-1266; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant began in June of 1996. Its long term goal is to be able to control the microstructure of directionally solidified eutectic alloys, through an improved understanding of the influence of convection. The primary objective of the projects in the present grant is to test hypotheses for the reported influence of microgravity on the microstructure of eutectics. The prior experimental results on the influence of microgravity on the microstructure of eutectics have been contradictory. With lamellar eutectics, microgravity had a negligible effect on the microstructure. Microgravity experiments with fibrous eutectics sometimes showed a finer microstructure and sometimes a coarser microstructure. Most research has been done on the MnBi/Bi rod-like eutectic. Larson and Pirich obtained a two-fold finer microstructure both from microgravity and by use of a magnetic field to quench buoyancy-driven convection. Smith, on the other hand, observed no change in microgravity. Prior theoretical work at Clarkson University showed that buoyancy-driven convection in the vertical Bridgman configuration is not vigorous enough to alter the concentration field in front of a growing eutectic sufficiently to cause a measurable change in microstructure. We assumed that the bulk melt was at the eutectic composition and that freezing occurred at the extremum, i.e. with minimum total undercooling at the freezing interface. There have been four hypotheses attempting to explain the observed changes in microstructure of fibrous eutectics caused by convection: I .A fluctuating freezing rate, combined with unequal kinetics for fiber termination and branching. 2. Off-eutectic composition, either in the bulk melt due to an off-eutectic feed or at the freezing interface because of departure from the extremum condition. 3. Presence of a strong habit modifying impurity whose concentration at the freezing interface would be altered by convection. At the beginning of the present grant, we favored the first of these hypotheses and set out to test it both experimentally and theoretically. We planned the following approaches: I .Pass electric current pulses through the MnBi/Bi eutectic during directional solidification in order to produce an oscillatory freezing rate. 2. Directionally solidify the MnBi/Bi eutectic on Mir using the QUELD II gradient freeze furnace developed by Professor Smith at Queen's University. 3. Select another fibrous eutectic system for investigation using the Accelerated Crucible Rotation Technique to introduce convection. 4. Develop theoretical models for eutectic solidification with an oscillatory freezing rate. Because of the problems with Mir, we substituted ground-based experiments at Queen's University with QUELD II vertical and horizontal, with and without vibration of the furnace. The Al-Si system was chosen for the ACRT experiments. Three related approaches were used to model eutectic solidification with an oscillatory freezing rate. A sharp interface model was used to calculate composition oscillations at the freezing interface in response to imposed freezing rate oscillations.
Author
Directional Solidification (Crystals); Eutectic Alloys; Gravitational Effects; Magnetic Fields; Microstructure; Electric Current

19990027465 NASA Lewis Research Center, Cleveland, OH USA

Void Management in MEPHISTO and Other Space Experiments

deGroh, Henry C., III, NASA Lewis Research Center, USA; Johnston, J. Christopher, NASA Lewis Research Center, USA; Wei, Bingbo, Northwestern Polytechnical Univ., China; 1998; 6p; In English; 1st; 4th; Pan-Pacific Basin: Microgravity Sciences, 8 -11 Jul. 1998, Tokyo, Tokyo, Japan, Japan; Sponsored by Waseda Univ., Japan

Contract(s)/Grant(s): NCC3-476; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The second flight of NASA's Shuttle Flight experiment program known as MEPHISTO suffered from a void in the liquid portion of the sample, even though a piston arrangement was in place to keep the ampoule filled. In preparations for the next flight of the MEPHISTO furnace an animated computer program, called MEPHISTO Volume Visualizer (MVV), was written to help avoid the formation of unwanted voids. A piston system on MEPHISTO has the ability to move approximately 5 mm in compression, to accommodate expansion of the solid during heating; then from the completely compressed position, the piston can move up to 25 mm in towards the sample, effectively making the ampoule smaller and hopefully eliminating any voids. Due to the nature of the piston design and ampoule and sample arrangement, the piston has gotten stuck during normal directional solidification; this creates the risk of a void. to eliminate such a void, the liquid in the hot zones of the furnace can be heated, thereby expanding the liquid and consuming any void. The problem with this approach is that if the liquid is heated too much an overpressure could result, breaking the ampoule and ending the experiment catastrophically. The MVV has been found to be a useful tool in the assessment of the risks associated with the formation of a void and the additional heating of the liquid in the hot zone of this Bridgman type furnace. The MVV software will be discussed and copies available; it is written in the Delphi 2 programming language and runs under Windows 95 and NT. The strategies used in other flight experiments, such as the Isothermal Dendritic Growth Experiment, will also be presented.

Author

Spaceborne Experiments; Space Shuttle Orbiters; Directional Solidification (Crystals); Computer Programs; Voids; Heating; Crystal Growth

19990027620 NASA Lewis Research Center, Cleveland, OH USA

Measurement of Critical Contact Angle in a Microgravity Space Experiment

Concus, P., California Univ., Lawrence Berkeley Lab., USA; Finn, R., Stanford Univ., USA; Weislogel, M., NASA Lewis Research Center, USA; Experiments in Fluids; 1998; 26p; In English

Contract(s)/Grant(s): NCC3-329; DE-AC03-76SF-00098; NAG3-1941; NSF DMS-94-00778; NSF DMS-94-01167; RTOP 962-24-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Mathematical theory predicts that small changes in container shape or in contact angle can give rise to large shifts of liquid in a microgravity environment. This phenomenon was investigated in the Interface Configuration Experiment on board the USML-2 Space Shuttle flight. The experiment's "double proboscis" containers were designed to strike a balance between conflicting requirements of sizable volume of liquid shift (for ease of observation) and abruptness of the shift (for accurate determination of critical contact angle). The experimental results support the classical concept of macroscopic contact angle and demonstrate the role of hysteresis in impeding orientation toward equilibrium.

Author

Microgravity; Spaceborne Experiments; Space Transportation System Flights; Space Shuttles

19990027884 NASA Lewis Research Center, Cleveland, OH USA

A Numerical Study of Directional Solidification and Melting in Microgravity

Chen, P. Y. P., New South Wales Univ., Australia; Timchenko, V., New South Wales Univ., Australia; Leonardi E., New South Wales Univ., Australia; deVahlDavis, G., New South Wales Univ., Australia; deGroh, H. C., III, NASA Lewis Research Center, USA; 1998; 22p; In English; International Mechanical Engineering Congress and Exposition, 15-20 Nov. 1998, Anaheim, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A computational model is presented for the study of the solidification and melting of a pure substance and of a binary alloy. The enthalpy method has been used, and incorporated into a commercial CFD code. Three examples of the use of the model are described: the three-dimensional solidification of a pure substance (succinonitrile), the results of which are compared with experiment; an example of the solidification of a bismuth-tin alloy; and a simulation of a solidification and melting experiment done in space known as the MEPHISTO program.

Author

Binary Alloys; Directional Solidification (Crystals); Enthalpy; Microgravity; Bridgman Method; Single Crystals; Computational Fluid Dynamics; Laminar Flow; Space Processing

19990028253 NASA Lewis Research Center, Cleveland, OH USA

Comparison Tools for Assessing the Microgravity Environment of Space Missions, Carriers and Conditions

DeLombard, Richard, NASA Lewis Research Center, USA; Hrovat, Kenneth, Tal-Cut Co., USA; Moskowitz, Milton, Tal-Cut Co., USA; McPherson, Kevin M., NASA Lewis Research Center, USA; 1998; 8p; In English; 7th; Visual Information Processing, 13-17 Apr. 1998, Orlando, FL, USA; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): NAS3-27254; RTOP 963-60-0D; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The microgravity environment of the NASA Shuttles and Russia's Mir space station have been measured by specially designed accelerometer systems. The need for comparisons between different missions, vehicles, conditions, etc. has been addressed by the two new processes described in this paper. The Principal Component Spectral Analysis (PCSA) and Quasi-steady Three-dimensional Histogram QTH techniques provide the means to describe the microgravity acceleration environment of a long time span of data on a single plot. As described in this paper, the PCSA and QTH techniques allow both the range and the median of the microgravity environment to be represented graphically on a single page. A variety of operating conditions may be made evident by using PCSA or QTH plots. The PCSA plot can help to distinguish between equipment operating full time or part time, as well as show the variability of the magnitude and/or frequency of an acceleration source. A QTH plot summarizes the magnitude and orientation of the low-frequency acceleration vector. This type of plot can show the microgravity effects of attitude, altitude, venting, etc.

Author

Microgravity; Space Missions; Low Frequencies; Mir Space Station; Accelerometers; Attitude (Inclination); Histograms

31
ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

19990026769 Rutgers Univ., Dept. of Mechanical and Aerospace Engineering, Piscataway, NJ USA

Framework for Building Systems

Benaryoya, Haym, Rutgers Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 23-25; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this presentation an overall framework for buildings in a lunar base are outlined. The types of construction which must be created are habitats, storage facilities, and supporting infrastructure. The requirements for the three different types of structures, the type of structures, the material considerations, the technology, and requirement definition studies are reviewed.

CASI

Buildings; Construction; Habitats; Lunar Bases; Life Support Systems

19990026770 Los Alamos National Lab., NM USA

Construction of Planetary Habitation Tunnels Using a Rock-Melt-Kerfing Tunnel-Boring Machine Powered by a Bimodal Heat Pipe Reactor

Blacic, J. D., Los Alamos National Lab., USA; Houts, M. G., Los Alamos National Lab., USA; Blacic, T. M., California Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 26-27; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The requirements for a Lunar kerf-melting tunnel boring machine (TBM) for creation of lunar and planetary habitation is reviewed. A possible TBM design is presented, and a potential power source is discussed.

CASI

Boring Machines; Construction; Melting; Lunar Construction Equipment; Tunnels; Lunar Shelters; Heat Pipes

19990026771 Colorado State Univ., Center for Engineering Infrastructure and Sciences in Space, Fort Collins, CO USA

Habitat Construction Requirements

Criswell, Marvin E., Colorado State Univ., USA; Abarbanel, Jenine E., Colorado State Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 28-31; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This presentation reviews the requirements of construction of lunar and martian habitats, and the potential use of in situ materials. The questions of what is feasible and economical and when are addressed. This is presented in a grid format, where there are several levels, for the development of a lunar settlement. There are 5 different levels defined as (1) Exploratory, a temporary outpost for exploration; (2) Pioneering designed as a research outpost; (3) Outpost, a operational base; (4) settlement, an extended

base, and (5) Colony, a self sufficient settlement. The feasible uses of in situ materials are reviewed. The requirements for the habitat are reviewed, and will change based upon the maturity of the base. For each of the above mentioned stages of development the use of in situ resources will change, and mature. There is a savings in imported mass through the use of in situ materials. The habitats must be pressure vessels, containing gases, having significant mass. They must also provide shielding and thermal stability. The many requirements in the areas of secondary structures, surfaces, and containers must also be considered. The appropriate mix of high value imported, and locally available and produced will constantly change.
CASI
Lunar Bases; Lunar Based Equipment; Space Colonies; Space Habitats; Lunar Shelters; Lunar Construction Equipment; Lunar Mining; Lunar Resources

19990026774 Bechtel Corp., San Francisco, CA USA
Materials Transportation
Franklin, H. A., Bechtel Corp., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 36; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This presentation discusses the different types of machines which will be required to move dirt and rocks, and to move materials and cargo on the moon. Particular interest is paid to the skid steer, the large earth movers, and road services.
CASI
Cargo; Transportation; Extraterrestrial Resources; Space Logistics

19990026777 Ohio Aerospace Inst., Cleveland, OH USA
Materials Refining for Structural Elements From Lunar Resources
Landis, Geoffrey A., Ohio Aerospace Inst., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 43-46; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Use of in situ resources for construction on the Moon will require manufacturing structural materials out of lunar resources. Likely materials that could be manufactured from lunar materials include steel, titanium, aluminum, and glass (for glass-fiber composite). Process sequences for manufacturing these materials out of lunar regolith are discussed.
Derived from text
Lunar Resources; Lunar Rocks; Lunar Soil; Manufacturing; Regolith

19990026780 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Ice as a Construction Material
Zuppero, Anthony, Idaho National Engineering Lab., USA; Lewis, Joseph, Jet Propulsion Lab., California Inst. of Tech., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 50-51; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of ice as a construction material is discussed. A model of an ice tire torus space ship, which slowly spins to produce artificial gravity is proposed. The size of the ship, needed to support a given number of people and the required envelope mass is presented.
CASI
Ice; Toruses; Spacecraft Construction Materials

19990027141 Department of Energy, Washington, DC USA
Characterization techniques for surface-micromachined devices
Eaton, W. P., Department of Energy, USA; Smith, N. F., Department of Energy, USA; Irwin, L., Department of Energy, USA; Tanner, D. M., Department of Energy, USA; Dec. 31, 1998; 8p; In English
Report No.(s): DE98-007267; SAND-98-1782C; CONF-980918; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Using a microengine as the primary test vehicle, the authors have examined several aspects of characterization. Parametric measurements provide fabrication process information. Drive signal optimization is necessary for increased microengine performance. Finally, electrical characterization of resonant frequency and quality factor can be more accurate than visual techniques.
NTIS
Miniaturization; Engines; Procedures; Performance Tests

19990027201 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Application of new mathematical structures to safety analysis

Cooper, J. A., Department of Energy, USA; Ross, T. J., Department of Energy, USA; Oct. 31, 1997; 8p; In English; Computational intelligence; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE98-000417; SAND-97-2429C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Probabilistic safety analyses (PSAs) often depend on significant subjectivity. The recent successes of fuzzy logic and fuzzy and hybrid mathematics in portraying subjectivity is a reminder that a selection made from the most applicable mathematical tools is more important than forced adaptation of conventional tools. In this paper, the authors consider new approaches that enhance conventional and fuzzy PSA by improved handling of subjectivity. The most significant of the mathematical structures were have investigated (from a standpoint of safety analysis applications) will be described, and the general types of applications will be outlined.

NTIS

Safety; Mathematical Logic

19990027254 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Methods of Analysis Failure of Squeeze Film Damper

Liu, Fangjie, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 533-537; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The methods of analysis failures of squeeze film dampers are presented. First, the studies of squeeze film dampers of the principal aeroengine manufacturing factories in the world have been introduced. It is not only to help the development of squeeze film dampers for China but also it raises an inspiration that is to research the failure of squeeze film damper should be based on the collocations of synthetical parameters. Thus, the bearing parameter B and unbalance eccentricity ratio U are used as the elementary parameters to detail the methods of analysis failures. There are two cases to define the failure. One is the rotor system can not to strit over the critical speed and the other is arising from the bistable characteristic. The data and character diagram of the inability to strid over critical speed, and three typical bistable curves have been presented.

Author

Squeeze Films; Failure Analysis

19990027269 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

Modelling of the HMAS Westralia Fire

Kennett, G. I., Defence Science and Technology Organisation, Australia; Gamble, G. I., Defence Science and Technology Organisation, Australia; Li, Jun-De, Defence Science and Technology Organisation, Australia; Jul. 1998; 26p; In English; Original contains color illustrations

Report No.(s): DSTO-TR-0698; DODA-AR-010-592; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The HMAS Westralia fire incident of 5 May 1998, involved the combustion of a quantity of diesel fuel in the engine compartment. Four sailors were killed and the ship disabled. This paper presents the results of a series of fire engineering calculations, material measurements together with a computer based simulation of the HMAS Westralia fire. The modelling is used to give an insight into the behaviour of the fire and physical phenomena observed.

Author

Fires; Models; Simulation; Numerical Analysis

19990027305 National Inst. of Standards and Technology, Building environment Div., Gaithersburg, MD USA

Method of Test for Tracer Gas Test of an Outdoor Furnace Designed for Installation without a Flue Pipe

Liu, S. T., National Inst. of Standards and Technology, USA; Kelly, G. E., National Inst. of Standards and Technology, USA; Nov. 1998; 28p; In English

Report No.(s): PB98--158363; NISTIR-6257; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An induced draft, gas-fired furnace originally designed for outdoor installation without a flue pipe was tested by the tracer gas method to determine its off-cycle power burner draft factor. When conducting the tracer gas test, the lack of the needed space for sensor installations and for shielding the sensors from ambient air disturbance creates an accuracy problem for the manufacturers and the testing agency to properly conduct the test. This report is to determine the feasibility of attaching a short flue pipe to

the outdoor furnace during the optional tracer gas test to facilitate test measurement without significantly increasing the measured power burner draft factor due to the stack action of the added flue pipe.
NTIS
Flues; Furnaces; Pipes (Tubes); Installing; Tests

19990027397 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Study on Tool Wear Monitoring Based on Milling Force
Li, Jinsong, Beijing Univ. of Aeronautics and Astronautics, China; Chen, Dingchang, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 571-574; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Based on a milling experiment, the characteristics included in milling force and concerning the conditions of tool wear was analyzed, the influence on cutting force spectra for cutting regime was analyzed, and the comparison among the effect to conditions of tool wear for components of cutting force was made. Through the analysis to the milling force spectra, it indicated that: 1)the radial force spectra is more sensitive to the conditions of tool wear, 2) there is characteristic band in cutting force spectrum, which has close relation with the conditions of tool wear and is out of the relation to the cutting regime. Through the analysis to cutting force in time domain, the relationship between the conditions of tool wear and the components ratio of radial force and tangential force was discussed.
Author
Tools; Wear; Spectrum Analysis

19990027399 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Scheduling Model and Resource Pricing in Multi-Stage Manufacturing Systems
Huang, Haijun, Beijing Univ. of Aeronautics and Astronautics, China; Xu, Gang, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 579-583; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

This paper presents a scheduling model of multi-stage manufacturing systems with multiple job classes and variable production capacity constraints at workstations. The model aims to minimize the total cost which is the sum of all costs incurred in holding, processing and schedule delay over the whole study horizon. On the basis of analyzing optimality conditions, the prices of production capacities or resources are derived and explained in economic terms. It is shown that the model can be transferred into an equivalent static minimum cost network flow problem over a space-time network which is a temporal expansion of the base workstation network. An adapted network approach based on the Frank-Wolfe algorithm is proposed to solve the equivalent problem and tested on a numerical example.
Author
Manufacturing; Scheduling; Optimization; Operations Research; Industrial Management; Resources Management

19990027506 National Inst. of Standards and Technology, Office of Standards Services, Gaithersburg, MD USA
Toward a National Standards Strategy: Conference Summary Report
Leight, W. G., National Inst. of Standards and Technology, USA; Johnsen Leuteritz, K. J., National Inst. of Standards and Technology, USA; Nov. 1998; 24p; In English
Report No.(s): PB99--111239; NISTIR-6259; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On September 23, 1998, the National Institute of Standards and Technology (NIST) and the American National Standards Institute (ANSI) co-hosted a summit conference, Toward a National Standards Strategy to Meet Global Needs. NIST Director Ray Kammer and ANSI President Sergio Mazza co-chaired a program that featured keynote addresses by Deputy Secretary of Commerce Robert Mallet and Dana Mead, Chairman and CEO of Tenneco and World Standards Day Chairman; a luncheon address by Evangelos Vardakas, Director, Directorate B. Legislation and Standardization, Telematics Networks, Directorate General (DG)-III: Industrial Affairs, European Commission; three panels comprised of standards experts from industry and government; and discussions of comments and questions raised by some of the 339 registered participants. This digest of the material presented at the conference was prepared by members of the staff of the NIST Office of Standards Services based on notes taken during the presentations, material provided by speakers, and audio tapes. A more complete report, containing full texts and figures, will be published separately and made available to all participants and others interested.
NTIS
Standardization; Panels; Information Systems; Industries

19990027670 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering, Volume 21

Liou, C. T., Editor, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Hong, H. K., Editor, National Taiwan Univ., Taiwan, Province of China; Lee, S. C., Editor, National Taiwan Univ., Taiwan, Province of China; Lee, T. T., Editor, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Lin, S. H., Editor, Yuan-Ze Inst. of Tech., Taiwan, Province of China; So, H., Editor, National Taiwan Univ., Taiwan, Province of China; Wu, J. K., Editor, National Taiwan Ocean Univ., Taiwan, Province of China; Yang, C. C., Editor, Feng Chia Univ., Taiwan, Province of China; Arimoto, S., Editor, Tokyo Univ., Japan; Chu, H. S., Editor, National Chiao Tung Univ., Taiwan, Province of China; Fu, L. C., Editor, National Taiwan Univ., Taiwan, Province of China; Hsiue, G. H., Editor, National Tsing Hua Univ., Taiwan, Province of China; Huang, S. C., Editor, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Hung, J. J., Editor, National Taiwan Univ., Taiwan, Province of China; Lan, W. W., Editor, National Chiao Tung Univ., Taiwan, Province of China; Lee, C. P., Editor, National Chiao Tung Univ., Taiwan, Province of China; Lee, D. T., Editor, Academia Sinica, Taiwan, Province of China; Lee, George C. S., Editor, Purdue Univ., USA; Lee, J. Y., Editor, Chang Gung Univ., Taiwan, Province of China; Lin, F. C., Editor, National Taiwan Univ., Taiwan, Province of China; Studies of Local Bonding and Chemistry at Internal Interfaces Using Electron Energy Loss Spectroscopy; November 1998; ISSN 0253-3839; 112p; In English; See also 19990027671 through 19990027677; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This special issue of the Chinese Institute of Engineers focuses on materials science and engineering. Topics discussed include: (1) Studies of local bonding and chemistry at internal interfaces using electron energy loss spectroscopy; (2) Survey of infrared sensing techniques for welding process monitoring and control; (3) Fine-structure superplasticity in materials; (4) Recent advances in the synthesis and properties of amorphous and crystalline carbon nitride; (5) Continuous fiber reinforced ceramic composites; (6) Invariant image matching by compacting and moment normalization; and (7) Detection for high resolution radars. CASI

Materials Science; Synthesis (Chemistry); Welding; Physical Properties; Composite Materials

19990028225 Department of Energy, Washington, DC USA

Performance of a tapered pulse tube

Swift, G., Department of Energy, USA; Allen, M., Department of Energy, USA; Woolan, J. J., Department of Energy, USA; Feb. 28, 1998; 17p; In English; 10th; Cryocooler, USA

Report No.(s): DE98-003368; LA-UR-97-4713; CONF-980541; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In a well instrumented pulse tube refrigerator having 1,500 W of cooling power at 125 K, the authors have measured the figure of merit of a tapered pulse tube at several operating points. At operating points near the operating point for which the taper was designed, the figure of merit is 0.96. This is close to the theoretical optimum figure of merit 0.97 calculated for this pulse tube considering only two loss mechanisms: heat conduction in the metal pulse tube wall and ordinary thermoacoustic heat transport in the gas within a few thermal penetration depths of the wall. At operating points farther from the design operating point, the measured figure of merit is much lower, as streaming driven convection adds a third loss mechanism. NTIS

Tapering; Tubes; Pulses

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COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. 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.

19990027080 Physics and Electronics Lab. TNO, The Hague, Netherlands

COTS and Interface FCM *Final Report*

Bierens, L. H. J., Physics and Electronics Lab. TNO, Netherlands; vantWout, C., Physics and Electronics Lab. TNO, Netherlands; Stijnman, P. A. M., Physics and Electronics Lab. TNO, Netherlands; July 1998; 41p; In English

Contract(s)/Grant(s): A97/Klu/735; TNO Proj. 27204

Report No.(s): TD98-0138; FEL-98-A052; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab.,Oude Waalsdorperweg 63, PO Box 96864, JG The Hague, The Netherlands), Hardcopy, Microfiche

This report describes the result of the project 'COTS Interface FCM'. The objective of the project was the specification, the design and the realization of an interface between the high-speed real-time SAR system data bus (the RACEway) at one side and the Fast Convolution Module (FCM) at the other side. The design of the COTS (commercial-off-the-shelf) interface is generic. In the future, it can be used for other dedicated hardware subsystems as part of the multi-purpose real-time SAR processor environment. The result of the project is successfully applied in the integration of the FCM in the multi-purpose real-time SAR processor. The FCM performs one of the critical SAR processing steps, the range compression. Using the FCM instead of commercially available DSP boards, saves at least a factor three in volume, power consumption and costs of the range compression hardware. The COTS interface allows the integration of COTS products for flexible processing parts with dedicated hardware for 'bulk-processing' parts. With this project TNO-FEL has shown that this 'best-of-both-worlds' approach leads to a substantial reduction in volume, power consumption and costs of complex application specific signal processing systems.
Author
Design Analysis; Specifications; Fabrication; Synthetic Aperture Radar; Channels (Data Transmission)

19990027156 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Modification of the ESAMS Model to Include RWR False Alarms, Signal Dropouts, and Sensitivity
Hilke, R. W.; Jan. 1998; 13p; In English
Report No.(s): AD-A359485; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In detecting threat radar signals via the penetrator aircraft's RWR, we need to be concerned about three crucial parameters: receiver false alarms and the ECM response to these false alarm signals, undetected threat signals (signal dropout), and receiver sensitivity. False alarms are those falsely detected signals in the absence of transmitted threat radar signals while signal dropouts are the absence of a detected signal in the presence of an actual transmitted threat radar signal. Receiver sensitivity defines the minimum signal strength a receiver can detect above the background noise density. These parameters are the most common anomalies in the reception of RF signals by the penetrator's RWR, hence EW simulation models such as ESAMS should be cognizant of these anomalies. Therefore these models should also incorporate a signal to noise power ratio, a false alarm probability, and receiver sensitivity variabilities into the model to simulate a more realistic engagement scenario.
DTIC
Countermeasures; Surface to Air Missiles; Simulation; False Alarms

19990027250 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Calculation Research of the Radar Cross Section
Xue, Xiaochun, Beijing Univ. of Aeronautics and Astronautics, China; Bin, Yang, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 549-550; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche
The paper focuses on tests on electromagnetic fields and Radar Cross Section (RCS) with densified grids provided by the flux-splitting method. It separated the representative value into positive and negative parts in order to hold down the allowance errors respectively. For the purpose of optimization design computation, the time-domain scheme is applied to calculate RCS; the final results agree satisfactorily compared with previous results.
Author
Electromagnetic Fields; Radar Cross Sections; Wave Scattering

19990027252 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
RCS Analysis of Bomb-Fins
Li, Jing, Beijing Univ. of Aeronautics and Astronautics, China; Wu, Zhe, Beijing Univ. of Aeronautics and Astronautics, China; Li, Tian, Shenyang Aerodynamics Research Inst., China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 542-545; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche
This paper analyzes the difference of corner reflection effect between bomb-fins and ordinary rectangular corner reflectors, and derives the formula of radar cross sections (RCS) of the corner reflection effect of bomb-fins for engineering calculation using equivalent-section-method, and the formula is verified by means of calculating the scatter property of bomb-fins synthetic model. The reflecting coefficient is induced to the RCS formula of polygon plate covered with radar absorption material (RAM), two

coefficients are used to express the two times of absorption/reflection effect of the corner reflection, and finally the scatter property of the model covered with RAM is calculated with this reflection-coefficient-method.
Author
Radar Corner Reflectors; Radar Cross Sections; Bombs (Ordnance); Fins; Absorptivity

19990027256 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Characteristics of the Inclined Narrow-Slot on a Sectoral Waveguide
Gao, Wenjun, Beijing Univ. of Aeronautics and Astronautics, China; Lu, Shanwei, Beijing Univ. of Aeronautics and Astronautics, China; Xiao, Wei; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 525-528; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

According to the continuative condition of the tangential fields on the slot aperture which is the inclined narrow-slot on the broadwall of a sectoral waveguide, the moment method is used to calculate the magnetic current coefficient and distribution. Then the scattering field, the scattering parameter and the equivalent impedance are obtained. Letting only the TE(sub 11) dominant mode propagate in the waveguide, the scattering parameters and the normalized equivalent series impedance in the X-band are computed. The basis designed slot antenna and the slot array is offered.
Author
Method of Moments; Slot Antennas; Electromagnetic Fields; Scattering Coefficients; Waveguides

19990027257 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Real-Time Frequency and 2-D Angle Estimation Method with Sub-Nyquist Sampling
Si, Deyi, Beijing Univ. of Aeronautics and Astronautics, China; Le, Qiang, Beijing Univ. of Aeronautics and Astronautics, China; Shen, Shituan, Beijing Univ. of Aeronautics and Astronautics, China; Li, Jingwen, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 522-524; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

A method is proposed to estimate real-time frequency and azimuth and elevation angles of arrival with parallel uniform linear arrays and elements output signal delay. The method uses PRO-ESPRIT algorithm in DFT beam-space. It can estimate the frequency and angles with sub-Nyquist sampling. The analog frequency is estimated by a general eigenvalue in the direct method. The alias zone of frequency can be determined by the estimation of analog frequency. Then, the digital frequency is estimated, and the analog frequency is calculated by digital frequency in the indirect method. The variance of the frequency estimates of indirect method is less than that of the direct method. Simulations are presented demonstrating the capabilities of the method.
Author
Frequency Measurement; Sampling; Nyquist Frequencies; Real Time Operation; Estimating

19990027259 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Space Determination of Message Buffer for LTPB Network
Xiong, Huagang, Beijing Univ. of Aeronautics and Astronautics, China; Li, Jingsheng, Beijing Univ. of Aeronautics and Astronautics, China; Luo, Zhiqiang, Beijing Univ. of Aeronautics and Astronautics, China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 514-517; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

In a network system, overflow or overwrite of a message buffer will cause missing of messages. For a timed token network, message transmission time and the message buffering space allocation in a node are very important issues on network real time capability. This paper analyzes the message buffering mechanism, describes the relationship of message buffering space and message transmission bandwidth allocation, and proposes a space determination method of a message buffer for a LTPB network. The maximum space redundancy avoiding buffer overflow for ”send” and ”receive” buffers has been derived . It is found that the space of ”send” and ”receive” buffers is equal to the message size under the condition that the message gap time is greater than message latency and node response time.
Author
Message Processing; Real Time Operation; Local Area Networks; Buffer Storage

19990027262 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Design of a Digital DS/BPSK Receiver

Li, Sanzhong, Beijing Univ. of Aeronautics and Astronautics, China; Zhang, Qishan, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronoautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 499-501; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of Beijing University of Aeronautics and Astronautics, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083, Hardcopy, Microfiche

The design of a new digital DS/BPSK receiver is introduced and its key problems and fundamental principles involved are described in this paper. The dedicated large-scale integrated circuit, combined with digital signal processing algorithm is adopted to implement demodulation of spread spectrum signal. It applies serial-parallel combined PN code acquisition, Costas phase-locked tracking loop and delay-lock tracking loop techniques. The receiver is characterized by excellent overall performance as well as a flexible hardware and software interface. It can be efficiently used in multi-objects telemetry and control systems based on code division multiple access.

Author

Receivers; Integrated Circuits; Phase Locked Systems; Binary Phase Shift Keying

19990027408 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Direct Digital Synthesizer (DDS) and Performance Analysis

Gao, Zexi, Beijing Univ. of Aeronautics and Astronautics, China; Gao, Cheng, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 615-618; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

This paper introduces the composition, operational principle and performance of DDS, and uses signal theory and methods to analyze the effect of phase noise, spurious noise and digital phase truncation errors on output wave forms and the effect of DAC non-linearity on spectrum purity in detail. The analysis formula and correspondence curve in question are also provided. The conclusion is somewhat instructive to increase the quality of DDS output signal.

Author

Frequency Synthesizers; Noise Spectra; Signal Processing; Error Signals

19990027512 National Aerospace Lab., Amsterdam, Netherlands

The Information and Communication Technology's Contribution to the MDO Project

Vogels, M. E. S., National Aerospace Lab., Netherlands; Allwright, Steve E., British Aerospace Airbus Ltd., UK; Stettner, M., Daimler-Benz Aerospace A.G., Germany; Sims, P., British Aerospace Public Ltd. Co., UK; Bartholomew, P., Defence Research Agency, UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 4.1 - 4.7; In English; See also 19990027508

Contract(s)/Grant(s): CEC-BE95-2056; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

When an enterprise embarks on an initiative to exploit multi-discipline analysis, design and optimization (MDO) the enterprise faces, next to the aeronautical challenge, challenges with respect to Information and Communication Technology (ICT) to support the aeronautics work. The experiences in the Brite-Euram MDO project executed by 14 european aeronautics companies, institutes and universities, have led to the identification of three key ICT areas. Firstly, the process followed by the MDO team being evolutionary by nature requires the MDO process to be documented and communicated in a manner understandable and accessible for the MDO team. MDO results can only be interpreted in relation to the process in which they were generated. Secondly, the specialists from the various disciplines need to work on the SAME design and within the SAME timeframe to bring together their results to come to a next design. Finally, the information, tools, and the operation of the computer network have to be arranged to form an effective and friendly environment for the MDO team to operate within. Highlights of the MDO project in the three key ICT areas are presented.

Author

Computer Networks; Aircraft Design; Multidisciplinary Design Optimization; Computer Aided Design

19990027677 National Taiwan Univ., Dept. of Electrical Engineering, Taipei, Taiwan, Province of China

Detection for High Resolution Radars

Leou, Jeng-Long, National Taiwan Univ., Taiwan, Province of China; Li, Jyh-Hsueh, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering; November 1998; Volume 21, No. 6, pp. 731-740; In English; See also 19990027670

Contract(s)/Grant(s): NSC-CS84-0210-D002-004; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we discuss detection problems for a high resolution radar. Fluctuation in the target radar cross section usually decreases the probability of detection. However, through integration of cells within range profiles of a high resolution radar, variation of the integrated magnitude with respect to the change of carrier frequency and target aspect becomes much smaller, and this is helpful for improving the probability of detection. Two detection algorithms, the cell integration method and the correlation method, for a high resolution radar are proposed, and their detection performances are compared with that obtained by a conventional low resolution radar. Some theoretical formulations are developed. Simulation results show the effectiveness of the proposed algorithms.
Author
Radar Detection; Imaging Techniques

19990027750 Range Commanders Council, Telemetry Group, White Sands Missile Range, NM USA
Test Methods for Telemetry Systems and Subsystems. Volume III. Test Methods for Recorder/Reproducer Systems and Magnetic Tape
Jan. 1999; 94p; In English
Report No.(s): AD-A360621; RCC/TG-118-99-VOL-3; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This volume describes the procedures used in measuring and where applicable, adjusting the performance parameters of recorder/reproducer systems and magnetic tapes to insure compatibility and uniformity.
DTIC
Telemetry; High Resolution

19990027774 Defence Research Establishment Ottawa, Ottawa, Ontario Canada
Multipurpose Data Interface Board (DIB)
Simoneau, Yves; Tom, Caroline; Jul. 1998; 72p; In English
Report No.(s): AD-A359683; DREO-1332; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Defence Research Establishment Ottawa is pursuing an in-house research activity in spread-spectrum technology to support development of robust, anti-jam satellite communications for the military. The in-house effort consists of developing a system simulator, including both a ground terminal processor and a payload processor, to research techniques involved in spread-spectrum synchronization. For these experiments, a multipurpose data interface board is required for different data operations, and is the subject of this report. The board is composed of mainly an erasable programmable logic device to reduce the number of integrated circuits and to add flexibility to the design. The board was designed to perform three functions. The first function is the data format conversion between a ground terminal processor and a data source, and likewise, a payload processor and a data sink. The second function is to provide an interface to a separate direct link between the payload and ground terminal subsystems for transmitting a reference pulse for synchronization. The third function is to provide a set of debug latches for the user. In this document, the software and hardware details are provided along with a user's guide for the board.
DTIC
Data Processing; Data Management; Computer Programs

19990027775 Information Policy Committee, Washington, DC USA
Options for Promoting Privacy on the National Information Infrastructure. Draft for Public Comment
1998; 82p; In English
Report No.(s): PB99--119885; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This Options Paper explores the growing public concern about personal information privacy. The paper describes the status of electronic data protection and fair information practices in the USA today, beginning with a discussion of the 'Principles for Providing and Using Personal Information' issued by the Information Infrastructure Task Force in 1995. It then provides an overview of new information technologies, which shows that personal information is currently collected, shared, aggregated, and disseminated at a rate and to a degree unthinkable just a few years ago. We next consider in more detail the laws and policies affecting information privacy in four specific areas: government records, communications, medical records, and the consumer market. This examination reveals that information privacy policy in the USA consists of various laws, regulations and practices, woven together to produce privacy protection that varies from sector to sector.
NTIS
Computer Information Security; Protection; Data; Privacy

19990027783 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
An Approach to Characterising Ground Probing Radar Target Echoes for Landmine Recognition
Carevic, Dragana, Defence Science and Technology Organisation, Australia; Jun. 1998; 36p; In English
Report No.(s): DSTO-TR-0680; DODA-AR-010-561; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, South Australia 5108), Hardcopy, Microfiche

This report investigates an approach to characterizing Ground Probing Radar (GPR) backscatter echoes from landmines using linear combinations of exponentially damped sinusoids. The GPR signatures of surrogate landmines and PVC cylinders buried in dry sand are measured using impulse radar system with center frequency of 1.4 GHz and a 90% bandwidth. The GPR signal parameters are represented as sets of complex poles computed from a series of neighboring signatures recorded over each target type. The algorithm proposed by Kumaresan and Tufts which uses backward linear prediction and the low-rank data matrix approximation based on singular value decomposition is applied for this computation. The performance of the Kumaresan and Tufts (KT) algorithm is compared with that of the Prony method when both techniques are applied to modelling simulated signals. It is concluded that the KT method provides more stable pole estimates. Two approaches to determining the order of the model are examined and compared for simulated and real data. The results show that the poles corresponding to different target types form clusters in the two-dimensional alpha-f space (where alpha is the pole damping factor and f is the pole frequency). This indicates that these pole clusters can be used for the recognition of landmines.
Author
Radar Echoes; Target Recognition; Radar Targets; Ground Penetrating Radar; Mines (Ordnance); Radar Signatures; Radar Detection

19990027859 Purdue Univ., Dept. of Earth and Atmospheric Sciences, West Lafayette, IN USA
AASERT95: Blind Adaptive Beamforming For Mobile Communications ***Final Report, 1 May 1995 - 30 Apr. 1998***
Zoltowski, Michael D.; Jul. 31, 1998; 11p; In English
Contract(s)/Grant(s): F49620-95-1-0367
Report No.(s): AD-A360436; PURDUE-TR-EE-98-3; AFRL-SR-BL-TR-99-0063; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Space-time adaptive processing schemes effecting both equalization and interference cancellation for mobile narrowband digital communications under time-varying multipath conditions were developed. Interference cancellation was effected through the use of an ”extended correlator” exploiting past symbol decisions to highly localize in time the contribution due to the desired signal. This facilitated a ”dead” time zone during which the spatial correlation matrix of the interference could be estimated and used in an adaptive beamformer. Novel ”sample-spaced” equalizer structures were developed based on the Zero-Forcing (ZF) criterion, the Minimum Mean Square Error (MMSE), and the Decision Feedback Equalization (DFE) criterion. For the case where: (1) the delay spread is on the order of T, where 1/T is the symbol rate, as would be the case in voice communications, (2) at least two spatially separated or polarization diverse antennas are available at the receiver, and (3) each baseband antenna output is oversampled sampled by a factor of 3 or 4, we showed that equalization may be effected via either the ZF, MMSE, or DFE criteria via a small set of ”sample-spaced” taps encompassing the delay spread which is a fraction of T. This is in contrast to conventional equalization which employs symbol-spaced taps encompassing roughly the duration of the pulse symbol waveform, which is on the order of 10T, for example. As a result, the new ”sample-spaced” equalizers have an inherent capability to better track time-varying multipath channels than conventional equalization schemes, as evidenced by extensive computer-based simulations.
DTIC
Multipath Transmission; Narrowband; Procedures; Beamforming; Mobile Communication Systems; Mean Square Values; Adaptive Control

19990027963 Range Commanders Council, White Sands Missile Range, NM USA
Spectrum Efficient Modulation
December 1998; 7p; In English
Report No.(s): AD-A360650; RCC/FMG-705-98; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

It is the responsibility of all programs to insure that their use of spectrum is as efficient as possible and that spectrum is not needlessly being wasted.
DTIC
Spectra; Frequency Modulation

19990028023 Stanford Univ., Space Telecommunications and Radioscience Lab., Stanford, CA USA

Statistical Analysis and Modeling of Low-Frequency Radio Noise and Improvement of Low-Frequency Communications ***Final Report***

Chrissan, Douglas A.; Aug. 1998; 118p; In English

Contract(s)/Grant(s): N00014-92-J-1576; N00014-93-1-1073

Report No.(s): AD-A360417; D179-1; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Naturally occurring radio noise above approximately 100 MHz is well modeled for most applications as a Gaussian random process; however, atmospheric radio noise below 100 MHz is often impulsive in nature and is not well modeled as Gaussian. Atmospheric events (mainly lightning strokes, which create electromagnetic emissions known as sferics) produce large, clustered impulses in the noise waveform seen at a receiving antenna, causing the waveform to vary greatly from typical Gaussian background noise. Due to large variations in sferic activity on a seasonal and diurnal basis and with the passing of individual storms, atmospheric noise is also non-stationary. The objective of this work is the statistical characterization and modeling of atmospheric radio noise in the range 10 Hz - 60 kHz (denoted low-frequency noise), with the specific goal of improving communication systems operating in this range. The analyses are based on many thousands of hours of measurements made by the Stanford Radio Noise Survey System.

DTIC

Statistical Analysis; Low Frequencies; Atmospheric Models; Electromagnetic Noise; Telecommunication

19990028185 Simkins (William L.), Camden, NY USA

Multichannel Receiver Characterization for Adaptive Array Applications, Phase 4, Calibration Procedures/Tests ***Interim Report, Jan. - Sep. 1997***

Simkins, William L.; Jan. 1999; 73p; In English

Contract(s)/Grant(s): F30602-95-C-0015; AF Proj. 4506

Report No.(s): AD-A359732; AFRL-SN-RS-TR-1998-228; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report described Phase IV of a multi-phase effort to develop an existing multichannel receiver into a multi-use bistatic testbed. It presents procedures developed for using the calibrated transponder in the radar cross section measurements of clutter and targets and using these procedures in the measurement of the local clutter environment.

DTIC

Adaptation; Antenna Arrays; Multichannel Communication; Radio Receivers; Characterization; Calibrating; Radar Receivers

19990028227 National Inst. of Health, Bethesda, MD USA

Source localization using recursively applied and projected (RAP) MUSIC

Mosher, J. C., National Inst. of Health, USA; Leahy, R. M., National Inst. of Health, USA; Mar. 31, 1998; 8p; In English; 31st; Signals, systems and computers, USA

Report No.(s): DE98-003363; LA-UR-97-4435; CONF-9711120; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A new method for source localization is described that is based on a modification of the well known multiple signal classification (MUSIC) algorithm. In classical MUSIC, the array manifold vector is projected onto an estimate of the signal subspace, but errors in the estimate can make location of multiple sources difficult. Recursively applied and projected (RAP) MUSIC uses each successively located source to form an intermediate array gain matrix, and projects both the array manifold and the signal subspace estimate into its orthogonal complement. The MUSIC projection is then performed in this reduced subspace. Using the metric of principal angles, the authors describe a general form of the RAP-MUSIC algorithm for the case of diversely polarized sources. Through a uniform linear array simulation, the authors demonstrate the improved Monte Carlo performance of RAP-MUSIC relative to MUSIC and two other sequential subspace methods, S and IES-MUSIC.

NTIS

Position (Location); Classifications

19990028234 Institute of Industrial Technology TNO, Eindhoven, Netherlands

Testing of Surface Layers for Electromagnetic Shielding ***Final Report Testen van oppervlaktelagen voor EM-afscherming; Eidrapport***

Buijs, J. A. H. M., Institute of Industrial Technology TNO, Netherlands; Oct. 14, 1998; 45p; In Dutch; Sponsored in part by the TNO Defence Research, Delft, The Netherlands

Contract(s)/Grant(s): A96/D/162; TNO Proj. 431670520

Report No.(s): TD98-0370; BUI.98/007807-1/JB; Copyright; Avail: Issuing Activity (TNO Inst. of Industrial Tech., Materials Tech. Div., De Wielen 6, NL-5612 AV Eindhoven, The Netherlands), Hardcopy, Microfiche

Electromagnetic shielding of electronic equipment is increasingly important for defence purposes (TEMPEST). This report describes the results of an experimental comparison of conducting surface layers that can be applied on plastic housings of e.g. computers for obtaining additional shielding. For intermediate shielding levels copper paint (50-60 dB far-field) has some advantage over nickel paint, mainly because of its better durability. The repairability of copper paint is very good and in joints between parts of the housing conductive gaskets function very well. For high shielding levels layers of zinc-spray (80-90 dB) and electroless copper/nickel (less than 100 dB) were investigated. The durability of copper/nickel turned out to be good, whereas with zinc-spray adhesion problems may arise. On joining or repairing these layers, inevitably some losses occur, for zinc-spray at most 10 dB, for copper/nickel possibly up to 30 dB. Consequently for both layers 80 dB shielding can be seen as the upper limit. As a result, for housings aimed at 40-50 dB shielding level copper paint is recommended, and for 60-70 dB electroless copper/nickel has slight preference over zinc-spray. Some conducting transparent foils were included in the study for shielding of monitor screens. Polyester with sputtered silver offers the highest shielding (25-30 dB) and good durability. This shielding level is, however, much less than that of the surface layers, so alternative measures for monitor shielding have to be considered.
Author

Performance Tests; Surface Layers; Electromagnetic Shielding; Experimentation; Shielding

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ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics.

19990026749 NASA Marshall Space Flight Center, Huntsville, AL USA

Semiconductors: In Situ Processing of Photovoltaic Devices

Curreri, Peter A., NASA Marshall Space Flight Center, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 6; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Current proposals for developing an extended human presence on the Moon and Mars increasingly consider the processing of nonterrestrial materials essential for keeping the Earth launch burden reasonable. Utilization of in situ resources for construction of lunar and Mars bases will initially require assessment of resource availability followed by the development of economically acceptable and technically feasible extraction processes. In regard to materials processing and fabrication, the lower gravity level on the Moon (0.125 g) and Mars (0.367 g) will dramatically change the presently accepted hierarchy of materials in terms of specific properties, a factor that must be understood and exploited. Furthermore, significant changes are expected in the behavior of liquid materials during processing. In casting, for example, mold filling and associated solidification processes have to be reevaluated. Finally, microstructural development, and therefore material properties, presently being documented through ongoing research in microgravity science and applications, need to be understood and scaled to the reduced gravity environments.
Author

Fabrication; Lunar Bases; Mars Bases; Semiconductors (Materials); Photovoltaic Cells

19990026772 NASA Marshall Space Flight Center, Huntsville, AL USA

Semiconductors: In Situ Processing of Photovoltaic Devices

Curreri, Peter A., NASA Marshall Space Flight Center, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 32-33; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The possible processing of semiconductor photovoltaic devices is discussed. The requirements for lunar PV cells is reviewed, and the key challenges involved in their manufacturing are investigated. A schematic diagram of a passivated emitter and rear cell (PERC) is presented. The possible fabrication of large photovoltaic arrays in space from lunar materials is also discussed.
CASI

Fabrication; Photovoltaic Cells; Semiconductor Devices; Solar Arrays

19990026839 Colorado State Univ., Dept. of Chemistry, Fort Collins, CO USA

Template Synthesis of Bismuth Telluride Nanowires ***Interim Report***

Sapp, Shawn A.; Lakshmi, Brinda B.; Martin, Charles R.; Dec. 01, 1998; 15p; In English

Contract(s)/Grant(s): N00014-91-J-1201

Report No.(s): AD-A360131; TR-24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the fabrication of thermoelectric bismuth telluride nanowires using the template synthesis method. A simple electrodeposition procedure was used to produce the nanowires within the pores of an alumina filtration membrane. The resulting bismuth telluride/alumina composite membranes constitute an array of thermoelectric nanowires surrounded by a thermally and electrically insulating matrix. The individual bismuth telluride nanowires can be isolated by removal of the template membrane. These nanowires were characterized and found to be composed of stoichiometric bismuth telluride.

DTIC

Thermoelectricity; Bismuth Tellurides; Electrodeposition; Fabrication; Stoichiometry; Synthesis (Chemistry)

19990026843 Florida Univ., Div. of Sponsored Research, Gainesville, FL USA

Tunable Wavelength Based Photonic Architectures for the Dynamic Control of Phased Array Antennas ***Final Report, Jan. 1996 - Mar. 1998***

Zmuda, Henry; Jan. 1999; 35p; In English

Contract(s)/Grant(s): F30602-96-2-0046; AF Proj. 4600

Report No.(s): AD-A359814; AFRL-SN-RS-TR-1998-227; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report examines three novel photonic systems for controlling broadband phased array antennas. These photonic systems take advantage of recent advances in fiber Bragg gratings, high dispersion optical fiber and tunable wavelength laser technologies. The first system is a transmit/receive beamformer that uses fiber gratings arranged in a prism-like configuration. A proof-of-concept breadboard for controlling a three-element phased array antenna demonstrated high-resolution beamsteering over a 3.5 GHz bandwidth. Based on this discrete architecture, two other systems are proposed; a transversal filter and an optical packet encoder/decoder for optical data communication systems. The second system utilizes high dispersion optical fiber along with fiber Bragg gratings to achieve continuous steering for both transmit or receive. The system, dubbed a photonic crossbar switch, allows the independent routing of a wavelength-encoded signal from an arbitrary input port to an arbitrary output port. The third system, a modified version of the crossbar switch, is capable of broadband null steering. Measurements taken over a ten-percent fractional bandwidth on a three-element proof-of-concept system showed a uniform null depth of better than 40 dB across the entire band. The architecture presented is best suited for small antenna array applications, for example GPS-guided airborne munitions.

DTIC

Fiber Optics; Antenna Arrays; Phased Arrays; Photonics; Tunable Lasers; Optical Communication; Fiber Lasers

19990026866 Department of Energy, Washington, DC USA

Properties of high gain GaAs switches for pulsed power applications

Zutavern, F. J., Department of Energy, USA; Loubriel, G. M., Department of Energy, USA; Hjalmarson, H. P., Department of Energy, USA; Mar, A., Department of Energy, USA; Helgeson, W. D., Department of Energy, USA; Sep. 30, 1997; 8p; In English; 11th; Pulsed power; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE98-000185; SAND-96-3015C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High gain GaAs photoconductive semiconductor switches (PCSS) are being used in a variety of electrical and optical short pulse applications. The highest power application, which the authors are developing, is a compact, repetitive, short pulse linear induction accelerator. The array of PCSS, which drive the accelerator, will switch 75 kA and 250 kV in 30 ns long pulses at 50 Hz. The accelerator will produce a 700 kV, 7 kA electron beam for industrial and military applications. In the low power regime, these switches are being used to switch 400 A and 5 kV to drive laser diode arrays which produce 100 ps optical pulses. These short optical pulses are for military and commercial applications in optical and electrical range sensing, 3D laser radar, and high speed imaging. Both types of these applications demand a better understanding of the switch properties to increase switch lifetime, reduce jitter, optimize optical triggering, and improve overall switch performance. These applications and experiments on the fundamental behavior of high gain GaAs switches will be discussed. Open shutter, infrared images and time-resolved images of the current filaments, which form during high gain switching, will be presented. Results from optical triggering experiments to produce multiple, diffuse filaments for high current repetitive switching will be described.

NTIS

High Gain; Gallium Arsenides; Switches; Switching

19990026872 Department of Energy, Office of Energy Research, Washington, DC USA

Neutron and X-ray scattering experiments on lithium polymer electrolytes

Saboungi, M. L., Department of Energy, USA; Price, D. L., Department of Energy, USA; Sep. 30, 1997; 6p; In English; Advanced non-aqueous battery research and development

Report No.(s): DE97-054391; ANL/MSD/CP-94529; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors are carrying out structural, dynamical and transport measurements of lithium polymer electrolytes, in order to provide information needed to improve the performance of secondary lithium battery systems. Development of batteries based on these materials has focused on rechargeable systems with intercalation/insertion cathodes and lithium or lithium-containing materials as anodes. The electrolytes are generally composites of a polyethylene oxide (PEO) or another modified polyether and a salt such as LiClO4, LiAsF6, or LiCF3SO3. Research on electrolyte materials for lithium batteries has focused on synthesis, characterization, and development of practical devices. Some characterization work has been carried out to determine the properties of the ion polymer and ion interactions, principally through spectroscopic, thermodynamic and transport measurements. The authors have initiated a combined experimental and theoretical study of the structure and dynamics of lithium polymer electrolytes. They plan to investigate the effects of the polymer host on ion solvation and the attendant effects of ion pairing, which affect the ionic transport in these systems.

NTIS

Neutron Scattering; X Ray Scattering; Solid Electrolytes; Lithium Compounds

19990026962 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Advanced Electronics Technology ***Quarterly Report, 1 Aug. - 31 Oct. 1998***

Niessen, Charles W.; Shaver, David C.; Nov. 15, 1998; 22p; In English

Contract(s)/Grant(s): F19628-95-C-0002

Report No.(s): AD-A360105; ESC*-TR-98-043; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Quarterly Technical Summary covers the period 1 August through 31 October 1998. It consolidates the reports of Division 6 (Communications and Information Technology) and Division 8 (Solid State) on the Advanced Electronics Technology Program.

DTIC

Quantum Electronics; Computer Networks; Information Systems

19990026971 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Models of Electron Transfer Through Organized Organic Thin Films (OOTFS) Adsorbed on Metal Surfaces

Mattila, James B.; Nov. 10, 1998; 12p; In English

Report No.(s): AD-A359972; AFIT-FY99-78; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because of their many useful electrical and mechanical properties, ordered organic monolayer films may be a key material used in future electronics and electrochemical applications. However, the complex relationships among these thin film's structure and bonding, and their electrical and chemical properties remain largely unknown. A discussion of the varied properties of these films and a proposed approach to calculating the electrical conductivities of the these films are provided.

DTIC

Thin Films; Organic Materials; Electron Transfer; Adsorption; Metal Surfaces

19990027062 Building and Construction Research TNO, Delft, Netherlands

Shock Testing of an Electric Motor, Type M2CA 315MB6B3, Manufacturer ABB Motors Oy

vanBragt, F. J., Building and Construction Research TNO, Netherlands; Jul. 17, 1998; 22p; In English; Original contains color illustrations; Sponsored in part by National Defence Research, TNO Div., The Netherlands

Contract(s)/Grant(s): A96/KM/151; TNO Proj. 82376139

Report No.(s): TD98-0108; TNO-98-CMC-R0373; Copyright; Avail: Issuing Activity (TNO Building Construction Research, Centre for Mechanical Engrg., Schoemakerstraat 97, P.O. Box 49, 2600 AA Delft, The Netherlands), Hardcopy, Microfiche

An electric motor, type M2CA 315MB6B3-make ABB Motors Oy, has been exposed to shock tests. The shock tests have been carried out in accordance with the shock specification for the LCF (equipment mounted on Leaf Spring Mounts). No mechanical damage has been ascertained. The tested motor meets the requirements for equipment on Leaf Spring Mounts.

Author

Shock Tests; Electric Motors

19990027064 Sienna Technologies, Inc., Woodinville, WA USA
High Thermal Conductivity AlN Packages for High-Temperature Electronics ***Final Report, 10 Jan. 1996 - 31 Aug. 1998***
Savrun, E.; Toy, C.; Sarikaya, M.; Sep. 1998; 52p; In English
Contract(s)/Grant(s): F49620-96-C-0008; AF Proj. STTR
Report No.(s): AD-A359647; TR-974; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A novel metallization for aluminum nitride substrates and related interconnection materials were investigated for packaging silicon carbide devices for use at temperatures up to 600 C. Aluminum nitride substrates were metallized with refractory metals using both thin and thick film metallization techniques. Excellent metallization adhesions (> or = 10 ksi) were achieved at low sheet resistivities for both films. Phase diagrams were used to select potential bond pad, die attach and wire bond materials. Diffusion couples were constructed to screen the selected candidates. Gold and platinum were found to be stable bond pad materials on the refractory metallizations at 700 C. Gold-gold and platinum-platinum pad-wire combinations were suitable for use at temperatures of 600 deg C and beyond. Platinum-gold, copper-gold, and nickel-gold pad-wire combinations could be used with refractory metallized aluminum nitride substrate up to 400 C.
DTIC
Thermal Conductivity; Aluminum Nitrides; Refractory Metals; Ceramics; Metallizing; Packaging; Semiconductor Devices; Electric Connectors

19990027079 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Testing of an Electric Actuator Type EL500, Manufacturer El-o-matic
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Jun. 29, 1998; 20p; In English; Original contains color illustrations
Contract(s)/Grant(s): A96/KM/151; TNO Proj. 82376087
Report No.(s): TD98-0106; TNO-98-CMC-R0365; Copyright; Avail: Issuing Activity (TNO Building and Construction Res., Centre for Mechanical Engrg., Schoemakerstraat 97, P.O. Box 49, 2600 AA Delft, The Netherlands), Hardcopy, Microfiche

An electric actuator, type EL 500 make E-lo-matic, has been exposed to shock tests. The shock tests have been carried out in accordance with the shock specification for the LCF Damage has been ascertained in a horizontal test direction preventing the actuator to operate in one direction, however the actuator can be operated manually.
Author
Shock Tests; Electromechanical Devices; Actuators

19990027192 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Wafer bonding of GaAs, InP, and Si annealed without hydrogen for advanced device technologies
Roberds, B. E., Department of Energy, USA; Choquette, K. D., Department of Energy, USA; Geib, K. M., Department of Energy, USA; Kravitz, S. H., Department of Energy, USA; Twesten, R. D., Department of Energy, USA; Oct. 31, 1997; 7p; In English; 48th; 192nd, USA, USA; Sponsored by Electrochemical Society, Inc., USA
Report No.(s): DE98-004025; SAND-97-2634C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper the authors report on the direct bonding of compound semiconductors and silicon annealed at low temperatures 400 C using hydrogen and nitrogen. Pressure and temperature relationships on interface characteristics were investigated with high resolution transmission electron microscopy and energy dispersive x-ray spectroscopy. It was found that no morphology differences existed between hydrogen and nitrogen annealed samples. applying the N2 bonding process, 850 nm bottom emitting vertical cavity surface emitting lasers (VCSELs), were bonded to a transparent AlGaAs substrate. Finally, high anneal temperatures up to 450 C and shear stress values (> 1.6 MPa) were obtained for GaAs bonded to Si using a dry (plasma) activation technique.
NTIS
Annealing; Bonding; Wafers; Silicon; Hydrogen; Semiconductors (Materials); Aluminum Gallium Arsenides

19990027204 Department of Energy, Assistant secretary for energy efficiency and renewable energy, Washington, DC USA
Recycling readiness of advanced batteries for electric vehicles
Jungst, R. G., Department of Energy, USA; Sep. 30, 1997; 14p; In English; 9th; Battery waste management
Report No.(s): DE98-000239; SAND-97-2343C; CONF-971096; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Maximizing the reclamation/recycle of electric-vehicle (EV) batteries is considered to be essential for the successful commercialization of this technology. Since the early 1990s, the US Department of Energy has sponsored the ad hoc advanced battery readiness working group to review this and other possible barriers to the widespread use of EVs, such as battery shipping and in-

vehicle safety. Regulation is currently the main force for growth in EV numbers and projections for the states that have zero-emission vehicle (ZEV) programs indicate about 200,000 of these vehicles would be offered to the public in 2003 to meet those requirements. The ad hoc Advanced Battery Readiness Working Group has identified a matrix of battery technologies that could see use in EVs and has been tracking the state of readiness of recycling processes for each of them. Lead-acid, nickel/metal hydride, and lithium-ion are the three EV battery technologies proposed by the major automotive manufacturers affected by ZEV requirements. Recycling approaches for the two advanced battery systems on this list are partly defined, but could be modified to recover more value from end-of-life batteries. The processes being used or planned to treat these batteries are reviewed, as well as those being considered for other longer-term technologies in the battery recycling readiness matrix. Development efforts needed to prepare for recycling the batteries from a much larger EV population than exists today are identified.
NTIS
Recycling; Electric Batteries; Electric Motor Vehicles

19990027206 Department of Defense, Washington, DC USA
Hardware review of electrical contact aging and performance in electromechanical stronglinks
Pebbles, D. E., Department of Defense, USA; Ohlhausen, J. A., Department of Defense, USA; Varga, K. S., Department of Defense, USA; Bryan, R. M., Department of Defense, USA; Sep. 30, 1997; 5p; In English; 21st; Aging, compatibility, and stockpile stewardship
Report No.(s): DE98-000198; SAND-97-2007C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Contacts from the functional switch assembly have been examined for a series of MC2969 stronglinks varying from 9 to 14 years of age. Wear tracks are apparent on the contacts as a result of oxide removal by wiping action as the switch is exercised. Typical contaminants observed on the contacts include C, O, S, Cl, F and Si, all of which vary with position on the contacts. All of the contacts show segregation of Ag into the near-surface region. Measurement of the local contact resistance on the ends of the contacts provide resistance values that are reasonable for this material, but with variation among contacts as a result of changes in the local surface chemistry.
NTIS
Contact Resistance; Electromechanics; Electric Contacts; Performance Tests

19990027215 Department of Energy, Washington, DC USA
Factors affecting the use of ceramic capacitors in pulse-discharge applications
Brooks, R. A., Department of Energy, USA; Harris, J. O., Department of Energy, USA; Jan. 31, 1998; 10p; In English; 18th; Capacitor and resistor technology, USA
Report No.(s): DE98-002730; SAND-98-0202C; CONF-980324; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High energy density, high current, pulse discharge capacitors have been utilized at Sandia National Laboratories for many years as the energy storage medium in firing sets, trigger circuits and as laser power sources. to achieve the required high reliability under often extreme environmental conditions, these capacitors have typically utilized Mylar or mica-paper dielectrics for voltage applications in the 2--6 kV range with peak currents of a few kA having rise times around 100 nsec. or less. The increased demands for higher energy density (much lower volume) and lower cost capacitors as energy storage devices have accelerated Sandia's research and development activities in the potential use of ceramic capacitors for these pulse discharge applications. The major weakness in utilizing this type of capacitor was its unknown reliability, in this particular usage mode, compared to discrete film-foil capacitors. Continued improvements in fabrication processes, materials and designs have demonstrated that satisfactory pulse discharge lifetimes can be achieved. Sandia's progress in this field since C.A. Hall's original studies will be presented showing that some ceramic capacitors from several commercial vendors have demonstrated pulse discharge lifetimes greater than 100,000 cycles. Derating of the manufacture's rated voltage as a function of required discharge lifetime and operating voltage and changes in capacitance as a function of voltage stress and temperature are also presented for several ceramic capacitors with different dielectrics.
NTIS
Ceramics; Capacitors; Research and Development

19990027332 Department of Energy, Washington, DC USA

New trends in the commercial IC industry and the impact on defense electronics

Dellin, T. A., Department of Energy, USA; Jorgenson, J. L., Department of Energy, USA; Winokur, P. S., Department of Energy, USA; Romig, A. D., Department of Energy, USA; Feb. 28, 1998; 6p; In English; Microcircuit applications, USA

Report No.(s): DE98-002724; SAND-98-0325C; CONF-980328; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The unprecedented rate and scope of change in the commercial microelectronics industry presents a significant challenge to, and a significant opportunity for, achieving affordable superiority in defense electronics. A proactive approach to making the industry inherently more leveragable is discussed. Defense microelectronics is inexorably linked to the commercial semiconductor industry. This is obvious in the case of COTS (Commercial Off the Shelf parts) and MOTS (Modified--e.g., upscreened--Off the Shelf parts) as these parts are produced by the commercial industry. However, even captive defense integrated circuit lines building specialized parts are being forced by their dependence on a commercial-industry-driven supplier base to follow commercial product/process/design trends. The just released 1997 version of the Semiconductor Industry Association (SIA) National Technology Roadmap for Semiconductors (NTRS) describes the unprecedented changes occurring in the commercial industry. The industry is evolving from a more stable pre- 1994 technology evolution to a discontinuous post-1997 technology evolution. The purpose of this paper is to discuss how these changes present both major challenges and major opportunities, for defense microelectronics, especially for applications involving long lifetimes, harsh environments and/or high consequences of failures. NTIS

Integrated Circuits; Microelectronics; Trends

19990027420 Naval Postgraduate School, Monterey, CA USA

Unattended Ground Sensors and Precision Engagement

Haider, Eric D.; Dec. 1998; 215p; In English

Report No.(s): AD-A359912; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Unattended ground sensors (UGS) are devices that automatically gather sensor data on a remote target, interpret the data and communicate information back to a receiver without interaction with a human operator. The objective of this thesis is to determine how unattended ground sensor technologies might support precision engagement. Comparative case analysis of the use of sensors in Vietnam, the Sinai and Iraq is used to develop principles that UGS must meet to support precision engagement. This study finds that precision engagement requires long endurance UGS to be delivered covertly to discriminate between targets, interrogate them for emissions, while disseminating a fused picture of the target. This study details roles and missions which UGS can fill as well as their costs, benefits and unintended consequences. DTIC

Remote Sensors; Targets; Remote Sensing

19990027444 TRW Space and Electronics Group, Redondo Beach, CA USA

EHF SATCOM Array Design (ESAD) ***Final Report, Sep. 1996 - May 1998***

Toland, Brent; Leight, James E.; Barlevy, Alon; Jan. 1999; 257p; In English

Contract(s)/Grant(s): F30602-96-C-0026; AF Proj. 2863

Report No.(s): AD-A359907; AFRL-SN-RS-TR-1998-221; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The objective of this effort was to develop five EHF SATCOM antenna designs that implement photonics: space and airborne, transmit and receive with nulling. The goal was to identify and develop designs that are performance and cost competitive with RF implementations. The scope of this effort included investigation of photonically implemented antenna design concepts, an analysis trade of these concepts and detailed development of selected design concepts. Verification experiments were to be conducted as necessary to verify novel/unique photonic concepts. EHF SATCOM used a 43.5 to 45.5 GHz uplink and a 20.2 to 21.2 GHz downlink. Airborne SATCOM antennas generally must provide wide angle scanning for a single beam, while the spaceborne antennas are multi-beam and include nulling capability. DTIC

Antenna Design; Extremely High Frequencies; Photonics; Phased Arrays

19990027468 NASA Lewis Research Center, Cleveland, OH USA

On-Wafer Characterization of Millimeter-Wave Antennas for Wireless Applications

Simons, Rainee N., DYNACS Engineering Co., Inc., USA; Lee, Richard Q., NASA Lewis Research Center, USA; July 1998; 16p; In English

Contract(s)/Grant(s): NAS3-98008; RTOP 632-50-5B; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper demonstrates a de-embedding technique and a direct on-substrate measurement technique for fast and inexpensive characterization of miniature antennas for wireless applications at millimeter-wave frequencies. The technique is demonstrated by measurements on a tapered slot antenna (TSA). The measured results at Ka-Band frequencies include input impedance, mutual coupling between two TSAs and absolute gain of TSA.
Author
Millimeter Waves; Slot Antennas; Extremely High Frequencies; Low Cost; Wafers

19990027472 Department of Energy, Washington, DC USA
Multilevel converters for large electric drives
Tolbert, L. M., Department of Energy, USA; Peng, F. Z., Department of Energy, USA; Nov. 30, 1997; 9p; In English; Applied power electronics, 1998, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-001911; ORNL/CP-95563; CONF-980207; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Traditional two-level high frequency pulse width modulation (PWM) inverters for motor drives have several problems associated with their high frequency switching which produces common-mode voltage and high voltage change (dV/dt) rates to the motor windings. Multilevel inverters solve these problems because their devices can switch at a much lower frequency. Two different multilevel topologies are identified for use as a converter for electric drives, a cascade inverter with separate dc sources and a back-to-back diode clamped converter. The cascade inverter is a natural fit for large automotive all electric drives because of the high VA ratings possible and because it uses several levels of dc voltage sources which would be available from batteries or fuel cells. The back to back diode damped converter is ideal where a source of ac voltage is available such as a hybrid electric vehicle. Simulation and experimental results show the superiority of these two converters over PWM based drives.
NTIS
Electric Batteries; Electric Motor Vehicles; Mechanical Drives; Voltage Converters (DC to DC)

19990027660 Department of Energy, Office of Energy Research, Washington, DC USA
Electromechanical properties of superconductors for DOE/OFE applications ***Final Report***
Ekin, J. W., Department of Energy, USA; Bray, S. L., Department of Energy, USA; Dec. 31, 1998; 50p; In English
Report No.(s): DE98-006432; DOE/ER/54208-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In many superconductor applications, especially large magnets, the superconductor is required to perform while under the influence of strong mechanical forces. These forces are commonly due to residual fabrication stress, differential thermal contraction of dissimilar materials, and electromagnetic forces generated within an energized magnet coil. Thorough knowledge of a superconductor's electrical performance under the influence of these forces (electromechanical properties) is required for successful magnet engineering. This report presents results of research conducted during the period from august 1993 through March 1997 on the electromechanical properties of superconductors for DOE/OFE fusion applications.
NTIS
Electrical Properties; Superconductors (Materials); Superconducting Magnets; Mechanical Properties

19990027768 University of Central Florida, Orlando, FL USA
Cascaded Spatial Solitons: Network Routing ***Final Report, 1 Jul. 1995 - 30 Jun. 1998***
Stegeman,; Jun. 30, 1998; 2p; In English
Contract(s)/Grant(s): F49620-95-1-0449; AF Proj. 3484
Report No.(s): AD-A359716; AFRL-SR-BL-TR-99-0030; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Experiments were performed on quadratic soliton generation in Type 1, non-critically phase-matched KNbO3. Using a very sensitive detector array and image enhancement protocols, the first picture of a quadratic soliton on was obtained. Further experiments were performed on KTP with the goal of demonstrating the spontaneous generation of quadratic solitons via down conversion from noise.
DTIC
Spatial Distribution; Cascades; Networks; Solitary Waves

19990027789 Department of the Navy, Washington, DC USA
Amplified Shear Transducer
Carlson, William B., Inventor; Ting, Robert Y., Inventor; Mar. 02, 1998; 22p; In English
Patent Info.: Filed 2 Mar. 1998; US-Patent-Appl-SN-09/034,771
Report No.(s): AD-D019262; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A 15 mode piezoelectric sensor with mechanical amplification is provided. The sensor consists of two piezoelectric members mounted on an electronically inert, rigid substrate. The two members have an electronically inert amplification device connected between them. When acoustic energy passes through the two members, they develop an electric charge which results in the upper ends of the members moving away from each other. Since the lower ends are anchored in the substrate, this causes a shearing response in the members. The shearing is amplified by the attached amplification device, yielding a strong piezoelectric response. In detection mode, incoming acoustic waves cause a mechanical flex in the attached amplification device. The flex of the amplification device causes a shearing response in the two attached piezoelectric members. This shearing causes a generation of electric charge.
DTIC
Patent Applications; Electroacoustic Transducers; Sound Waves; Piezoelectricity

19990027834 Naval Postgraduate School, Monterey, CA USA
Summary of Research 1997 Department of Electrical and Computer Engineering, *1 Jan. - 31 Dec. 1997*
Loomis, Herschel H., Jr.; Knorr, Jeffrey B.; Jan. 1999; 111p; In English
Report No.(s): AD-A360591; NPS-09-98-013; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This report contains summaries of research projects in the Department of Electrical and Computer Engineering. A list of recent publications is also included which consists of conference presentations and publications, books, contributions to books, published journal papers, technical reports, and thesis abstracts.
DTIC
Electrical Engineering; Documents

19990027836 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA
Investigations of the Nonlinear Optical Response of Composite and Photonic Band Gap Materials *Final Report, 1 Sep. 1993 - 24 Sep. 1998*
Nelson, Robert L.; Nov. 1998; 127p; In English
Contract(s)/Grant(s): Proj-4348
Report No.(s): AD-A360593; AFRL-ML-WP-TR-1998-4200; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This report is a doctoral thesis on the nonlinear optical properties of composite and photonic band gap optical materials. Emphasis is placed on the enhancement effect in both types of structures where the effective nonlinearity is greater than the nonlinearity of either of the constituent materials.
DTIC
Nonlinear Optics; Energy Bands; Optical Properties; Optical Materials

19990027944 Academy of Sciences of the Lithuanian SSR, Microwave Lab., Vilnius, Lithuania
Resistive Sensor for Short HPM Pulse Measurement *Final Report*
Kancleris, Zilvinas, Academy of Sciences of the Lithuanian SSR, Lithuania; December 1998; 27p; In English
Contract(s)/Grant(s): F61708-97-W0208
Report No.(s): AD-A360639; EOARD-SPC-97-4050; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report results from a contract tasking Semiconductor Physics Institute as follows: The contractor will investigate the development of a resistive sensor for HPM pulse measurement. Contractor will work on improving the rise time of the sensor and optimizing the frequency response and will design and manufacture sensors as described in the proposal.
DTIC
Waveguides; Microwaves; Semiconductors (Materials)

19990027949 NASA Lewis Research Center, Cleveland, OH USA
Electrodeposited CulnSe2 Thin Film Junctions
Raffaelle, R. P., Florida Inst. of Tech., USA; Mantovani, J. G., Florida Inst. of Tech., USA; Bailey, S. G., NASA Lewis Research Center, USA; Hepp, A. F., NASA Lewis Research Center, USA; Gordon, E. M., Wilberforce Univ., USA; Haraway, R., Wilberforce Univ., USA; Materials Research Society Symposium Proceedings: Chemical Aspects of Electronic Ceramics Processing; 1998; Volume 495, pp. 383-388; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
We have investigated thin films and junctions based on copper indium diselenide (CIS) which have been grown by electrochemical deposition. CIS is a leading candidate for use in polycrystalline thin film photovoltaic solar cells. Electrodeposition is a cost-effective method for producing thin-film CIS. We have produced both p and n type CIS thin films from the same aqueous solution by simply varying the deposition potential. A CIS pn junction was deposited using a step-function potential.

Stoichiometry of the single layer films was determined by energy dispersive spectroscopy. Carrier densities of these films increased with deviation from stoichiometry, as determined by the capacitance versus voltage dependence of Schottky contacts. Optical bandgaps for the single layer films as determined by transmission spectroscopy were also found to increase with deviation from stoichiometry. Rectifying current versus voltage characteristics were demonstrated for the Schottky barriers and for the pn junction.
Author
Copper; Electrodeposition; Indium; Photovoltaic Cells; Selenides; Thin Films; P-N Junctions; Stoichiometry

19990027952 NASA Lewis Research Center, Cleveland, OH USA
Non-Micropipe Dislocations in 4H-SiC Devices: Electrical Properties and Device Technology Implications
Neudeck, Philip G., NASA Lewis Research Center, USA; Huang, Wei, State Univ. of New York, USA; Dudley, Michael, State Univ. of New York, USA; Fazi, Christian, Army Research Lab., USA; 1998; 10p; In English, 13-17 Apr. 1998, San Francisco, CA, USA; Sponsored by Materials Research Society, USA
Contract(s)/Grant(s): RTOP 505-23-2Q; DARPA Order D149; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

It is well-known that SiC wafer quality deficiencies are delaying the realization of outstandingly superior 4H-SiC power electronics. While efforts to date have centered on eradicating micropipes (i.e., hollow core super-screw dislocations with Burgers vectors greater than or equal to 2c), 4H-SiC wafers and epilayers also contain elementary screw dislocations (i.e., Burgers vector = 1c with no hollow core) in densities on the order of thousands per sq cm, nearly 100-fold micropipe densities. While not nearly as detrimental to SiC device performance as micropipes, it has recently been demonstrated that elementary screw dislocations somewhat degrade the reverse leakage and breakdown properties of 4H-SiC p(+)n diodes. Diodes containing elementary screw dislocations exhibited a 5% to 35% reduction in breakdown voltage, higher pre-breakdown reverse leakage current, softer reverse breakdown I-V knee, and microplasmic breakdown current filaments that were non-catastrophic as measured under high series resistance biasing. This paper details continuing experimental and theoretical investigations into the electrical properties of 4H-SiC elementary screw dislocations. The nonuniform breakdown behavior of 4H-SiC p'n junctions containing elementary screw dislocations exhibits interesting physical parallels with nonuniform breakdown phenomena previously observed in other semiconductor materials. Based upon experimentally observed dislocation-assisted breakdown, a re-assessment of well-known physical models relating power device reliability to junction breakdown has been undertaken for 4H-SiC. The potential impact of these elementary screw dislocation defects on the performance and reliability of various 4H-SiC device technologies being developed for high-power applications will be discussed.
Author
Electrical Properties; Diodes; Silicon Carbides; Hydrogen; Pipes (Tubes)

19990027967 Naval Postgraduate School, Dept. of Electrical and Computer Engineering, Monterey, CA USA
PEBB Feedback Control Low Library, Volume 1, Three-Phase Inverter Control Algorithms
Ciezki, John G., Naval Postgraduate School, USA; Ashton, Robert W., Naval Postgraduate School, USA; January 1999; 81p; In English
Report No.(s): AD-A360711; NPS-EC-99-002; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Navy is actively engaged in developing Power Electronic Building Blocks (PEBBs) for its initiatives into DC Zonal Electric Distribution (DC ZEDS). DC ZEDS is a key element of the Integrated Power System (IPS) effort which seeks to modify the current surface combatant so that both ship service and ship propulsion electrical loads are powered from a common set of prime movers. Presently, the current generation of PEBB-like devices include high-power, fast-switching, high-bandwidth dc-dc converters and dc-ac inverters. This report summarized the algorithms required to control a conventional three-phase inverter. First, implementation issues regarding the Sine-Triangle Pulse-Width-Modulation and Space-Vector Modulation are presented with an emphasis placed on digital realizations. Then, two current control schemes are documented via analysis, design example, and simulation. Next, a complex voltage-control scheme is documented, a design example proffered, and simulation studies conducted to illustrate dynamic response. The report concludes with detailed analyses, designs, and simulations of two three-phase induction machine startup and speed control algorithms.
DTIC
Inverters; Electric Potential; Feedback Control

19990027982 Department of Energy, Washington, DC USA

Mechanical properties of Pb-free solder alloys on thick film hybrid microcircuits

Hernandez, C. L., Department of Energy, USA; Vianco, P. T., Department of Energy, USA; Rejent, J. A., Department of Energy, USA; Hosking, F. M., Department of Energy, USA; Mar. 10, 1998; 10p; In English; IPC Printed Circuits Expo '98, 1998, USA

Report No.(s): DE98-002810; SAND-97-2578C; CONF-980422; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The technology drivers of the electronics industry continue to be systems miniaturization and reliability, in addition to addressing a variety of important environmental issues. Although the Sn-Pb eutectic alloy is widely used as a joining material in the electronics industry, it has drawn environmental concern due to its Pb content. The solder acts both as an electrical and mechanical connection within the different packaging levels in an electronic device. New Pb-free solders are being developed at Sandia National Laboratories. The alloys are based on the Sn-Ag alloy, having Bi and Au additions. Prototype hybrid microcircuit (HMC) test vehicles have been assembled to evaluate Pb-free solders for Au-Pt-Pd thick film soldering. The test components consist of a variety of dummy chip capacitors and leadless ceramic chip carriers (LCCC's). The mechanical properties of the joints were evaluated. The reflow profiles and the solid state intermetallic formation reaction will also be presented. Improved solder joint manufacturability and increased fatigue resistance solder alloys are the goals of these materials.

NTIS

Printed Circuits; Soldered Joints; Lead Alloys; Pollution Control; Mechanical Properties; Technology Transfer; Electronic Equipment

19990027985 Department of Energy, Washington, DC USA

Lessons learned from early microelectronics production at Sandia National Laboratories

Weaver, H. T., Department of Energy, USA; Feb. 28, 1998; 22p; In English

Report No.(s): DE98-002893; SAND-98-0269; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

During the 1980s Sandia designed, developed, fabricated, tested, and delivered hundreds of thousands of radiation hardened Integrated Circuits (IC) for use in weapons and satellites. Initially, Sandia carried out all phases, design through delivery, so that development of next generation ICs and production of current generation circuits were carried out simultaneously. All this changed in the mid-eighties when an outside contractor was brought in to produce ICs that Sandia developed, in effect creating a crisp separation between development and production. This partnership had a severe impact on operations, but its more damaging effect was the degradation of Sandia's microelectronics capabilities. This report outlines microelectronics development and production in the early eighties and summarizes the impact of changing to a separate contractor for production. This record suggests that low volume production be best accomplished within the development organization.

NTIS

Integrated Circuits; Radiation Hardening; Design Analysis; Microelectronics

19990027987 Department of Energy, Washington, DC USA

IC chip stress during plastic package molding

Palmer, D. W., Department of Energy, USA; Benson, D. A., Department of Energy, USA; Peterson, D. W., Department of Energy, USA; Sweet, J. N., Department of Energy, USA; Feb. 28, 1998; 8p; In English; 48th; Electronic Component and Technology (ECTC), USA

Report No.(s): DE98-002897; SAND-98-0383C; CONF-980550; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Approximately 95% of the world's integrated chips are packaged using a hot, high pressure transfer molding process. The stress created by the flow of silica powder loaded epoxy can displace the fine bonding wires and can even distort the metalization patterns under the protective chip passivation layer. In this study the authors developed a technique to measure the mechanical stress over the surface of an integrated circuit during the molding process. A CMOS test chip with 25 diffused resistor stress sensors was applied to a commercial lead frame. Both compression and shear stresses were measured at all 25 locations on the surface of the chip every 50 milliseconds during molding. These measurements have a fine time and stress resolution which should allow comparison with computer simulation of the molding process, thus allowing optimization of both the manufacturing process and mold geometry.

NTIS

Integrated Circuits; Packaging; Chips; CMOS; Shear Stress; Manufacturing; High Pressure; Molding Materials

19990028205 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

GaAs-based JFET and PHEMT technologies for ultra-low-power microwave circuits operating at frequencies up to 2.4 GHz

Baca, A. G., Department of Energy, USA; Hietala, V. M., Department of Energy, USA; Greenway, D., Department of Energy, USA; Shul, R. J., Department of Energy, USA; Hafich, M. J., Department of Energy, USA; May 31, 1998; 9p; In English; 193rd, USA; Sponsored by Electrochemical Society, Inc., USA

Report No.(s): DE98-003345; SAND-98-0624C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this work the authors report results of narrowband amplifiers designed for milliwatt and submilliwatt power consumption using JFET and pseudomorphic high electron mobility transistors (PHEMT) GaAs-based technologies. Enhancement-mode JFETs were used to design both a hybrid amplifier with off-chip matching as well as a monolithic microwave integrated circuit (MMIC) with on-chip matching. The hybrid amplifier achieved 8--10 dB of gain at 2.4 GHz and 1 mW. The MMIC achieved 10 dB of gain at 2.4 GHz and 2 mW. Submilliwatt circuits were also explored by using 0.25 (micro)m PHEMTs. 25 (micro)W power levels were achieved with 5 dB of gain for a 215 MHz hybrid amplifier. These results significantly reduce power consumption levels achievable with the JFETs or prior MESFET, heterostructure field effect transistor (HFET), or Si bipolar results from other laboratories.

NTIS

Gallium Arsenides; JFET; Microwave Circuits; Narrowband; Microwave Amplifiers

19990028263 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

How to build VLSI-efficient neural chips

Beiu, V., Department of Energy, USA; Feb. 28, 1998; 13p; In English; EIS 1997: Engineering of intelligent systems, USA

Report No.(s): DE98-003416; LA-UR-97-4460; CONF-980216; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents several upper and lower bounds for the number-of-bits bounds can be used to efficiently build neural network chips. The focus will be on complexity aspects pertaining to neural networks: (1) size complexity and depth (size) trade-offs, and (2) precision of weights and thresholds as well as limited interconnectivity. They show difficult problems-exponential growth in either space (precision and size) and/or time (learning and depth)-when using neural networks for solving general classes of problems (particular cases may enjoy better performances). The bounds for the number-of-bits required for solving a classification problem represent the first step of a general class of constructive algorithms, by showing how the quantization of the input space could be done in O (m(sup 2)n) steps. Here m is the number of examples, while n is the number of dimensions. The second step of the algorithm finds its roots in the implementation of a class of Boolean functions using threshold gates. It is substantiated by mathematical proofs for the size O (mn/(Delta)), and the depth O (log(mn)/log(Delta)) of the resulting network (here (Delta) is the maximum fan in). Using the fan in as a parameter, a full class of solutions can be designed. The third step of the algorithm represents a reduction of the size and an increase of its generalization capabilities. Extensions by using analogue COMPARISONs, allows for real inputs, and increase the generalization capabilities at the expense of longer training times. Finally, several solutions which can lower the size of the resulting neural network are detailed. The interesting aspect is that they are obtained for limited, or even constant, fan-ins. In support of these claims many simulations have been performed and are called upon.

NTIS

Very Large Scale Integration; Chips; Neural Nets

19990028265 Department of Energy, Washington, DC USA

Integrated separation and optical detection for novel on-chip chemical analysis

Warren, M. E., Department of Energy, USA; Anex, D. S., Department of Energy, USA; Rakestraw, D., Department of Energy, USA; Gourley, P. L., Department of Energy, USA; Mar. 31, 1998; 15p; In English, USA

Report No.(s): DE98-003407; SAND-98-0509; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report represents the completion of a two years Laboratory Directed Research and Development (LDRD) program to investigate miniaturized systems for chemical detection and analysis. The future of advanced chemical detection and analysis is in miniature devices that are able to characterize increasingly complex samples, a laboratory on a chip. In this concept, chemical operations used to analyze complicated samples in a chemical laboratory sample handling, species separation, chemical derivitization and detection are incorporated into a miniature device. by using electrokinetic flow, this approach does not require pumps or valves, as fluids in microfabricated channels can be driven by externally applied voltages. This is ideal for sample handling in miniature devices. This project was to develop truly miniature on-chip optical systems based on Vertical Cavity Surface Emitting Lasers (VCSELs) and diffractive optics. These can be built into a complete system that also has on-chip electrokinetic fluid

handling and chemical separation in a microfabricated column. The primary goal was the design and fabrication of an on-chip separation column with fluorescence sources and detectors that, using electrokinetic flow, can be used as the basis of an automated chemical analysis system. Secondary goals involved investigation of a dispersed fluorescence module that can be used to extend the versatility of the basic system and on chip, intracavity laser absorption as a high sensitivity detection technique.
NTIS
Chips; Chemical Analysis; Detection; Separation

19990028273 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Development of a high-voltage, high-power thermal battery
Guidotti, R. A., Department of Energy, USA; Scharrer, G. L., Department of Energy, USA; Binasiewicz, E., Department of Energy, USA; Reinhardt, F. W., Department of Energy, USA; Apr. 30, 1998; 6p; In English; 38th; Power Sources, USA
Report No.(s): DE98-004743; SAND-98-0938C; CONF-980644; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The power requirements for an inverter application were specified to be 500 V at 360 A, or 180 kW per each of six 1-s pulses delivered over a period of 10 minutes. Conventional high-power sources (e.g., flywheels) could not meet these requirements and the use of a thermal battery was considered. The final design involved four, 125-cell, 50-kW modules connected in series. A module using the LiSi/CoS2 couple and all-Li (LiCI-LiBr-LiF minimum-melting) electrolyte was successfully developed and tested. A power level of over 40 kW was delivered during a 0.5-s pulse. This translates into a specific power level of over 9 kW/kg or 19.2 kW/L delivered from a module. The module was still able to deliver over 30 kW during a 1-s pulse after 10 minutes.
NTIS
Thermal Batteries; Inverters; Fabrication; High Voltages

19990028274 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Temperature effects on the performance of PMAN-derived carbon anodes in 1M LiPF6/EC-DMC solution
Guidotti, R. A., Department of Energy, USA; Johnson, B. J., Department of Energy, USA; Apr. 30, 1998; 6p; In English; 38th; Power Sources, USA
Report No.(s): DE98-004742; SAND-98-0939C; CONF-980644; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The effect of temperature on the reversible and irreversible capacities of disordered carbons derived from polymethacryonitrile (PMAN) and divinylbenzene (DVB) copolymers was studied in 1 M LiPF6/ethylene carbonate (EC)-dimethyl carbonate (DMC) (1:1 v/v) solution by galvanostatic cycling. The kinetics of passive film formation were examined by complex-impedance spectroscopy. Temperatures of 5, 21, and 35 C were used in the study.
NTIS
Electric Batteries; Anodes; Temperature Dependence; Carbon

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FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling. For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

19990026831 Department of Energy, Office of Energy Research, Washington, DC USA
Active control of convection
Bau, H. H., Department of Energy, USA; Sep. 30, 1997; 11p; In English; 13th; Energy engineering sciences
Report No.(s): DE97-009415; CONF-9505200-1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Using stability theory, numerical simulations, and in some instances experiments, it is demonstrated that the critical Rayleigh number for the bifurcation (1) from the no-motion (conduction) state to the motion state and (2) from time-independent convection to time-dependent, oscillatory convection in the thermal convection loop and Rayleigh-Benard problems can be significantly increased or decreased. This is accomplished through the use of a feedback controller effectuating small perturbations in the boundary data. The controller consists of sensors which detect deviations in the fluid's temperature from the motionless, conductive values and then direct actuators to respond to these deviations in such a way as to suppress the naturally occurring flow instabi-

lities. Actuators which modify the boundary's temperature/heat flux are considered. The feedback controller can also be used to control flow patterns and generate complex dynamic behavior at relatively low Rayleigh numbers.
NTIS
Active Control; Control Equipment; Rayleigh-Benard Convection

19990026842 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA
Stability and Transition of Hypersonic Boundary-Layer Flows ***Final Report***
Reed, Helen L.; Dec. 1998; 12p; In English
Contract(s)/Grant(s): F49620-98-1-0205
Report No.(s): AD-A360211; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Transition location can be a significant source of uncertainty in high-speed vehicle drag and heating predictions. Also, the efficacy of transition control depends largely on where transition is predicted. Because of facility noise, transition measurements in ground-test facilities are generally not reliable predictors of flight performance and we must rely on computational approaches for design for flight. The program at Arizona State University to investigate stability and transition of hypersonic boundary-layer flows has been ongoing for several years. In this final report we compile the significant theoretical and computational results from this program. The research has progressed through several logical steps with increasing complexity: Linear stability theory with the effects of chemistry and bow shock on a sharp circular cone at zero incidence with a PNS basic state. Examine 3-D effects on a sharp elliptic cone at zero incidence with a PNS basic state. Include nose bluntness (entropy layer and curved shock) plus nonequilibrium chemistry on a circular cone in the nonlinear Parabolized Stability Equations with a Navier-Stokes basic state. Provide a new crossflow Reynolds number including compressibility and wall-temperature effects for use in conceptual design.
DTIC
Boundary Layer Transition; Hypersonic Flow; Nonequilibrium Flow; Shock Waves; Boundary Layer Flow; Cross Flow; Flight Characteristics; Navier-Stokes Equation; Slender Cones; Transition Flow

19990026847 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A 3-D Unstructured CFD Method for Maneuvering Vehicles
Hughson, Montgomery C.; Jan. 20, 1999; 122p; In English
Report No.(s): AD-A360119; AFIT-FY99-53; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Numerical simulation of maneuvering vehicles is accomplished using a three dimensional (3-D) unstructured computational fluid dynamic (CFD) method. The equations of fluid motion used are either the inviscid Euler equations or the full viscous Navier Stokes equations cast in an Arbitrary Lagrangian-Eulerian (ALE) framework. A turbulence model developed by Spalart and Allmaras is used for viscous solutions. The system of fluid equations are solved implicitly using upwind, flux-splitting techniques for the convective fluxes of either Roe or Van Leer with up to second-order temporal and spatial accuracy for steady or unsteady computations. Innovative boundary conditions for a moving mesh to include inviscid, viscous, far-field and a solid rocket motor exhaust exit surface were developed. The temporal solution is found using an application of Newton's method. The computational field simulation (CFS) of two 3-D wings and a waisted-body of revolution are compared to experimental data for boundary condition validation. An unsteady CFS of a pitching wing is validated by comparison to experimental data. A number of unsteady missile maneuver trajectories coupled with a six degree of freedom model using Euler angles and the Flat-Earth model are presented.
DTIC
Computational Fluid Dynamics; Computational Grids; Navier-Stokes Equation; Euler Equations of Motion; Maneuvers; Three Dimensional Flow

19990027077 Department of Energy, Office of Energy Research, Washington, DC USA
Hydrodynamic instabilities and coherent structures ***Final Report, 1990-1997***
Frenkel, A. L., Department of Energy, USA; Apr. 30, 1998; 8p; In English
Report No.(s): DE98-006455; DOE/ER/14100-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This project has had two related parts: (1) Nonlinear behavior of wavy film flows, and (2) Linear and nonlinear stability of space-time-periodic flows. In this project, the author has developed novel methods of perturbative derivations of evolution equations governing film flows. In particular, these methods allow one to obtain a priori parametric regions of validity for such approximate descriptions of the nonlinear film dynamics. The methods yield the most general evolution equations, thus eliminating the need for a new derivation every time a new parametric domain is considered (corresponding to one choice of the infinite number of possible different order-of-magnitude relations between the system parameters). New concepts were introduced to advance understanding of these matters. New evolution equations were derived, and their numerical solutions were worked out. The latter uncovered new and unexpected types of nonlinear dynamical phenomena, including particle-like interactions of localized

coherent structures having emerged spontaneously and, under certain conditions, proceeding to self-organized process of formation of patterns with unprecedented (at least in fluid dynamics) complexity of order (in an intuitive sense). Exciting agreements were obtained with recent important real-life experiments performed by different groups of researchers. Large-scale instability of space-periodic flow has been studied in connection with such intriguing phenomena in hydrodynamic turbulence as inverse cascade of energy to--and negative eddy viscosity at--large scales of motion and self- organization of large-scale coherent structures. Certain results can be obtained by considering a statistical ensemble of flows such as in Lipscombe, Frenkel and ter Haar 91. However, the main thrust in this project has been the study of instability of deterministic viscous flows sustained by a periodic external forcing. Whereas time-independent flows were considered before, the author included into consideration the periodic dependence on time; it stands to reason that flows periodic in both space and time are more appropriate for turbulence modeling. The conceptual foundation for such studies was worked out in Frenkel 91a. That approach, reducing a differential eigenvalue problem to an algebraic one, proved in the course of studies very useful in clarifying the question of generality of previous conclusions even for steady flows, where only very special, having high symmetry flows had been considered before. The author also emphasized the importance of intermediate-scale instabilities (which cannot be captured by the alternative, differential-equation approach popular in the field), and developed the first nonlinear theory of such instability.
NTIS
Coherence; Flow Stability

19990027100 City Coll. of the City Univ. of New York, Dept. of Mechanical Engineering, NY USA
The Effects of Expansion Waves on Vortices and Turbulence ***Final Report, 1 Mar. - 30 Nov. 1998***
Briassulis, G.; Agui, J. H.; Andreopoulos, Yiannis; Jan. 1999; 60p; In English
Contract(s)/Grant(s): F49620-98-1-0358; AF Proj. 2307
Report No.(s): AD-A360166; TR-96-07; AFRL-SR-BL-TR-99-0046; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A decaying compressible nearly homogeneous and nearly isotropic, grid generated turbulent flow has been set-up in a large scale shock tube research facility. Experiments have been performed by using instrumentation with spatial resolution of the order of 7 to 26 Kolmogorov viscous length scales. A variety of turbulence generating grids provided a wide range of turbulence scales with flow Mach numbers ranging from 0.3 to 0.6 and turbulent Reynolds number up to 700. The decay of Mach number fluctuations was found to follow a power law similar to that describing the decay of incompressible isotropic turbulence. It was also found that the decay coefficient and the decay exponent decrease with increasing Mach number while the virtual origin increases with increasing Mach number. A mechanism possibly responsible for these effects appears to be the inherently low growth rate of compressible shear layers emanating from the cylindrical rods of the grid. Measurements of time-dependent, three dimensional vorticity vector were attempted for the first time with a 12 wire miniature probe. This also allowed estimates of dilatation, compressible dissipation and dilatational stretching to be obtained. It was found that the fluctuations of these quantities increase with increasing Mach number of the flow. The time-dependent signals of enstrophy, vortex stretching/tilting vector and dilatational stretching vector found to exhibit a rather strong intermittent behavior which is characterized by bursts of high amplitudes with values up to 8 times their r.m.s. followed by less violent periods of time. Several of these bursts are evident in all signals suggesting the existence of a dynamical flow phenomenon as a common cause.
DTIC
Elastic Waves; Vortices; Turbulence; Computational Fluid Dynamics

19990027130 Department of Energy, Office of Fiancial Management and Controller, Washington, DC USA
Hybrid solution for advection-diffusion problems with variable advective fields and semi-infinite domains
Driessen, B. J., Department of Energy, USA; Dohner, J. L., Department of Energy, USA; Dec. 31, 1998; 14p; In English; Mechanical Engineering, 1998, USA
Report No.(s): DE98-007192; SAND-98-1050C; CONF-981107; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper a hybrid, finite element/boundary element method which can be used to solve for particle diffusion in semi-infinite domains containing geometric obstructions and a variable advective field is presented. In previous work either boundary element or finite element/difference methods were used to solve for particle concentrations in an advective domain. These methods of solution had a number of limitations. Due to limitations in computing spatially dependent Green's functions, the boundary element method of solution was limited to domains containing only constant advective fields, and due to its inherent formulation, finite element/difference methods were limited to only domains of finite spatial extent. Thus, where the finite element solution was limited, the boundary element solution was not, and where the boundary element solution was limited, the finite element solution was not. In this paper it is proposed to split the total domain into two sub-domains where each method of solution is applicable.

For each of these sub-domains, the appropriate solution method is used; thereby, producing a general method of solution for the total semi-infinite domain.
NTIS
Particle Diffusion; Domains; Advection

19990027270 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Investigation into the Effects of Underwater Shock Waves on Simple Structures, Shielded and Bare Explosive Materials
Kinsey, Trevor, Defence Science and Technology Organisation, Australia; Chung, Michael, Defence Science and Technology Organisation, Australia; Jun. 1998; 25p; In English
Report No.(s): DSTO-RR-0134; DODA-AR-010-571; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001), Hardcopy, Microfiche

The detonation of an underwater charge creates a shock wave and a bubble of gaseous products at high temperature and pressure. At greater ranges, the shock wave and bubble become separated and their effects on structures may be studied separately. However, close to the point of detonation, in the regions typically used for sea-mine neutralization, the shock wave and bubble he in close proximity and their relative importance in the neutralization process is not known. A series of scaled experiments to visualize the early development of the shock wave and bubble, and their interactions with an explosive and with simple structures were devised. These experiments used spherical pentolite charges and cylindrical Composition B charges as the donor and acceptor charges respectively. Both charges were suspended in a small, transparent water-filled tank and the effects of the exploding donor recorded by a Cordin rotating mirror camera.
Author
Experimentation; Shock Waves; Underwater Acoustics; Detonation

19990027307 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Computer assisted gamma and X-ray tomography: Applications to multiphase flow systems
Kumar, S. B., Department of Energy, USA; Dudukovic, M., Department of Energy, USA; Jan. 31, 1998; 68p; In English
Report No.(s): DE98-058031; DOE/PC/95051-13; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In process vessels, involving two or three phases it is often important not only to know the volume fraction (holdup) of each phase but also the spatial distribution of such holdups. This information is needed in control, trouble shooting and assessment of flow patterns and can be observed noninvasively by the application of Computed Tomography (CT). This report presents a complete overview of X-ray and gamma ray transmission tomography principles, equipment design to specific tasks and application in process industry. The fundamental principles of tomography, the algorithms for image reconstruction, the measurement method and the possible sources of error are discussed in detail. A case study highlights the methodology involved in designing a scanning system for the study of a given process unit, e.g., reactor, separations column etc. Results obtained in the authors' laboratory for the gas holdup distribution in bubble columns are also presented. Recommendations are made for the Advanced Fuels Development Unit (AFDU) in LaPorte, TX.
NTIS
Computer Aided Tomography; Image Reconstruction; Multiphase Flow; Algorithms; Gamma Rays; X Rays

19990027309 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
MFIX documentation numerical technique
Syamlal, M., Department of Energy, USA; Jan. 31, 1998; 83p; In English
Report No.(s): DE98-057983; DOE/MC/31346-01; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

MFIX (Multiphase Flow with Interphase eXchanges) is a general-purpose hydrodynamic model for describing chemical reactions and heat transfer in dense or dilute fluid-solids flows, which typically occur in energy conversion and chemical processing reactors. The calculations give time-dependent information on pressure, temperature, composition, and velocity distributions in the reactors. The theoretical basis of the calculations is described in the MFIX Theory Guide. Installation of the code, setting up of a run, and post-processing of results are described in MFIX User's manual. Work was started in April 1996 to increase the execution speed and accuracy of the code, which has resulted in MFIX 2.0. to improve the speed of the code the old algorithm was replaced by a more implicit algorithm. In different test cases conducted the new version runs 3 to 30 times faster than the old version. to increase the accuracy of the computations, second order accurate discretization schemes were included in MFIX 2.0. Bubbling fluidized bed simulations conducted with a second order scheme show that the predicted bubble shape is rounded, unlike

the (unphysical) pointed shape predicted by the first order upwind scheme. This report describes the numerical technique used in MFIX 2.0.
NTIS
Multiphase Flow; Heat Transfer; Hydrodynamics; Chemical Reactions; Fluid Flow; Computer Programs

19990027418 Old Dominion Univ., Dept. of Computer Science, Norfolk, VA USA
Parallel Implicit Algorithms for CFD ***Final Report, Period ending 30 Sep. 1998***
Keyes, David E., Old Dominion Univ., USA; December 1998; 7p; In English
Contract(s)/Grant(s): NAG1-1692
Report No.(s): ODURF-151671; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The main goal of this project was efficient distributed parallel and workstation cluster implementations of Newton-Krylov-Schwarz (NKS) solvers for implicit Computational Fluid Dynamics (CFD.) "Newton" refers to a quadratically convergent nonlinear iteration using gradient information based on the true residual, "Krylov" to an inner linear iteration that accesses the Jacobian matrix only through highly parallelizable sparse matrix-vector products, and "Schwarz" to a domain decomposition form of preconditioning the inner Krylov iterations with primarily neighbor-only exchange of data between the processors. Prior experience has established that Newton-Krylov methods are competitive solvers in the CFD context and that Krylov-Schwarz methods port well to distributed memory computers. The combination of the techniques into Newton-Krylov-Schwarz was implemented on 2D and 3D unstructured Euler codes on the parallel testbeds that used to be at LaRC and on several other parallel computers operated by other agencies or made available by the vendors. Early implementations were made directly in Massively Parallel Integration (MPI) with parallel solvers we adapted from legacy NASA codes and enhanced for full NKS functionality. Later implementations were made in the framework of the PETSC library from Argonne National Laboratory, which now includes pseudo-transient continuation Newton-Krylov-Schwarz solver capability (as a result of demands we made upon PETSC during our early porting experiences). A secondary project pursued with funding from this contract was parallel implicit solvers in acoustics, specifically in the Helmholtz formulation. A 2D acoustic inverse problem has been solved in parallel within the PETSC framework.
Derived from text
Algorithms; Computational Fluid Dynamics; Massively Parallel Processors; Nonlinearity; Parallel Processing (Computers); Wings; Incompressible Flow

19990027446 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA
Endurance Pump Tests With Fresh and Purified MIL-H-5606 Hydraulic Fluid Historic Resources Survey ***Final Report, 1995 - 1998***
Sharma, Shashi K.; Snyder, Carl E., Jr.; gschwender, Lois J.; Cecere, Gregory J.; Jenney, Timothy; Jun. 1998; 53p; In English
Contract(s)/Grant(s): F33615-90-C-5963; AF Proj. 4347
Report No.(s): AD-A359940; AFRL-ML-WP-TR-1998-4211; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

There has been a move in the U.S. Armed Forces to begin using additional purifiers to clean up used hydraulic fluid for continued use to reduce the hydraulic fluid waste stream. Two 1500 hour pump tests were conducted to study if the fluid purification had any adverse impact on the life of aircraft hydraulic pumps. Pump tests with both fresh and purified MIL-H-5606 fluids were successfully completed, and there was no apparent difference in pump performance with either fluid. In test with fresh MIL-H-5606, the main shaft that acts as the inner race for the needle bearing, showed considerable spalling. Polishing wear was observed on most of the pump parts except that there was some erosion on the cylinder block face and on the piston shoe faces. The erosion on the piston shoe faces was somewhat more with the purified fluid than observed in the test with fresh MIL-5606. No degradation in the pump performance was observed due to shaft spalling or the erosion on cylinder block and piston shoe faces.
DTIC
Pumps; Hydraulic Fluids; Hydraulic Equipment; Engine Parts; Purification

19990027454 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA
Automated Fluid Feature Extraction from Transient Simulations ***Progress Report***
Haimes, Robert, Massachusetts Inst. of Tech., USA; Lovely, David, Massachusetts Inst. of Tech., USA; Feb. 08, 1999; 68p; In English
Contract(s)/Grant(s): NCC2-985; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the past, feature extraction and identification were interesting concepts, but not required to understand the underlying physics of a steady flow field. This is because the results of the more traditional tools like iso-surfaces, cuts and streamlines were more interactive and easily abstracted so they could be represented to the investigator. These tools worked and properly conveyed the

collected information at the expense of much interaction. For unsteady flow-fields, the investigator does not have the luxury of spending time scanning only one ”snap-shot” of the simulation. Automated assistance is required in pointing out areas of potential interest contained within the flow. This must not require a heavy compute burden (the visualization should not significantly slow down the solution procedure for co-processing environments like pV3). and methods must be developed to abstract the feature and display it in a manner that physically makes sense. The following is a list of the important physical phenomena found in transient (and steady-state) fluid flow: (1) Shocks, (2) Vortex cores, (3) Regions of recirculation, (4) Boundary layers, (5) Wakes. Three papers and an initial specification for the (The Fluid eXtraction tool kit) FX Programmer’s guide were included. The papers, submitted to the AIAA Computational Fluid Dynamics Conference, are entitled : (1) Using Residence Time for the Extraction of Recirculation Regions, (2) Shock Detection from Computational Fluid Dynamics results and (3) On the Velocity Gradient Tensor and Fluid Feature Extraction.
Author
Steady Flow; Unsteady Flow; Vortices; Wakes; Computer Programs; Computational Fluid Dynamics; Algorithms; Shock Waves; Boundary Layers

19990027541 Department of Energy, Office of Energy Research, Washington, DC USA
Two-phase flow measurements by nuclear magnetic resonance (NMR *Final Report, 1 Jan. 1993 - 30 Sep. 1997*
Fukushima, E., Department of Energy, USA; Jul. 29, 1998; 3p; In English
Report No.(s): DE98-006349; DOE/ER/14316-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Researchers pioneered NMR studies of concentrated suspensions starting in the late 1980’s (Majors, et al., 1989; Altobelli, et al., 1991; Abbott, et al., 1991). In those studies, they measured concentration and velocity of the liquid component either in pipe or Couette flow. If one compares these early studies of suspensions with more recent ones, imaging time has gone from 40 minutes to 8 minutes and the imaging matrix has increased from 32 x 32 to 128 x 128. In the interim, many concentrated suspension flows in both pipe and Couette geometries, with different particle sizes and shapes, and different kinds of liquids have been performed. The author summarizes the main results here and lists the publications that emanated from this grant.
NTIS
Flow Measurement; Two Phase Flow; Nuclear Magnetic Resonance

19990027602 NASA Lewis Research Center, Cleveland, OH USA
Reversal in Spreading of a Tabbed Circular Jet Under Controlled Excitation
Zaman, K. B. M. Q., NASA Lewis Research Center, USA; Raman, G., NYMA, Inc., USA; Physics of Fluids; December 1997; Volume 9, No. 12, pp. 3733-3741; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Detailed flow field measurements have been carried out for a turbulent circular jet perturbed by tabs and artificial excitation. Two ”delta tabs” were placed at the nozzle exit at diametrically opposite locations. The excitation condition involved subharmonic resonance that manifested in a periodic vortex pairing in the near flow field. While the excitation and the tabs independently increased jet spreading, a combination of the two diminished the effect. The jet spreading was most pronounced with the tabs but was reduced when excitation was applied to the tabbed jet. The tabs generated streamwise vortex pairs that caused a lateral spreading of the jet in a direction perpendicular to the plane containing the tabs. The excitation, on the other band, organized the azimuthal vorticity into coherent ring structures whose evolution and pairing also increased entrainment by the jet. In the tabbed case, the excitation produced coherent azimuthal structures that were distorted and asymmetric in shape. The self-induction of these structures produced an effect that opposed the tendency for the lateral spreading of the streamwise vortex pairs. The passage of the distorted vortices, and their pairing, also had a cancellation effect on the time-averaged streamwise vorticity field. These led to the reduction in jet spreading.
Author
Tabs (Control Surfaces); Turbulent Jets; Excitation; Flow Distribution; Thrust Vector Control

19990027617 NASA Lewis Research Center, Cleveland, OH USA
Finite Element Analysis of Magnetic Damping Effects on G-Jitter Induced Fluid Flow
Pan, Bo, Louisiana State Univ., USA; Li, Ben Q., Louisiana State Univ., USA; deGroh, Henry C., III, NASA Lewis Research Center, USA; 1997; 16p; In English; Spacebound 1997, 11 Mar. - 15 May 1997, Montreal, Quebec, Canada
Contract(s)/Grant(s): NCC8-92; RTOP 963-80-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper reports some interim results on numerical modeling and analyses of magnetic damping of g-jitter driven fluid flow in microgravity. A finite element model is developed to represent the fluid flow, thermal and solute transport phenomena in a 2-D cavity under g-jitter conditions with and without an applied magnetic field. The numerical model is checked by comparing with analytical solutions obtained for a simple parallel plate channel flow driven by g-jitter in a transverse magnetic field. The model

is then applied to study the effect of steady state g-jitter induced oscillation and on the solute redistribution in the liquid that bears direct relevance to the Bridgman-Stockbarger single crystal growth processes. A selection of computed results is presented and the results indicate that an applied magnetic field can effectively damp the velocity caused by g-jitter and help to reduce the time variation of solute redistribution.
Author
Magnetic Effects; Fluid Flow; Microgravity; Finite Element Method; Cavities; Crystal Growth; Magnetic Fields

19990027850 Helsinki Univ. of Technology, Lab. of Materials Science and Metallurgy, Espoo, Finland
Travel Report: Introduction to the ASME Fluids Engineering Division Summer Meeting 1998
Xia, Jiliang, Helsinki Univ. of Technology, Finland; 1998; ISSN 1455-2329; 24p; In English; Fluids Engineering, 20-25 Jun. 1998, Washington, DC, USA; Sponsored by American Society of Mechanical Engineers, USA
Report No.(s): PB99--121691; TKK-MK-47; ISBN 951-22-4228-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the oldest divisions, Fluids Engineering Division (FED) was established in 1926 to provide engineers in the fluids engineering field an open forum for discussion and to promote the art and science of fluids engineering to those interested in research, design and fluids equipment use. Among these divisions are Materials Division, which are mainly involved in information on properties of materials and the influence of these properties on design consideration in materials selection for engineering structures, and Materials Handling Engineering Division, which is for information on systems engineering methods that integrate control technology, information technology, and material transport equipment to provide efficient, safe, and economical material handling.
NTIS
Systems Engineering; Information Systems; Mechanical Engineering; Fluid Mechanics

19990028242 Indiana Univ., Indianapolis, IN USA
Fluid Mechanics and Rheology of Fluid Fiber Flow: Fundamental Science and Technological Applications ***Final Report, 1 Apr. 1996 - 31 Dec. 1998***
Wang, Qi; Jan. 03, 1999; 7p; In English
Contract(s)/Grant(s): F49620-96-1-0131
Report No.(s): AD-A360525; AFRL-SR-BL-TR-99-0058; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research activities are focused on modeling of polymeric liquid crystal (LCF) flows. We first summarizes our comprehensive studies on the shear and elongational flow with an imposed velocity field. This includes a complete characterization of the orientational equilibria and their bifurcation behavior as well as the detailed study on the orientation dynamics with respect to both types of flows. In particular, biaxial patterns and their dynamics are treated carefully. We then report on the work on the modeling of fiber spinning processes of thermotropic liquid crystal polymers, where new models along with an extensive study for fiber flows of thermotropic liquid crystals are presented. The study on the influence of microstructure on the capillary instability of liquid crystal jets follows. Finally, we report on some long wave stability analysis for ideal liquid jets of LCPs and the progress on some ongoing projects.
DTIC
Liquid Crystals; Fluid Flow; Shear Flow; Ideal Gas; Fluid Jets; Rheology

19990028250 NASA Lewis Research Center, Cleveland, OH USA
Inlet-Compressor Analysis Using Coupled CFD Codes
Cole, Gary, NASA Lewis Research Center, USA; Suresh, Ambady, DYNACS Engineering Co., Inc., USA; Townsend, Scott, DYNACS Engineering Co., Inc., USA; 1998; 6p; In English, 25-27 Aug. 1998, Brook Park, OH, USA; Sponsored by NASA Lewis Research Center, USA
Contract(s)/Grant(s): NAS3-98008; RTOP 509-10-11; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Propulsion performance and operability are key factors in the development of a successful aircraft. For high-speed supersonic aircraft, mixed-compression inlets offer high performance but are susceptible to an instability referred to as unstart. An unstart occurs when a disturbance originating in the atmosphere or the engine causes the shock system to be expelled from the inlet. This event can have adverse effects on control of the aircraft, which is unacceptable for a passenger plane such as the high speed civil transport (HSCT). The ability to predict the transient response of such inlets to flow perturbations is, therefore, important to the proper design of the inlet and the control measures used to prevent unstart. Computational fluid dynamics (CFD) is having an increasing role in the analysis of individual propulsion components. isolated inlet studies are relatively easy to perform, but a major uncertainty is the boundary condition used at the inlet exit to represent the engine - the so-called compressor face boundary condi-

tion. A one-dimensional (I-D) Euler inlet simulation (ref. 1) showed that the predicted inlet unstart tolerance to free-stream pressure perturbations can vary by as much as a factor of about six, depending on the boundary condition used. Obviously, a thorough understanding of dynamic interactions between inlets and compressors/fans is required to provide the proper boundary condition. Derived from text

Compressors; Computational Fluid Dynamics; Engine Inlets; Boundary Conditions; Supersonic Transports; Free Flow; Aircraft Control

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Aircraft Instrumentation, and 19 Space Instrumentation.

19990026815 Department of Energy, Washington, DC USA

Field Testing of a Portable Radiation Detector and Mapping System

Hofstetter, K. J., Department of Energy, USA; Hayes, D. W., Department of Energy, USA; Eakle, R. F., Department of Energy, USA; Dec. 31, 1998; 6p; In English; SPECTRUM '98: Nuclear and Hazardous Waste Management, 1996, USA

Report No.(s): DE98-051767; WSRC-MS-97-00851; CONF-980905; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Researchers at the Savannah River Site (SRS) have developed a man-portable radiation detector and mapping system (RADMAPS) which integrates the accumulation of radiation information with precise ground locations. RADMAPS provides field personnel with the ability to detect, locate, and characterize nuclear material at a site or facility by analyzing the gamma or neutron spectra and correlating them with position. The man-portable field unit records gamma or neutron count rate information and its location, along with date and time, using an embedded Global Positioning System (GPS). RADMAPS is an advancement in data fusion, integrating several off-the-shelf technologies with new computer software resulting in a system that is simple to deploy and provides information useful to field personnel in an easily understandable form. Decisions on subsequent actions can be made in the field to efficiently use available field resources. The technologies employed in this system include: recording GPS, radiation detection (typically scintillation detectors), pulse height analysis, analog-to-digital converters, removable solid-state (Flash or SRAM) memory cards, Geographic Information System (GIS) software and personal computers with CD-ROM supporting digital base maps. RADMAPS includes several field deployable data acquisition systems designed to simultaneously record radiation and geographic positions. This paper summarizes the capabilities of RADMAPS and some of the results of field tests performed with the system.

NTIS

Radiation Detectors; Maps; Field Tests; Geographic Information Systems; Scintillation Counters; Data Acquisition; Digital Data; Computer Programs

19990026957 Naval Postgraduate School, Monterey, CA USA

Performance Analysis of IRTOOL Ray Refraction Program and Comparison to LWKD and PIRAM Marine Boundary Layer Programs

Georgopoulos, Antonios; Dec. 1998; 83p; In English

Report No.(s): AD-A360095; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The prediction of mirage conditions by the IRTOOL engagement simulation program has been evaluated by comparison with experimental visible and IR observations extracted from the MAPTIP experiment data base. IRTOOL predictions have also been compared with the LWKD and PIRAM Boundary Layer programs for identical input conditions. For sensors located above about 20 meters the values of Minimum Mirage Range and Maximum Inter-Vision Range become inconsistent and all models show similar mirage threshold performance offset internally and from the measurements by approximately 1-3 km (5-20%). This may be related to uncertainties in the temperature profiles generated from Boundary Layer models. Variations of 2-4 C in Air Sea Temperature are insufficient to account for the observed deviations.

DTIC

Atmospheric Refraction; Computer Programs; Infrared Tracking; Marine Environments; Air Water Interactions; Atmospheric Boundary Layer; Infrared Imagery; Temperature Profiles; FLIR Detectors

19990027018 NASA Goddard Space Flight Center, Greenbelt, MD USA

Mars Solar Balloon Landed Gas Chromatograph Mass Spectrometer

Mahaffy, P., NASA Goddard Space Flight Center, USA; Harpold, D., NASA Goddard Space Flight Center, USA; Niemann, H., NASA Goddard Space Flight Center, USA; Atreya, S., Michigan Univ., USA; Gorevan, S., Honeybee Robotics Ltd., USA; Israel, G., Centre National de la Recherche Scientifique, France; Bertaux, J. L., Centre National de la Recherche Scientifique, France; Jones, J., Jet Propulsion Lab., California Inst. of Tech., USA; Owen, T., Hawaii Univ., USA; Raulin, F., Paris Univ., France; 1999; 3p; In English; Mars Exploration Programme and Sample Return Missions Symposium, 1 Feb. - May 1999, Paris, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A Mars surface lander Gas Chromatograph Mass Spectrometer (GCMS) is described to measure the chemical composition of abundant and trace volatile species and isotope ratios for noble gases and other elements. These measurements are relevant to the study of atmospheric evolution and past climatic conditions. A Micromission plan is under study where a surface package including a miniaturized GCMS would be delivered to the surface by a solar heated hot air balloon based system. The balloon system would be deployed about 8 km above the surface of Mars, wherein it would rapidly fill with Martian atmosphere and be heated quickly by the sun. The combined buoyancy and parachuting effects of the solar balloon result in a surface package impact of about 5 m/sec. After delivery of the package to the surface, the balloon would ascend to about 4 km altitude, with imaging and magnetometry data being taken for the remainder of the daylight hours as the balloon is blown with the Martian winds. Total atmospheric entry mass of this mission is estimated to be approximately 50 kg, and it can fit as an Ariane 5 piggyback payload. The GCMS would obtain samples directly from the atmosphere at the surface and also from gases evolved from solid phase material collected from well below the surface with a Sample Acquisition and Transport Mechanism (SATM). The experiment envisioned in the Mars Micromission described would obtain samples from a much greater depth of up to one meter below the surface, and would search for organic molecules trapped in ancient stratified layers well below the oxidized surface. Insitu instruments on upcoming NASA missions working in concert with remote sensing measurement techniques have the potential to provide a more detailed investigation of mineralogy and the extent of simple volatiles such as CO2 and H2O in surface and subsurface solid phase materials. Within the context of subsequent mission opportunities such as those provided by the Ariane 5 piggyback payload based Micromissions, it is essential to implement an even broader chemical analysis and to enable a significant extension of previous isotope measurements. Such a development would enhance the presently very active study of questions of atmospheric evolution and loss and past climatic conditions. The method selected to implement this program can be based on well-established mass spectrometry techniques. Sampled gas is chemically and physically processed to separate the gas mixture into components using gas chromatograph and related enrichment techniques. This allows trace species to be identified and reveals isotopic distributions in many cases with improved precision. Samples of interest, such as organic molecules, may lie deep below the highly oxidized surface layer and the suggested program includes enhanced sampling techniques to measure volatiles preserved in solid phase material deep below the surface as well as gas from the well mixed atmosphere.

Derived from text

Gas Chromatography; Imaging Techniques; Isotope Ratios; Mars Atmosphere; Mars Surface; Mass Spectrometers; Payloads

19990027070 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA

Using the MCLIB Library: Small-Angle Instrument with Focusing-Mirror Collimation

Seeger, P. A., Department of Energy, USA; Aug. 31, 1997; 7p; In English; Materials research using cold neutrons at pulsed sources Report No.(s): DE98-002671; LA-UR-97-4029; CONF-9708115; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Focusing mirrors in 1 or 2 dimensions can be used to increase the intensity in a small-angle instrument while maintaining high resolution. Using the recently added toroidal mirror region type in MCLIB (Monte Carlo library for neutron instrument design), we compare five mirror shares: the ideal ellipsoid the tangent toroid, 8 tangent toroidal segments, 8 tangential cylindrical segments, and 20 tangential cylindrical segments. A small-angle scattering instrument on a spallation source was simulated to study resolution. Comparisons show that the ellipsoid provides superior resolution, but that the 8 tangential toroids are a good compromise. A resolution of 0.00056 (Angstrom)(exp -1)(rms), or +/- 11% at Q = 0.005 (Angstrom)(exp -1), was achieved in the simulation using neutrons in the wavelength range 4-15 A. The count rate is high because the full area of the moderator is viewed.

NTIS

Monte Carlo Method; Collimation; Mirrors; Subroutine Libraries (Computers)

19990027202 Department of Energy, Office of Energy Research, Washington, DC USA

Instrumentation using cold neutrons at pulsed neutron sources

Crawford, R. K., Department of Energy, USA; Sep. 30, 1997; 10p; In English; ICNS 1997: Satellite

Report No.(s): DE98-000293; ANL/IPNS/CP-94545; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper discusses some basic aspects of instrumentation for cold neutrons, with emphasis on conditions peculiar to pulsed sources. It also indicates the conditions under which pulsed source instruments can be most effective for cold neutron research, and presents a brief report on the status of cold neutron instrumentation at pulsed sources.

NTIS

Cold Neutrons; Neutron Sources; Instruments

19990027284 Rutherford Appleton Lab., Chilton, UK

PRISMA Single Crystal Cold Neutron Spectrometer and Diffractometer User Manual: Second Edition.

Harris, M. J., Rutherford Appleton Lab., UK; Bull, M. J., Rutherford Appleton Lab., UK; Jul. 28, 1998; ISSN 1358-6254; 48p; In English

Report No.(s): RAL-TR-1998-049; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX110QX, UK), Hardcopy, Microfiche

PRISMA (--PRogetto dell'Istituto di Strutura della MAteria del CNR) is the result of a collaboration between the Italian Consiglio Nazionale delle Ricerche (CN-R) and the British Engineering and Physical Sciences Research Council (EPSRC). A brief introduction to how PRISMA works is given here. PRISMA has a dual role as both a neutron diffractometer and spectrometer. In diffraction mode it is identical in principle to other single crystal diffractometers. When operated as a spectrometer it is perhaps understood best by comparison with a conventional triple-axis spectrometer. Both machines use Bragg reflection from analyser crystals to select the neutrons scattered by the sample that will ultimately be detected. However, unlike a triple axis spectrometer PRISMA has an array of independent analyser-detector arms instead of just one. Also, instead of having a monochromator crystal to define the incident neutron energy, PRISMA utilizes the time of flight technique. To configure PRISMA as a high-resolution, low background diffractometer, simply remove the analyzer crystals.

Author (revised)

Bragg Angle; Cold Neutrons; Diffraction; Diffractometers; Neutron Spectrometers; Documentation; Time of Flight Spectrometers

19990027324 Department of Energy, Washington, DC USA

Forest without trees: Development of high-surface-area materials for enhanced-sensitivity SAW arrays

Yelton, W. G., Department of Energy, USA; Ricco, A. J., Department of Energy, USA; Staton, A. W., Department of Energy, USA; Dec. 31, 1998; 1p; In English; Sponsored by Electrochemical Society, Inc., USA

Report No.(s): DE98-007223; SAND-98-1678C; CONF-981108; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Chemical sensor arrays are an alternative to the tedious development of highly specific single-analyte detectors. Recent efforts have focused on the chemical and physical diversity of interface materials for SAW sensor arrays. However, the issues of wide dynamic range and high sensitivity must also be addressed for sensor arrays to compete in applications requiring low detection limits. Because SAW devices respond in proportion to change in mass per nominal unit area of the device surface, sensitivity is enhanced by surface modification with high-area, thin-film coating materials: a greater mass of analyte is adsorbed at a given ambient concentration. The authors are exploring several classes of electrochemically prepared high-area films, materials whose formulations and processing are well documented for applications other than chemical sensors. They present results from films formed by anodization, chemical conversion, and electroplating, yielding surface area enhancements as high as 170x.

NTIS

Forests; Surface Properties; Sensitivity; Arrays; Surface Waves

19990027326 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA

MAXED, a computer code for the deconvolution of multisphere neutron spectrometer data using the maximum entropy method

Reginatto, M., Department of Energy, USA; Goldhagen, P., Department of Energy, USA; Jun. 30, 1998; 37p; In English

Report No.(s): DE98-007067; EML-595; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The problem of analyzing data from a multisphere neutron spectrometer to infer the energy spectrum of the incident neutrons is discussed. The main features of the code MAXED, a computer program developed to apply the maximum entropy principle

to the deconvolution (unfolding) of multisphere neutron spectrometer data, are described, and the use of the code is illustrated with an example. A user's guide for the code MAXED is included in an appendix. The code is available from the authors upon request.
NTIS
Computer Programs; Neutron Spectrometers; Maximum Entropy Method

19990027348 Department of Energy, Office of Energy Research, Washington, DC USA
Calibration and monitoring system for the PHENIX lead-scintillator electromagnetic calorimeter
David, G., Department of Energy, USA; Kistenev, E., Department of Energy, USA; Stoll, S., Department of Energy, USA; Nov. 30, 1997; 9p; In English; Scintillating and Fiber Detectors (SCIFI '97), 1997, USA
Report No.(s): DE98-004626; BNL-65335; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A system for calibrating the PHENIX lead-scintillator electromagnetic calorimeter modules with cosmic rays and monitoring the stability during operation is described. The system is based on a UV laser which delivers light to each module through a network of optical fibers and splutters and is monitored at various points with silicon and vacuum photodiodes. Results are given from a prototype system which used a nitrogen laser to set the initial phototube gains and to establish the energy calibration of calorimeter modules and monitor their stability. A description of the final system to be used in PHENIX based on a high power YAG laser, is also given.
NTIS
Calorimeters; Prototypes; Scintillation Counters; YAG Lasers; Calibrating; Monitors; Plastic Bodies

19990027349 Department of Energy, Office of Energy Research, Washington, DC USA
PHENIX PbSc calorimeter and its performance
David, G., Department of Energy, USA; Goto, Y., Department of Energy, USA; Kistenev, E., Department of Energy, USA; Nov. 30, 1997; 11p; In English; 7th; Calorimetry in High Energy Physics, USA
Report No.(s): DE98-004627; BNL-65312; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have recently completed the production of the 15552 channel PbSc Electromagnetic calorimeter for the PHENIX experiment at RHIC. The design features a single 4 tower module which is repeated throughout and which was produced with a number of QC steps designed to achieve consistent, large light yield in all channels. They present results on uniformity of the calorimeter, accuracy of a cosmic muon based precalibration scheme and test beam performance.
NTIS
Calorimeters; Performance Prediction; Calibrating; Plastics; Scintillation Counters

19990027409 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Close Loop FOG Self Diagnosing and Application in RSDIMU
Yang, Yuanhong, Beijing Univ. of Aeronautics and Astronautics, China; Ma, Jing, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 619-622; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The loop characteristic of closed-loop interferometer fiber optic gyroscope(I-FOG) was studied first and its self-diagnosing capability has been revealed. A new type FOG with self-diagnosing capability has been obtained and used in a redundant strapdown inertial measure unit (RSDIMU), and a new fault tolerance algorithm has been designed for this unit too. In this algorithm, both the output and the state information of this FOG were induced, so that the information redundancy at the instrument grade has been realized and the fault tolerance capability was improved from fail operate(FO)-fail operate(FO)-fail safe(FS) to FO-FO-FO-FO-FS. Using Markov reliability evaluation mode, the reliability was calculated and compared with the old system, the reliability was improved greatly.
Author
Gyroscopes; Fiber Optics; Fault Tolerance; Fault Detection; Feedback Control; Redundancy; Component Reliability

19990027431 Cornell Univ., New York, NY USA
KWIC: A Widefield Mid-Infrared Array Camera/Spectrometer for the KAO ***Final Report***
Stacey, Gordon J., Cornell Univ., USA; [1999]; 5p; In English
Contract(s)/Grant(s): NAG2-1072; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant covered a one year data analysis period for the data we obtained with the Kuiper Widefield Infrared Camera (KWIC) on the KAO during CY94 and CY95. A fairly complete list of scientific papers produced, or soon to be produced under

this award is contained at the end of this report. Below we summarize some of the highlights of the work we did under this grant. KWIC Imaging of the Orion Nebula. KWIC was successfully developed under the KAO grants program (NASA grant NAG2-800). First funding arrived in November of 1992, and we flew our first two flights in February of 1994 -just 15 months later. These flights were very successful. We imaged the Orion Nebula in the 37.7 micron continuum and [SiII] 35 micron line and imaged M82 and Arp299 in the 37.7 micron continuum. Our Orion image demonstrates that the 37.7 micron continuum arises in the warm dust associated with the photodissociated surfaces (photodissociation regions, or PDRs) of molecular clouds. We use the brightness and color temperature distribution to ascertain the morphology of the Orion PDR. The [SiII] image of Orion encompassed the entire Orion A HII region and its enveloping PDR. Most of the emission in the PDR regions of the map appears to coincide very well with our 37.7 micron continuum map indicating a PDR origin for the [SiII] in agreement with theoretical predictions. The [SiII] line emission is very clumpy in the PDR directly imaging the clump spectrum indirectly ascertained by examining the distribution and flux ratios of [CII] and [0I] far-IR fine structure line, and high J CO emission. We also detected very strong [SiII] line emission from the embedded BN-KL star formation region tracing the morphology and physical conditions of the high velocity shock from these very young stars.
Author
Infrared Radiation; Cameras; Imaging Techniques; Fine Structure

19990027439 NASA Lewis Research Center, Cleveland, OH USA
An Experimental Study of a Radially Arranged Thin Film Heat Flux Gauge
Cho, Christoper S. K., University of Western Michigan, USA; Fralick, Gustave C., NASA Lewis Research Center, USA; Bhatt, Hemanshu D., NASA Lewis Research Center, USA; Measurement Science and Technology; 1997; ISSN 0957-0233; Volume 8, pp. 721-727; In English
Contract(s)/Grant(s): NAG3-1699; WMU-FRACASF96-047; RTOP 523-26-13; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new thin-film heat-flux gauge was designed and fabricated on three different substrate materials. Forty pairs of Pt-Pt/10% Rh thermocouple junctions were deposited in a circular pattern on the same plane of the substrate. Over the thermocouples, 5 and 10 micron thick thermal resistance layers were deposited to create a temperature gradient across those layers. Calibration and testing of these gauges were carried out in an arc-lamp calibration facility. The heat flux calculated from the gauge output is in good agreement with the value obtained from the pre-calibrated standard sensor. A CO2 laser was also used to test the steady-state and dynamic responses of the heat-flux gauge. During the steady-state test, the time constant for the heating period was 30 s. The frequency response of the heat-flux gauge was measured in the frequency domain using a CO2 laser and a chopper. The responses from an infrared detector and the heat-flux gauge were measured simultaneously and compared. It was found that the thin-film heat-flux gauge has a dynamic frequency response of 3 kHz.
Author
Thin Films; Platinum; Temperature Gradients; Frequency Response; Measuring Instruments

19990027478 Department of Energy, Office of Energy Research, Washington, DC USA
Overview of the front end electronics for the Atlas LAR calorimeter
Rescia, S., Department of Energy, USA; Nov. 30, 1997; 12p; In English; 7th; Calorimetry in high energy physics, USA
Report No.(s): DE98-003339; BNL-65097; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Proposed experiments for the Large Hadron Collider (LHC) set new demands on calorimeter readout electronics. The very high energy and large luminosity of the collider call for a large number of high speed, large dynamic range readout channels which have to be carefully synchronized. The ATLAS liquid argon collaboration, after more than 5 years of R and D developments has now finalized the architecture of its front end and read-out electronics, which have been written down in its Technical Design Report (TDR). An overview is presented.
NTIS
Calorimeters; Electronic Equipment; Argon; Liquefied Gases

19990027999 Department of Energy, Washington, DC USA
Extended calibration of thin-foil manganin gage in ALOX material
Salas, J., Department of Energy, USA; Duggins, B. D., Department of Energy, USA; Benham, R. A., Department of Energy, USA; Mar. 31, 1998; 8p; In English; Pressure Vessel and Piping (PVP), 1998, USA; Sponsored by American Society of Mechanical Engineers, USA
Report No.(s): DE98-005034; SAND-97-2368C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The purpose of this program was to extend an existing manganin gage calibration curve, correlating stress as a function of change in gage resistance/gage resistance ((Delta)R/R), and obtain gage repeatability data from stripped manganin thin-foiled gages manufactured by the Measurements Group Inc., Micro-Measurements division. The experiments extended the existing calibration curve range from the current 0.5 GPa to 6.1 GPa by examining impact stresses of 0.1 GPa in the lower range, and 8.0 and 10.0 GPa in the higher range. The manganin gages were embedded in ALOX (42% by volume alumina in EPON 828 epoxy) material. A light gas-gun was used at Sandia National Laboratories Explosive Components Facility (ECF) to drive an impactor material, ALOX or Tungsten, into the ALOX target containing two gages in a centered arrangement. Tilt and velocity of the impactor were measured along with the gage outputs. A total of 11 tests were conducted using the same ALOX target material that was used when obtaining the original calibration curve. Two initial tests were completed using Polymethyl Methacrylate (PMMA) as the impactor and target at an impact pressure of 3.3 GPa for comparison of gage output with analysis and literature values. The installed gage, stripped of its backing, has a nominal thickness of 5 microns. The thin gage and high speed instrumentation allowed higher output resolution measurements than can be obtained with 76 microns manganin wire used previously. The areas of investigation that will be presented include: (1) experimental setup, (2) comparison with existing calibration curve, and (3) discussions of the extended calibration data.
NTIS
Aluminum Oxides; Calibrating; Manganin (Trademark); Composite Materials; Strain Gages; Impact Tests

19990028222 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Simulation of a fast framing staring sensor
Jefferson, K. J., Department of Energy, USA; Wickstrom, R. D., Department of Energy, USA; Apr. 30, 1998; 11p; In English; 12th; Aerospace/defense sensing, simulation and controls, USA
Report No.(s): DE98-003379; SAND-98-0732C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A sensor system simulation has been developed which aids in the evaluation of a proposed fast framing staring sensor as it will perform in its operational environment. Beginning with a high resolution input image, a sequence of frames at the target sensor resolution are produced using the assumed platform motion and the contribution of various noise sources as input data. The resulting frame sequence can then be used to help define system requirements, to aid algorithm development, and to predict system performance. In order to assess the performance of a sensor system, the radiance measured by the system is modeled using a variety of scenarios. For performance prediction, the modeling effort is directed toward providing the ability to determine the minimum Noise Equivalent Target (NET) intensities for each band of the sensor system. The NET is calculated at the entrance pupil of the instrument in such a way that the results can be applied to a variety of point source targets and collection conditions. The intent is to facilitate further study within the user community as new mission areas and/or targets of interest develop that are not addressed explicitly during sensor conceptual design.
NTIS
Computerized Simulation; Sensors

19990028252 NASA Langley Research Center, Hampton, VA USA
Differential Absorption Lidar (DIAL) Measurements from Air and Space
Browell, E. V., NASA Langley Research Center, USA; Ismail, S., NASA Langley Research Center, USA; Grant, W. B., NASA Langley Research Center, USA; Applied Physics B: Lasers and Optics; 1998; Volume 67, pp. 399-410; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Differential absorption lidar (DIAL) systems have been used for the measurement of ozone, water vapor, and aerosols from aircraft platforms for over 18 years, yielding new insights into atmospheric chemistry, composition, and dynamics in large-scale field experiments conducted all over the world. The successful deployment of the lidar in-space technology experiment (LITE) in September 1994 demonstrated that space-based lidars can also collect valuable information on the global atmosphere. This paper reviews some of the contributions of the NASA Langley Research Center's airborne ozone and water vapor DIAL systems and space-based LITE system to the understanding of the atmosphere and discusses the feasibility and advantages of putting DIAL systems in space for routine atmospheric measurements of ozone and/or water vapor and aerosols and clouds. The technology and applications of the differential absorption lidar (DIAL) technique have progressed significantly since the first DIAL measurements of Schotland, and airborne DIAL measurements of ozone and water vapor are frequently being made in a wide range of field experiments. In addition, plans are underway to develop DIAL systems for use on satellites for continuous global measurements. This paper will highlight the history of airborne lidar and DIAL systems, summarize the major accomplishments of the NASA Langley DIAL program, and discuss specifications and goals for DIAL systems in space.
Author
Radar Measurement; Absorption Spectroscopy; Differential Absorption Lidar; Aerosols; Optical Radar

19990028268 Department of Energy, Office of Energy Research, Washington, DC USA

Wide-band coherent receiver development for enhanced surveillance

Simpson, M. L., Department of Energy, USA; Richards, R. K., Department of Energy, USA; Hutchinson, D. P., Department of Energy, USA; Mar. 31, 1998; 10p; In English; Active Systems, USA; Meeting sponsored in part by IRIS

Report No.(s): DE98-003390; ORNL/CP-96965; CONF-980347; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Oak Ridge National Laboratory (ORNL) has been developing advanced coherent IR heterodyne receivers for plasma diagnostics in fusion reactors for over 20 years. Recent progress in wide band IR detectors and high speed electronics has significantly enhanced the measurement capabilities of coherent receivers. In addition, developments in new HgCdTe and quantum well IR photodetector (QWIP) focal plane arrays are providing the possibility of both active and passive coherent imaging. In this paper the authors discuss the implications of these new enabling technologies to the IR remote sensing community for enhanced surveillance. Coherent receivers, as opposed to direct or thermal detection, provide multiple dimensions of information about a scene or target in a single detector system. Combinations of range, velocity, temperature, and chemical species information are all available from a coherent heterodyne receiver. They present laboratory data showing measured noise equivalent power (NEP) of new QWIP detectors with heterodyne bandwidths greater than 7 GHz. For absorption measurements, a wide band coherent receiver provides the capability of looking between CO2 lines at off-resonance peaks and thus the measurement of lines normally inaccessible with conventional heterodyne or direct detection systems. Also described are differential absorption lidar (DIAL) and Doppler laboratory measurements using an 8 x 8 HgCdTe focal plane array demonstrating the snapshot capability of coherent receiver detector arrays for enhanced chemical plume and moving hardbody capture. Finally they discuss a variety of coherent receiver configurations that can suppress (or enhance) sensitivity of present active remote sensing systems to speckle, glint, and other measurement anomalies.

NTIS

Receivers; Surveillance; Bandwidth

36
LASERS AND MASERS

Includes parametric amplifiers. For related information see also 76 Solid-State Physics.

19990026968 New Mexico Univ., Dept. of Electrical Engineering and Computer Science, Albuquerque, NM USA

A Versatile High-Power Laser System for High Spatial Resolution Nanosecond Plasma Diagnostic in Electron-Beam Driven HPM Sources ***Final Report, 1 Aug. 1996 - 31 Dec. 1998***

Schamiloglu, Edl; Feb. 01, 1999; 9p; In English

Report No.(s): AD-A359964; F49620-96-1-0379; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of the acquired instrumentation was to perform high spatial resolution and nanosecond time resolution plasma diagnostics in intense electron beam-driven high power microwave (HPM) sources to better understand the ”pulse shortening” problem. We have thus performed the first laser interferometry measurement inside a high power backward wave oscillator (or any other intense beam-driven HPM source for that matter) during the course of microwave generation reported in the literature. Line-integrated electron densities between 9 x 10(exp 15) and 2 x 10(exp 16)/sq cm for microwave powers between 20 and 120 MW have been measured. The two main sources of the measured electron density are postulated to be: (1) plasma generated from the cutoff neck due to beam scrape off and, (2) material removed and ionized from the slow wave structure walls during microwave generation. A catastrophic microwave discharge results in termination of subsequent microwave generation. Novel modifications to the inlet of the slow wave structure in intense beam-driven backward wave oscillators are suggested as a result of this research.

DTIC

Plasma Diagnostics; Laser Interferometry; Microwave Oscillators; High Power Lasers; Electron Beams; Backward Waves

19990027106 Department of Energy, Office of Energy Research, Washington, DC USA

High-Yield Metal Materials for Photocathode RF Gun

Wang, X. J., Department of Energy, USA; Ben-Zvi, I., Department of Energy, USA; Smedley, J., Department of Energy, USA; inivasan-Rao, T., Department of Energy, USA; Woodle, M., Department of Energy, USA; Nov. 30, 1997; 6p; In English; 4th; FEL 1997: Free electron laser

Report No.(s): DE98-002640; BNL-65002; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Significant progress has been made in both improving the quantum efficiency and understanding the physics process of photoemission of metal photocathode materials under high electric field. Metal material, copper and magnesium were installed on the

photocathode RF gun, and experimentally investigated using frequency quadrupled Nd:YAG laser 266 nm. A systemic procedure was developed for preparing cathode; this involves diamond polishing, ultrasonic cleaning and high temperature vacuum bake out. Using laser cleaning and explosive electron emission cleaning, the highest quantum efficiency measured for copper and magnesium are 0.02% and 0.3%, respectively. The Schottky effect was experimental investigated, the quantum efficiency of the Cu is dominated by the Schottky effect since the work function of the copper is almost equal to the photon energy used 4.66 eV. The quantum efficiency of the magnesium is significant enhanced by the Schottky effect.
NTIS
Photocathodes; Radio Frequencies; Yield Strength; Electron Guns; Photoelectric Emission

19990027152 Lebedev Physical Inst., Moscow, Russia
Frequency Tuning of IR First-Overtone CO Laser Radiation by Diffraction Grating and Frequency Selective Output Couplers ***Final Report, Aug. 1998 - Jan. 1999***
Ionin, Andre; Jan. 1999; 40p; In English
Contract(s)/Grant(s): F61775-08-WE109
Report No.(s): AD-A359499; EOARD-SPC-98-4076; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report results from a contract tasking P. N. Lebedev Physical Institute as follows. The contractor will investigate, both experimentally and theoretically, the feasibility of frequency tuning the first overtone carbon monoxide laser radiation by the use of diffraction gratings and frequency-selective output couplers.
DTIC
Diffraction; Couplers; Carbon Monoxide Lasers; Infrared Lasers; Tuning; Frequencies

19990027296 Department of the Navy, Washington, DC USA
Interband Quantum Well Cascade Laser, with a Blocking Quantum Well for Improved Quantum Efficiency
Meyer, Jerry, Inventor; Vurgaftman, Igor, Inventor; Yang, Ruan Q., Inventor; Aug. 25, 1998; 13p; In English
Patent Info.: Filed 1 Nov. 96,; US-Patent-Appl-SN-743,433; US-Patent-5,799,026
Report No.(s): AD-D019214; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A gain region for an interband quantum well laser includes: (a) an emitter region of semiconductor material having at least one conduction subband and at least one valence subband, these subbands being spaced apart by an energy band-gap; (b) a collector region of semiconductor material having at least one conduction subband and at least one valence subband, these subbands spaced apart by an energy band-gap; (c) a type-I or type-II active region, and (d) a blocking quantum well region of semiconductor material between the active region and the collector region, for keeping electrons in the active region from tunneling or scattering into the collector region, but allowing electrons in the highest valence subband in the active region to pass into the collector region. Another aspect of the invention is a cascade laser made from a stack of these gain regions, connected in series, optical cladding regions at opposing ends of the stack, and a voltage source for applying a bias voltage to the stack, and an optical cavity perpendicular to the stacking axis fabricated by cleaving or other means.
DTIC
Quantum Wells; Light Emitting Diodes; Quantum Well Lasers; Electric Potential; Accumulators

19990027333 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Selectively oxidized vertical-cavity laser performance and technology
Choquette, K. D., Department of Energy, USA; Hou, H. Q., Department of Energy, USA; Geib, K. M., Department of Energy, USA; Hammons, B. E., Department of Energy, USA; Feb. 28, 1998; 8p; In English; Aerospace; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-002721; SAND-98-0305C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The authors discuss revolutionary performance advances in selectively oxidized vertical-cavity surface emitting lasers (VCSELs), which have enabled low operating power laser diodes appropriate for aerospace applications. Incorporating buried oxide layers converted from AIGaAs layers within the laser cavity produces enhanced optical and electrical confinement enabling superior laser performance, such as high efficiency and modulation bandwidth. VCSELs also shown to be viable over varied environmental conditions such as ambient temperature and ionized radiation. The development of novel VCSEL technologies for advanced system applications is also described. Two dimensional individually addressable VCSEL arrays exhibit uniform threshold and operating characteristics. Bottom emitting 850 nm VCSEL arrays fabricated using wafer fusion are also reported.
NTIS
Aerospace Engineering; Oxides; Laser Cavities; Technology Assessment

19990027447 Naval Postgraduate School, Monterey, CA USA

Anti-Ship Missile Defense and the Free Electron Laser

Herbert, Paul A.; Dec. 1998; 80p; In English

Report No.(s): AD-A359942; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In order to improve ship self-defense against sea-skimming missiles, several concepts, such as the free electron laser, high-power microwaves, and the Phalanx gun system are reviewed and evaluated in this thesis. Phalanx computer simulations show that Phalanx is an inadequate means of protection. High-power microwaves are found to damage electronics, but calculations show limitations due to diffraction and the possibility of shielding. This thesis evaluates several damage mechanisms caused by the free electron laser's ultra-short picosecond pulse. Theories and experiments predicting the laser damage from short picosecond pulses are reviewed and applied to the fel weapon design. It is found that there may be a significant advantage to the ultra-short pulse format of an FEL weapon; as a result, new experiments are planned. As MW FELs are not yet a reality, this thesis uses computer simulations to explore FEL operation for many values of the electron pulse length, peak current and cavity desynchronism in order to explain recent Thomas Jefferson National Accelerator Facility (TJNAF) experimental observations of high average power.

DTIC

Free Electron Lasers; Antiship Missiles; Computerized Simulation; Missile Defense

19990027591 Colorado Univ., Boulder, CO USA

Precision Atomic Beam Laser Spectroscopy ***Final Report, 1 Nov. 1994 - 31 Oct. 1997***

Hall, John L.; Feb. 20, 1999; 14p; In English

Contract(s)/Grant(s): N00014-89-J-1227

Report No.(s): AD-A360672; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ONR contract has provided partial support for a vigorous program of optics and physics research involving approximately 12 researchers at all levels of training from beginning students, through thesis-level, postdoctorals, and visiting faculty researchers. The organizing principles of our work are to enhance the coherence and general utility of laser sources by appropriate servo control techniques and to apply these sources to scientific problems of outstanding physical interest.

DTIC

Lasers; Control Systems Design; Laser Spectroscopy; Atomic Beams

19990027647 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

Laser Aperture Synthesis Imagery: Theory and Experiments ***Reflectometrie optique coherente en milieu tres diffusant***

Poupardin, Mathieu, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 166p; In French; Original contains color illustrations

Report No.(s): NT-1998-9; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

We studied an active aperture synthesis optical imaging technique. A loser lights an object. The backscattered light is measured by a moving receiver. Using heterodyne detection, this one is able to measure the amplitude and the phase of the optical field. The receiver displacement allows us to access different places in space. Then, a deconvolution algorithm reconstructs an image of the illuminated object. This algorithm uses knowledge on the object support to retrieve the optical field in a virtual aperture. The theoretical study allows us to compute the limits of the method (object size, measurement configuration) and the optical performance (signal to noise ratio, field of view, resolution), and to stress the hot points of the experimental set-up (moving precision, "a priori" knowledge). An experimental set-up is defined and realised. The move of the detector is performed by a periscope, whose spacing and position can change, allowing the detector to access different points in a plane. The modification of the optical length of the signal path have to be corrected before any reconstruction. The experimental set-up is tested with different objects. The results demonstrate the validity of our technique and show the points that have to be improved. As a conclusion, this imaging technique is interesting because the some set of measurement can be used for imaging with different focuses, wavefront analysis and distance measurement. This opens a wide variety of applications.

Author

Apertures; Synthetic Apertures; Imagery; Signal to Noise Ratios; Imaging Techniques

19990027651 Norwegian Defence Research Establishment, Kjeller, Norway

Evaluation of Yb:Ho:YAG as a Laser Material for 2 Micron Operation

Rustad, Gunnar, Norwegian Defence Research Establishment, Norway; Sep. 09, 1998; 34p; In English; Original contains color illustrations

Contract(s)/Grant(s): FFIE Proj. 729/115

Report No.(s): FFI/RAPPORT-98/04602; ISBN 82-464-0286-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ytterbium-Holmium codoped YAG is evaluated as a laser material for 2 micron operation and compared with Tm:YAG, Tm:Ho:YAG, and Tm:Ho:YAG. It is found that the material may be a good choice in pulsed, side-pumped lasers with low average output powers. In lasers with higher average output powers, the large quantum defect of the material results in a significant heat load which makes the material less attractive.

Author

Holmium; Ytterbium; Thallium; Laser Materials; Pulsed Lasers; Infrared Sources (Astronomy)

19990027858 Brown Univ., Providence, RI USA

D-Optical Fiber and Cladding Pumped Optical Fiber Lasers ***Final Report, Jul. 1997 - Jul. 1998***

Morse, T. F.; Feb. 1999; 26p; In English

Contract(s)/Grant(s): F30602-97-C-0189; AF Proj. 4600

Report No.(s): AD-A360415; AFRL-SN-RS-TR-1999-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report presents information in research relating to co-doping of potential cladding pumped optical fibers. The emphasis is on experiments conducted that permitted the comparison of a series of co-doped optical fiber preforms made using an aerosol deposition process developed at Brown University. A set-up was developed that uses ASE (Amplified Spontaneous Emission) as a vehicle by which the relative efficiencies of a series of co-doped Yb-Er optical fibers were examined. These fibers were compared with a fiber from Lucent Technologies. Work on the co-doping of optical fibers so obtain multiple lasing from a Tm-Er system was investigated. This laser permitted pumping at the convenient 980 wavelength to yield lasing at 1550 nm, at 1850 nm, or at both wavelengths. In addition, an attempt was made to extend a new technique that was developed for the tuning of fiber lasers to include the possibility of ultra-fast switching of fiber lasers over a wide wavelength regime. More work is needed in this area, particularly in waveguide design, in order to obtain the required wavelength selectivity.

DTIC

Fiber Optics; Cladding; Erbium; Ytterbium; Optical Pumping; Optical Fibers; Fiber Lasers

19990027940 New Mexico Univ., Center for High Technology Materials, Albuquerque, NM USA

MBE System for Antimonide Based Semiconductor Lasers ***Final Report, 1 Mar. 1997 - 28 Feb. 1998***

Lester, Luke F.; Jan. 31, 1999; 28p; In English

Contract(s)/Grant(s): F49620-97-1-0146

Report No.(s): AD-A360444; 48041FT; AFRL-SR-BL-TR-99-0053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the approval of the program manager, the equipment purchased on this grant was changed to a Plasma Therm, Inc. SLR-770 inductively coupled plasma (ICP) processing system. The SLR-770 has been invaluable in the study of plasma etching of AlGaAsSb and GaSb-materials that form the backbone of antimonide-based semiconductor lasers. AlGaAsSb is especially difficult to pattern with wet chemicals because it is prone to oxidation. The combination of sputtering and chemical etching in plasmas represents the only reproducible means of etching this quaternary alloy. Specifically, we have studied etch rate and selectivity of GaSb and AlGaAsSb in plasmas containing BCl3, Cl2, and Ar as a function of process pressure, DC bias, ICP power, and reactant concentration. Smooth and anisotropic etching was obtained over a variety of process conditions. This research will benefit future efforts to fabricate ridge-waveguide, DFB, and etched mirror laser diodes designed with antimonide semiconductors.

DTIC

Semiconductor Lasers; Molecular Beam Epitaxy; Antimonides

19990027943 Free Univ., Optique Nonlineaire Theorique, Brussels, Belgium

Semiconductor Laser Instabilities ***Final Report***

Erneux, Thomas, Free Univ., Belgium; Jan. 19, 1999; 8p; In English

Contract(s)/Grant(s): F61775-98-WE049

Report No.(s): AD-A360637; EOARD-SPC-98-4030; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report results from a contract tasking Universite Libre de Bruxelles; Optique Nonlineaire Theorique as follows: The contractor will investigate predictions of the semiconductor laser equations for large values of the detuning parameter in an effort to understand instabilities in the lasers output intensity that have been observed by AFRL scientists.
DTIC
Semiconductor Lasers; Stability

19990027977 NASA Goddard Space Flight Center, Greenbelt, MD USA
Stable CW Single-Frequency Operation of Fabry-Perot Laser Diodes by Self-Injection Phase Locking
Duerksen, Gary L., Maryland Univ., USA; Krainak, Michael A., NASA Goddard Space Flight Center, USA; 1998; 2p; In English; Lasers and Electro-Optics, Apr. 1999, Baltimore, MD, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Previously, single-frequency semiconductor laser operation using fiber Bragg gratings (FBG) has been achieved by two methods: (1) use of the FBG as the output coupler for an anti-reflection-coated semiconductor gain element; (2) pulsed operation of a gain-switched Fabry-Perot laser diode with FBG-optical and RF-electrical feedback. Here, we demonstrate CW single frequency operation from a non-AR coated Fabry-Perot laser diode using only FBG optical feedback.
Derived from text
Bragg Gratings; Radio Frequencies; Semiconductor Lasers; Continuous Radiation

19990027988 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Size dependence of selectively oxidized VCSEL transverse mode structure
Hegarty, S. P., Department of Energy, USA; Huyet, G., Department of Energy, USA; McInerney, J. G., Department of Energy, USA; Choquette, K. D., Department of Energy, USA; Hou, H. Q., Department of Energy, USA; May 31, 1998; 9p; In English; Lasers and Electro-Optics, USA
Report No.(s): DE98-002898; SAND-98-0367C; CONF-980529; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The performance of vertical cavity surface emitting lasers (VCSELs) has improved greatly in recent years. Much of this improvement can be attributed to the use of native oxide layers within the laser structure, providing both electrical and optical transverse confinement. Understanding this optical confinement will be vital for the future realization of yet smaller lasers with ultralow threshold currents. Here the authors report the spectral and modal properties of small (0.5 (micro)m to 5 (micro)m current aperture) VCSELs and identify Joule heating as a dominant effect in the resonator properties of the smallest lasers.
NTIS
Semiconductor Lasers; Oxides; Laser Outputs; Ohmic Dissipation; Surface Emitting Lasers; Threshold Currents; Size (Dimensions)

37
MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

19990026970 Dayton Univ. Research Inst., Research Inst., OH USA
B-1 Aircraft Main Hydraulic Pump Tests With MIL-H-87257 Hydraulic Fluid ***Final Report, 1 Jun. 1992 - 30 Sep. 1993***
Sharma, Shashi K.; Gschwender, Lois J.; Snyder, Carl E., Jr; Cecere, Gregory J.; Jun. 1998; 70p; In English
Contract(s)/Grant(s): F33615-90-C-5963; AF Proj. 4347
Report No.(s): AD-A359968; AFRL-ML-WP-TR-1998-4212; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In an effort to convert the B-1 aircraft from MIL-H-5606 to M1-H-87257, the Air Force sponsored a study conducted by Rockwell International from April 1991 through June 1992, under contract F34601-89-C-0401. The results of this study are published in Rockwell Report NA-91-1598, dated 17 June 1992. As part of this study, two pump tests were conducted by Vickers using B-1 aircraft hydraulic pumps (Vickers PV3-300-7B) and MIL-H-872S7 (ROYCO 777) hydraulic fluid. During the first test, the pump failed prematurely. The second test was stopped before the scheduled test duration because some metal was observed in the filter patch-test. Due to lack of finding no additional pump tests were carried out to check the compatibility of MIL-H-87257 and B-1 hydraulic pumps. This being the only unresolved issue standing in the way of transitioning this fluid to the B-1 aircraft, the Non-structural Materials Branch of the Materials Directorate of Wright Laboratory (WL/MLBT) decided to conduct in-house pump

tests with MIL-H-87257 and B-1 hydraulic pumps to provide the necessary data. The results of the two pump tests carried out at WL/MLBT are the subject of this report.
DTIC
B-1 Aircraft; Hydraulic Equipment; Pumps; Patch Tests

19990027074 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Partial oxidation for improved cold starts in alcohol-fueled engines, Phase 2
Apr. 30, 1998; 34p; In English
Report No.(s): DE98-004544; NREL/SR-540-23863; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Alcohol fuels exhibit poor cold-start performance because of their low volatility. Neat alcohol engines become difficult, if not impossible, to start at temperatures close to or below freezing. Improvements in the cold-start performance (both time to start and emissions) are essential to capture the full benefits of alcohols as an alternative transportation fuel. The objective of this project was to develop a neat alcohol partial oxidation (POX) reforming technology to improve an alcohol engine's ability to start at low temperatures (as low as (minus)30 C) and to reduce its cold-start emissions. The project emphasis was on fuel-grade ethanol (E95) but the technology can be easily extended to other alcohol fuels. Ultimately a compact, on-vehicle, ethanol POX reactor was developed as a fuel system component to produce a hydrogen-rich, fuel-gas mixture for cold starts. The POX reactor is an easily controllable combustion device that allows flexibility during engine startup even in the most extreme conditions. It is a small device that is mounted directly onto the engine intake manifold. The gaseous fuel products (or reformate) from the POX reactor exit the chamber and enter the intake manifold, either replacing or supplementing the standard ethanol fuel consumed during an engine start. The combustion of the reformate during startup can reduce engine start time and tail-pipe emissions.
NTIS
Internal Combustion Engines; Oxidation; Fuel Systems; Ethyl Alcohol; Engine Inlets; Engine Starters; Air Pollution

19990027330 Department of Energy, Washington, DC USA
Surface micromachined counter-meshing gears discrimination device
Polosky, M. A., Department of Energy, USA; Garcia, E. J., Department of Energy, USA; Allen, J. J., Department of Energy, USA; Jan. 31, 1998; 11p; In English; 5th; Smart structures and materials, USA
Report No.(s): DE98-002726; SAND-98-0256C; CONF-980308; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper discusses the design, fabrication and testing of a surface micromachined Counter-Meshing Gears (CMG) discrimination device which functions as a mechanically coded lock, A 24 bit code is input to unlock the device. Once unlocked, the device provides a path for an energy or information signal to pass through the device. The device is designed to immediately lock up if any portion of the 24 bit code is incorrect. The motivation for the development of this device is based on occurrences referred to as High Consequence Events, A High Consequence Event is an event where an inadvertent operation of a system could result in the catastrophic loss of life, property, or damage to the environment.
NTIS
Fabrication; Micromachining; Gears

19990027555 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Advanced lubrication systems and materials *Final Report*
Hsu, S., Department of Energy, USA; May 07, 1998; 276p; In English
Report No.(s): DE98-006427; DOE/CE/50354-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report described the work conducted at the National Institute of Standards and Technology under an interagency agreement signed in September 1992 between DOE and NIST for 5 years. The interagency agreement envisions continual funding from DOE to support the development of fuel efficient, low emission engine technologies in terms of lubrication, friction, and wear control encountered in the development of advanced transportation technologies. However, in 1994, the DOE office of transportation technologies was reorganized and the tribology program was dissolved. The work at NIST therefore continued at a low level without further funding from DOE. The work continued to support transportation technologies in the development of fuel efficient, low emission engine development. Under this program, significant progress has been made in advancing the state of the art of lubrication technology for advanced engine research and development. Some of the highlights are: (1) developed an advanced high temperature liquid lubricant capable of sustaining high temperatures in a prototype heat engine; (2) developed a novel liquid lubricant which potentially could lower the emission of heavy duty diesel engines; (3) developed lubricant chemistries for ceramics used in the heat engines; (4) developed application maps for ceramic lubricant chemistry combinations for design

purpose; and (5) developed novel test methods to screen lubricant chemistries for automotive air-conditioning compressors lubricated by R-134a (Freon substitute). Most of these findings have been reported to the DOE program office through Argonne National Laboratory who manages the overall program. A list of those reports and a copy of the report submitted to the Argonne National Laboratory is attached in Appendix A. Additional reports have also been submitted separately to DOE program managers. These are attached in Appendix B.
NTIS
Lubrication Systems; Lubrication; High Temperature Lubricants

19990027592 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Tribological Evaluation of Magnetron-Sputtered Coating for Military Applications ***Final Report, Nov. 1994 - Mar. 1997***
Beatty, John H.; Huang, Paul J.; Fountzoulas, Constantine G.; Kelly, John V.; Feb. 1999; 19p; In English
Report No.(s): AD-A360673; ARL-TR-1892; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There is a continuing requirement for high-performance tribological coatings in both commercial and military applications. to maximize system performance, corresponding improvements in wear resistance, high-temperature stability, Corrosion behavior, and bearing durability must be realized. In our ongoing study, a number of different coatings were applied to 52100 bearing steel, 4340 steel, Inconel 718, and Ti-6Al-4V to improve wear characteristics, corrosion resistance, and rolling contact fatigue behavior. This report deals with CrN, TiN, W, and Ta coatings deposited by magnetron sputtering. Data on corrosion, Falex annular wear, ball-on-disk, and rolling contact fatigue are presented.
DTIC
Corrosion Resistance; Protective Coatings; Aluminum Alloys; Titanium Alloys; Vanadium Alloys

19990027929 DYNACS Engineering Co., Inc., Brook Park, OH USA
An Experimental Determination of Losses in a Three Port Wave Rotor
Wilson , J., DYNACS Engineering Co., Inc., USA; Journal of Engineering for Gas Turbines and Power; October 1998; Volume 120, pp. 833-842; In English, 10-13 Jun. 1996, Birmingham, UK; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Wave rotors, used in a gas turbine topping cycle, offer a potential route to higher specific power and lower specific fuel consumption. In order to calculate this potential realistically a knowledge of the loss mechanisms is required. The experiment reported here was designed as a statistical experiment to identify the losses due to finite passage opening time, friction, and leakage, using a three port, flow divider, wave rotor cycle. Incidence loss was also found to be important. Rotors of 12 in. diameter were used, with two different lengths, 9 in. and 18 in., and two different passage widths, 0.25 in. and 0.54 in., in order to vary friction and opening time. to vary leakage, moveable end walls were provided so that the rotor to end wall gap could be adjusted. The experiment is described, and the results are presented, together with a parametric fit to the data.
Author
Fuel Consumption; Gas Turbines; Wave Rotors; Inlet Pressure; Stagnation Pressure; Laminar Flow; Walls; Losses

19990027945 NASA Lewis Research Center, Cleveland, OH USA
CVD Diamond, DLC, and c-BN Coatings for Solid Film Lubrication
Miyoshi, Kazuhisa, NASA Lewis Research Center, USA; Murakawa, Masao, Nippon Inst. of Tech., Japan; Watanabe, Shuichi, Nippon Inst. of Tech., Japan; Takeuchi, Sadao, Nippon Inst. of Tech., Japan; Miyake, Shojiro, Nippon Inst. of Tech., Japan; Wu, Richard L. C.; Tribology Letters; 1998; Volume 5, pp. 123-129; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The main criteria for judging coating performance were coefficient of friction and wear rate, which had to be less than 0.1 and 10(exp -6) cubic MM /(N*m), respectively. Carbon- and nitrogen-ion-implanted, fine-grain, chemical-vapor-deposited (CVD) diamond and diamondlike carbon (DLC) ion beam deposited on fine-grain CVD diamond met the criteria regardless of environment (vacuum, nitrogen, and air).
Author
Coefficient of Friction; Diamonds; Lubrication; Vapor Deposition; Tribology; Diamond Films; Sliding Friction; Wear Resistance; Carbon

19990028217 ESDU International Ltd., London, UK
Geneva Mechanisms, Part 3, Examples
Jul. 1997; 33p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-96035-Pt-3; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham Street, London, N1 6UA, England), Hardcopy, Microfiche

ESDU 96035 provides examples illustrating the use of ESDU 96002. The first two examples are primarily intended to show the use of the program, ESDUpac A961 1, and so low speed applications in which inertial effects are not significant are considered. In the first the use of the program to analyse a typical external Geneva mechanism is described when the distance between the crank and the wheel shafts, the operating speed of the crank, and the load to be driven by the output shaft are all fixed. The two-stage process by which the a new design is modelled using the software is described. In the second the analysis of an internal Geneva mechanism with the same function is described using the same roller bearing, lubricant and materials. The characteristics and performance of the two mechanisms are compared. The third example demonstrates the most desirable strategy when only the operating speed of the motor, the driven load and the minimum dwell time are specified. It considers the effect on the performance of an external Geneva mechanism of varying the number of slots in the wheel and the roller/pin size for a constant speed crank. Author

Shafts (Machine Elements); Wheels; Computer Programs; Computer Aided Design; Timing Devices

19990028238 Naval Postgraduate School, Monterey, CA USA

Summary of Research: Department of Mechanical Engineering, *1 Jan. 1997 - 31 Dec. 1997*

McNelley, Terry R.; Shin, Young S.; Jan. 1999; 79p; In English

Report No.(s): AD-A360486; NPS-09-98-012; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report contains summaries of research projects in the Department of Mechanical Engineering. A list of recent publications is also included which consists of conference presentations and publications, books, contributions to books, published journal papers, technical reports, and thesis abstracts.

DTIC

Mechanical Engineering; Research and Development

38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990027328 Department of Energy, Washington, DC USA

Rule-based inspection of printed green ceramic tape

Patek, D. R., Department of Energy, USA; Goddard, J. S., Department of Energy, USA; Karnowski, T., Department of Energy, USA; Lamond, D., Department of Energy, USA; Hawkins, T. A., Department of Energy, USA; Jan. 31, 1998; 14p; In English; BIOS 1998: Biomedical optics, USA

Report No.(s): DE98-002728; ORNL/CP-96066; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A template-based vision system for the 100% inspection of printed flaws on green ceramic tape has been developed. Design goals included a requirement for the detection of flaws as small as two thousandths of an inch on parts up to 8 by 8 inches in size. The inspection engine is a Datacube, Inc., MV200 pipeline processor. As each part is inspected, four 2K by 2K pixel quadrant images are stitched together to construct a single 4K by 4K pixel image with the aid of multiple fiducials located in each quadrant. The part fiducial locations, mask image, and punched-hole position data are generated, beforehand, from CAD designs using a defect map editor (DME), a preprocessing software package developed for the PC. The DME also generates a part 'defect map'. Each unique structure in the printed pattern is defined as an object. Objects are grouped into user-defined categories such as die pads, contact fingers, traces, and electrolysis buses. The map is used during the runtime inspection to associate each detected defect with an object group and a particular defect specification for that group. Repeat defects are optionally tracked for up to three consecutive parts.

NTIS

Inspection; Ceramics; Templates; Computer Aided Design

19990027407 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

ANN Based Expert System and its Application to Fault Diagnosis

Luo, Dehan, Beijing Univ. of Aeronautics and Astronautics, China; Chen, Weihai, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 611-614; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Fault diagnosis of complex devices has become an issue of high importance in modern industrial process automation. Many methods about fault diagnosis were presented in last 30 years, and intelligent diagnostic methods have been rapidly developed

in recent years. Their applications, however, are limited due to their inherent defects in some fields. In this paper, a new intelligent diagnostic model which combines Artificial Neural Networks (ANN) with Expert System (ES) is developed. The architecture of its hardware, and software are discussed. Its knowledge base, and knowledge acquisition are studied. The hybrid reasoning mechanism and layered diagnosing strategy are proposed. The diagnostic expert system based on the new model has been built for MK9-5 machines fault diagnosis. It has been shown that the new intelligent diagnostic expert system based on ANN has higher effect and liability than the common diagnostic expert system does. It is expected to be further developed and improved in order to apply it in practice.
Author
Neural Nets; Expert Systems; Fault Detection; Complex Systems; Systems Health Monitoring

19990027672 Auburn Univ., Materials Research and Education Center, AL USA
Survey of Infrared Sensing Techniques for Welding Process Monitoring and Control
Wikle, Howard Clyde, III, Auburn Univ., USA; Chen, Fuhu, Auburn Univ., USA; Nagarajan, Sundaram, Hobart Bros. Co., USA; Chin, Bryan Allen, Auburn Univ., USA; Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering; November 1998; Volume 21, No. 6, pp. 645-657; In English; See also 19990027670; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Infrared sensing techniques used in arc welding and resistance welding process monitoring and control are presented. A variety of IR sensors have been investigated for use in monitoring and controlling weld bead width, penetration depth, seam tracking and cooling rate during arc welding, and nugget size and cooling rate during resistance welding. In addition, factors that affect or interfere with infrared sensing are discussed.
Author
Arc Welding; Infrared Detectors; Weldability

19990028167 Missouri Univ., Dept. of Statistics, Columbia, MO USA
Inference and Modeling for Repairable Systems and Software ***Progress Report, 15 Jun. 1995 - 14 Sep. 1997***
Basu, Asit P.; Apr. 22, 1998; 9p; In English
Contract(s)/Grant(s): F49620-94-1-0355
Report No.(s): AD-A360482; MU-TR-3; AFRL-SR-BL-TR-99-0066; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Interesting results on software reliability theory have been obtained. Comparative studies of existing methods are made. Also criteria are being developed as to when a software can be released to the users. Both Bayesian and frequentist approaches are considered.
DTIC
Software Reliability; Computer Systems Programs

19990028281 Department of Defense, Washington, DC USA
Emerging NDE Technology for aging aircraft
Moore, D. G., Department of Defense, USA; Perry, R. L., Department of Defense, USA; Mar. 31, 1998; 6p; In English, USA; Sponsored by American Society for Nondestructive Testing, Inc., USA
Report No.(s): DE98-003380; SAND-98-0726C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper presents an overview of several emerging nondestructive evaluation technologies that are being employed or considered for use to inspect commercial transport, commuter aircraft and military aircraft. An overview of the Federal Aviation Administration (FAA) Airworthiness Assurance NDI Validation Center (AANC) is described and how AANC teams with industry, universities, and other federal entities to assess these technologies.
NTIS
Nondestructive Tests; Transport Aircraft

39
STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

19990026955 Department of Energy, Office of Energy Research, Washington, DC USA
Measurement of acoustoelastic effect of Rayleigh surface waves using laser ultrasonics
Lu, W. Y., Department of Energy, USA; Peng, L. W., Department of Energy, USA; Holland, S., Department of Energy, USA; Nov. 30, 1997; 8p; In English
Report No.(s): DE98-050607; SAND-98-8417C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The acoustoelastic effect refers to the fact that elastic wave velocities vary with stress. Measurements of the change in stress induced velocity yield information which leads to the determination of stresses. Some work has been done to explore the possibility of using ultrasonic waves, including bulk longitudinal and shear waves as well as surface waves, for the nondestructive evaluation of stresses. This paper focuses on Rayleigh surface waves, which have the advantage of detecting both surface stresses and stress gradients. Piezoelectric or electromagnetic acoustic transducers have been used for the application of Rayleigh waves in the acoustoelastic measurement of stress. The size of these transducers and their fixtures limit the distance between transducers. Sharp edge wedges are usually bound to the pick-up piezoelectric transducers, known as the Rayleigh or surface wave device (SWD), to provide a better spatial resolution when the stress field is not uniform. The smallest distance reported is 11 mm. On the other hand, acoustic microscopes (AM) can measure localized stress for a very small area, from 30 (micro)m to 2 mm. Both SWD and AM method may lack the agility required for general applications. Laser ultrasonics (LU) is a method for optical generation and detection of ultrasound. The generation and detection areas can be focused to very small spot sizes, less than 1 mm, which allow velocity measurements to be made over a path length of a few millimeters. The LU technique is non-contact and can be applied remotely; it has many potential applications. The authors used the LU technique to measure the acoustoelastic behavior of an aluminum alloy, A16061- T6.
NTIS
Velocity Measurement; Acoustic Microscopes; Elastic Waves; Electroacoustic Transducers; Rayleigh Waves; Acoustic Emission; Acoustic Measurement

19990026959 Naval Postgraduate School, Monterey, CA USA
Optimal Design of Nonlinear Shock Isolation for Large, Locally Nonlinear Structural Systems
Durant, Brian R.; Dec. 1998; 103p; In English
Report No.(s): AD-A360098; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The method of Time Domain Structural Synthesis is reviewed and examples of linear structural modification and sub-structure coupling are presented. The general formulation for both linear and nonlinear syntheses are compared to highlight the similarities between the two and the difficulties experienced with the introduction of nonlinear elements. Examples of linear and nonlinear sub-structural coupling are presented to emphasize the similarity of the procedures used. Finally, a general approach for the optimal design of nonlinear shock isolation for large structural systems is developed. The repeated solution of arbitrarily large finite element models with localized nonlinear components is made possible through the use of a highly efficient nonlinear transient re-analysis procedure. The method has demonstrated order of magnitude decreases in compute time over traditional direct integration methods and is exact, regardless of the nature of the isolation. An example is included which demonstrates the procedure.
DTIC
Structural Analysis; Nonlinear Systems; Mechanical Shock; Finite Element Method; Vibration Isolators

19990027134 Department of Energy, Washington, DC USA
Time-resolved particle velocity measurements at impact velocities of 10 km/s
Furnish, M. D., Department of Energy, USA; Chhabildas, L. C., Department of Energy, USA; Reinhart, W. D., Department of Energy, USA; Dec. 31, 1998; 16p; In English; Hypervelocity Impact, 1998, USA
Report No.(s): DE98-007227; SAND-98-0043C; CONF-981109; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Hypervelocity launch capabilities (9--16 km/s) with macroscopic plates have become available in recent years. It is now feasible to conduct instrumented plane-wave tests using this capability. Successfully conducting such tests requires a planar launch and impact at hypervelocities, appropriate triggering for recording systems, and time-resolved measurements of motion or stress at a particular point or set of points within the target or projectile during impact. The authors have conducted the first time-resolved

wave-profile experiments using velocity interferometric techniques at impact velocities of 10 km/s. These measurements show that aluminum continues to exhibit normal release behavior to 161 GPa shock pressure, with complete loss of strength of the shocked state. These experiments have allowed a determination of shock-wave window transparency in conditions produced by a hypervelocity impact. In particular, lithium fluoride appears to lose transparency at a shock stress of 200 GPa; this appears to be the upper limit for conventional wave profile measurements using velocity interferometric techniques.
NTIS
Hypervelocity Impact; Velocity Measurement; Time Measurement; Impact Velocity

19990027247 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Structural Optimization Based on Envelope Function and Two-Level Approximation Concepts
Chen, Shaojun, Beijing Univ. of Aeronautics and Astronautics, China; Xia, Renwei, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 559-562; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

An efficient solution method for structural optimization is proposed by coordinated use of mathematical transformation, two-level approximation concepts and dual theory. At first the original multi-constraint structural optimization problem is converted into a single-constraint optimization problem by using envelope function which is then approximated by a new two-point approximation function proposed in this paper, and then a corresponding high accuracy approximation problem is constructed. The solution of the approximation problem is obtained by two-level strategy and dual theory. Theory and computation examples have shown that the main advantages of methods developed in the paper are the generality in use and the efficiency in computation, which are particularly important for large scale problems with complicated functions in engineering.
Author
Optimization; Structural Design; Approximation; Duality Theorem

19990027271 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Analysis of Fatigue Crack Growth from Cold-Expanded/Interference Fitted Stop Drilled Holes
Callinan, R. J., Defence Science and Technology Organisation, Australia; Wang, C. H., Defence Science and Technology Organisation, Australia; Sanderson, S., Defence Science and Technology Organisation, Australia; Jul. 1998; 32p; In English
Report No.(s): DSTO-TR-0704; DODA-AR-010-604; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001), Hardcopy, Microfiche

In this report a numerical study has been carried out into the fatigue life enhancement of a through cracked plate specimen using stop drilled holes at the end of each crack tip. Also the effect of cold working and the use of interference plugs are considered. While it has been found that under a static remote tension load the use of interference plugs gives no additional static strength, results from cyclic loads indicate that the accumulation of strain energy per cycle is less with interference fit plugs. Also the introduction of stationary cracks of crack-length 0.066 to 1.0 mm have been considered with constraints to prevent crack closure. The crack-tip opening displacements of re-initiated cracks at the edge of the stop hole have been determined using the finite element method, and it is found that the equivalent stress intensity factors are significantly higher than predicted by linear elastic fracture mechanics. Furthermore the use of these results together with the FASTRAN II computer program predicts fatigue lifetimes which are in reasonable agreement with experimental data.
Author
Fatigue (Materials); Drilling; Computer Programs; Numerical Analysis; Cold Working; Crack Propagation

19990027520 British Aerospace Aircraft Group, Military Aircraft and Aerostructures, Warton, UK
Development and Application of MSC NASTRAN Sol. 200 within the BAe ECLIPSE System
Thompson, D., British Aerospace Aircraft Group, UK; Haley, C., British Aerospace Aircraft Group, UK; Ayres, J., British Aerospace Aircraft Group, UK; Major, M., British Aerospace Airbus Ltd., UK; Golby, D., British Aerospace Public Ltd. Co., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 12.1 - 12.7; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

During the period 1970-1990 the Military Aircraft division of British Aerospace based at Warton developed a structural sizing and optimization system initially based on an inhouse developed Finite Element System. This subsequently progressed to utilising MSC NASTRAN which was rapidly evolving to be the standard FE application used within all divisions of British Aerospace. The many problems associated with the development and application of this evolving system are described. These problems covered a wide range from software development, engineering application, resource management and hardware dependence. One problem which has received a great deal of attention since 1990 is the incorporation of Panel Buckling constraining particularly

when applied to laminated structures. This paper describes an early attempt to incorporate this constraint followed by a brief description of the application and integration of a specialized panel buckling code. The paper concludes by describing how the company is attempting to incorporate the buckling constraint using MSC NASTRAN in a High Performance Computing Environment (HPC). In addition this development illustrates how many of the problems described earlier are being overcome by working in partnership with software vendors, hardware vendors and other business units in the company.
Author
Buckling; Engineering Management; Finite Element Method; Nastran; Software Engineering; Computer Techniques; Structural Analysis

19990027523 British Aerospace Airbus Ltd., Chester, UK
Development of Integrated Decision Support System for Creep Age Forming
Levers, A., British Aerospace Airbus Ltd., UK; Tanner, A., British Aerospace Airbus Ltd., UK; Al-Khalil, M., British Aerospace Airbus Ltd., UK; Platts, M. J., Cambridge Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 16.1 - 16.6; In English; See also 19990027508; Sponsored in part by HKS (UK) Ltd.; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The creep age forming process involves the creation of a primary elastic stress field within a component, via clamping to an overformed, theoretically rigid tool surface. The component/tool assembly is then exposed to a thermal cycle appropriate to the development of mechanical properties within the parent alloy system of the component. During this cycle, the applied stress partially relaxes as a by-product of precipitation hardening. As a result, once the constraint holding the component in contact with the tool are released, the remaining locked-in stress is released allowing the component to springback to a final shape which, with the fortune of good tooling design, will be the final required shape. The main feature of the Creep Age Forming process is the large amount of elastic springback making the design of tool surface profiles (often incorporating significant double curvature) difficult, time consuming and costly. This level of uncertainty has prevented the full exploitation of the process within design and manufacture. In this paper the development and application of an integrated decision support system is discussed, elements of which include a customized user interface to a proprietary Finite Element package, allowing manufacturability assessment of competing product designs and the determination of process and hardware requirements. Additionally the application of an iterative optimisation scheme for tool surface profile generation will be presented, together with the results of large-scale analysis on aircraft structural components.
Author
Aging (Metallurgy); Decision Support Systems; Finite Element Method; Forming Techniques; Mechanical Properties; Elastic Properties

19990028271 Department of Defense, Washington, DC USA
Identifying sources of variation for reliability analysis of field inspections
Spencer, F. W., Department of Defense, USA; Apr. 30, 1998; 10p; In English; Airframe Inspection Reliability under Field/Depot Conditions, USA
Report No.(s): DE98-004756; SAND-98-0980C; CONF-980552; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

It has been recognized that nondestructive inspection (NDI) techniques and instruments that have proven themselves in the laboratory do not always perform as well under field conditions. In this paper, the authors explore combinations of formal laboratory and field experimentation to characterize NDI processes as they may be implemented in field conditions. They also discuss appropriate modeling for probability of detection (POD) curves as applied to data gathered under field conditions. A case is made for expanding the more traditional two-parameter models to models using either three or four parameters. They use NDI data gathered from various airframe inspection programs to illustrate the points.
NTIS
Inspection; Field Tests; Reliability Analysis; Procedures; Nondestructive Tests

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GEOSCIENCES (GENERAL)

19990027306 Maryland Univ., College Park, MD USA

Dating of Liquefaction Features in the New Madrid Seismic Zone and Implications for Earthquake Hazard, *Sep. 1995 - Jun. 1998*

Tuttle, M. P., Maryland Univ., USA; Lafferty, R. H., III, Maryland Univ., USA; Schweig, E. S., III, Maryland Univ., USA; Sep. 1998; 126p; In English

Report No.(s): NUREG/GR-0017; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Results of paleoseismological investigations of earthquake-induced liquefaction features at nine sites earthquakes struck the New Madrid region in A.D. 900 +/- 100 years and A.D. 1530 +/- 130 years. This finding is consistent with other paleoseismological studies in the region. The A.D. 900 event was probably similar to the 1811-1812 earthquake sequence. Less is known about the A.D. 1530 event, but it is likely to have been very large as well. These data suggest that very large earthquakes occurred in the New Madrid seismic zone every 200 to 900 years during the past 1200 years. In addition, liquefaction features along the Black and Current Rivers suggest an earthquake source, possibly associated with the Commerce geophysical lineament, in the western Lowlands. Much work remains to refine estimates of the timing, magnitude, and source areas of prehistoric earthquakes in the New Madrid region and to determine if the recent high rate of seismicity reflects the long-term hazard.

NTIS

Liquefaction; Seismology; Earthquakes; Geological Faults; Geophysics; Chronology

19990027544 Department of Energy, Office of Energy Research, Washington, DC USA

Learning and enhanced climate representation in integrated assessment models *Final Report, Sep. 19954 - May 1997*

Kolstad, C. D., Department of Energy, USA; Dec. 31, 1997; 5p; In English

Report No.(s): DE98-006354; DOE/ER/61944-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of the project is to enhance capabilities for integrated-assessment modeling in two major areas: learning/R and D/information acquisition and the nexus between climate dynamics and climate impacts. In the first of these areas, the author's objective is to improve the way in which economic models deal with learning (endogenous and/or exogenous) within an economy. This would obviously include the R and D process, whereby knowledge about climate change (and many other things) is acquired over time and influences regulatory actions. The work in climate dynamics is focused in part on incorporating the regional climate-change results from equilibrium and transient general circulation model (GCM) simulations in the simplified integrated-assessment model. While the work is generic and therefore applicable to any integrated-assessment model, it is done in the context of a standard Ramsey growth model. Thus, the work involves theoretical conceptualization, empirical implementation in an integrated-assessment model, and analysis using that model.

NTIS

Climate; Climate Models; Learning

19990028000 Nebraska Univ., Mid-America Transportation Center, Lincoln, NE USA

Kansas Department of Transportation Wetland Mitigation Sites: Analysis and Opportunity for Improving Success

Kindscher, Kelly, Kansas State Biological Survey, USA; Mehaffey, M., Kansas State Biological Survey, USA; Fraser, A., Kansas State Biological Survey, USA; Pogge, Ernie, Kansas Univ., USA; Sep. 1998; 62p; In English

Contract(s)/Grant(s): DTRS95-G-0007

Report No.(s): PB99--121014; MATC-KU96-3; TRAN-KU-96-3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of the study was to examine wetland status, success rate, and the potential for continued development as wetlands of six Kansas Department of Transportation wetland mitigations. The wetlands were constructed to compensate for impacts caused by KDOT road projects in accordance with the Army Corps of Engineers 404 permit process. At each mitigation the vegetation, soils, and hydrology were studied to assess the site's current and future ability to function as a wetland. Each site was monitored for the presence of wetland parameters, and the results were analyzed in the context of long term site goals and objectives.

NTIS

Wetlands; Water Quality; Transportation

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see 35 Instrumentation and Photography.

19990026833 Murray State Univ., Mid-America Remote Sensing Center, KY USA
Hyperspectral Remote Sensing and Ecological Modeling Research and Education at Mid America Remote Sensing Center (MARC): Field and Laboratory Enhancement ***Final Report, 1 Nov. 1997 - 31 Oct. 1998***
Cetin, Haluk, Murray State Univ., USA; January 1999; 28p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-6582; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this project was to establish a new hyperspectral remote sensing laboratory at the Mid-America Remote sensing Center (MARC), dedicated to in situ and laboratory measurements of environmental samples and to the manipulation, analysis, and storage of remotely sensed data for environmental monitoring and research in ecological modeling using hyperspectral remote sensing at MARC, one of three research facilities of the Center of Reservoir Research at Murray State University (MSU), a Kentucky Commonwealth Center of Excellence. The equipment purchased, a FieldSpec FR portable spectroradiometer and peripherals, and ENVI hyperspectral data processing software, allowed MARC to provide hands-on experience, education, and training for the students of the Department of Geosciences in quantitative remote sensing using hyperspectral data, Geographic Information System (GIS), digital image processing (DIP), computer, geological and geophysical mapping; to provide field support to the researchers and students collecting in situ and laboratory measurements of environmental data; to create a spectral library of the cover types and to establish a World Wide Web server to provide the spectral library to other academic, state and Federal institutions. Much of the research will soon be published in scientific journals. A World Wide Web page has been created at the web site of MARC. Results of this project are grouped in two categories, education and research accomplishments. The Principal Investigator (PI) modified remote sensing and DIP courses to introduce students to ii situ field spectra and laboratory remote sensing studies for environmental monitoring in the region by using the new equipment in the courses. The PI collected in situ measurements using the spectroradiometer for the ER-2 mission to Puerto Rico project for the Moderate Resolution Imaging Spectrometer (MODIS) Airborne Simulator (MAS). Currently MARC is mapping water quality in Kentucky Lake and vegetation in the Land-Between-the Lakes (LBL) using LANDSAT-TM data. A LANDSAT-TM scene of the same day was obtained to relate ground measurements to the satellite data. A spectral library has been created for overstory species in LBL. Some of the methods, such as NPDF and IDFD techniques for spectral unmixing and reduction of effects of shadows in classifications- comparison of hyperspectral classification techniques, and spectral nonlinear and linear unmixing techniques, are being tested using the laboratory.

Author
Remote Sensing; Ecology; Environment Models; Research; Environmental Monitoring; Laboratories; Research Facilities

19990026874 Utah Univ., Dept. of Geography, Salt Lake City, UT USA
Enhancement of Capabilities in Hyperspectral and Radar Remote Sensing for Environmental Assessment and Monitoring ***Final Report***
Hepner, George F., Utah Univ., USA; Jan. 10, 1999; 11p; In English
Report No.(s): COE/97-0045; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The University of Utah, Department of Geography has developed a research and instructional program in satellite remote sensing and image processing. The University requested funds for the purchase of software licenses, mass storage for massive hyperspectral imager data sets, upgrades for the central data server to handle the additional storage capacity, a spectroradiometer for field data collection. These purchases have been made. This equipment will support research in one of the newest and most rapidly expanding areas of remote sensing.

CASI
Image Processing; University Program; Computer Programs

19990026887 Sherbrooke Univ., Dept. de Geographie et Teledetection, Quebec Canada
Relationship Between Spectral Classification (TM of LANDSAT) and Plant Species Charts, National Prairies Park, SASkatchewan ***Relation Entre la Classification Spectrale (TM de LANDSAT) et les Cartes d'Especes Vegetales, Parc National des Prairies, SASkatchewan***
Hall-Beyer, Myrka, Sherbrooke Univ., Canada; Gwyn, Q. H. J., Sherbrooke Univ., Canada; Bulletin de Recherche; March 1998; ISSN 0710-0868, Nos. 138-140; 166p; In French; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

During a resource analysis undertaken when National Prairies Park in SASkatchewan was created, a vegetation chart, whose units were based on plant associations in 1366 quadrants, was developed. Our research focuses on the spectral response of the plant units defined on this chart in order to evaluate the possibility of integrating remote sensing into park management. We propose an image classification method which unites the two methods for determining unit limits, thus giving management the possibility of using both the charts obtained from land data and those derived from remote sensing images. From a spectral viewpoint, units of vegetation are best viewed using a combination of TM 3 and 4 bands of the NDVI and textural measurements obtained from the tasseled cap transformation vegetation index. Depending upon the divergence measurement obtained from the unit signatures, one may expect exactitude levels of above 70%, but the results of a controlled classification vary from 0 to 31% according to the unit.
Author
Research; Vegetation; Signatures; SASkatchewan; Image Classification; Grasslands; Charts

19990026989 Naval Research Lab., Mapping Sciences Section, Stennis Space Center, MS USA
Developing a 1:3,000,000 Arctic and Antarctic Regions Shoreline Using the WVS Plus ***Final Report***
Doody, Martin J., III; Breckenridge, John L.; McKay, Gary; Perniciaro, Ralph; Dec. 29, 1998; 12p; In English; Original contains color plates; --Original contains color plates: All DTIC reproductions will be in black and white. Prepared in collaboration with Planning Systems Inc., Slidell, LA.
Report No.(s): AD-A359597; NRL/MR/7441-98-8093; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The National/Naval Ice Center (NIC) is currently involved in the creation of an Arctic Sea Ice Atlas for the Environmental Working Group (EWG) Arctic Climatology Project. The NIC is also responsible for creating near-real-time Arctic ice analysis products for various customers. The Naval Research Laboratory Geographic Information Systems (GIS) Lab has been tasked to assist in the EWG project by creating a shoreline for the Arctic and Antarctic Areas of Interest (AOI) defined by NIC. The creation of these shoreline data sets is in fulfillment of the deliverables of parts 3 and 7 in the Plan of Action and Milestones for the Development of a Spatial Data Transfer Specification Translation of EWG Sea Ice Data for the Naval/National Ice Center. The shorelines are to be used as products by the NIC for present and future operations.
DTIC
Mapping; Antarctic Regions; Arctic Regions; Sea Ice; Climatology; Real Time Operation; Shorelines

19990027019 NASA Goddard Space Flight Center, Greenbelt, MD USA
Secondary Forest Age and Tropical Forest Biomass Estimation Using TM
Nelson, R. F., NASA Goddard Space Flight Center, USA; Kimes, D. S., NASA Goddard Space Flight Center, USA; Salas, W. A., New Hampshire Univ., USA; Routhier, M., New Hampshire Univ., USA; Biosciences; Jan. 12, 1999; 31p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The age of secondary forests in the Amazon will become more critical with respect to the estimation of biomass and carbon budgets as tropical forest conversion continues. Multitemporal Thematic Mapper data were used to develop land cover histories for a 33,000 Square kM area near Ariquemes, Rondonia over a 7 year period from 1989-1995. The age of the secondary forest, a surrogate for the amount of biomass (or carbon) stored above-ground, was found to be unimportant in terms of biomass budget error rates in a forested TM scene which had undergone a 20% conversion to nonforest/agricultural cover types. In such a situation, the 80% of the scene still covered by primary forest accounted for over 98% of the scene biomass. The difference between secondary forest biomass estimates developed with and without age information were inconsequential relative to the estimate of biomass for the entire scene. However, in futuristic scenarios where all of the primary forest has been converted to agriculture and secondary forest (55% and 42% respectively), the ability to age secondary forest becomes critical. Depending on biomass accumulation rate assumptions, scene biomass budget errors on the order of -10% to +30% are likely if the age of the secondary forests are not taken into account. Single-date TM imagery cannot be used to accurately age secondary forests into single-year classes. A neural network utilizing TM band 2 and three TM spectral-texture measures (bands 3 and 5) predicted secondary forest age over a range of 0-7 years with an RMSE of 1.59 years and an R(Squared) (sub actual vs predicted) = 0.37. A proposal is made, based on a literature review, to use satellite imagery to identify general secondary forest age groups which, within group, exhibit relatively constant biomass accumulation rates.
Author
Age Factor; Amazon Region (South America); Carbon; Tropical Regions; Deforestation; Rain Forests; Canopies (Vegetation); Reforestation; Environment Effects

19990027082 Physics and Electronics Lab. TNO, The Hague, Netherlands

Geographical Information Extraction with Remote Sensing, Part 1, Main Report ***Final Report***

vandenBroek, A. C., Physics and Electronics Lab. TNO, Netherlands; vanPersie, M., Physics and Electronics Lab. TNO, Netherlands; Noorbergen, H. H. S., Physics and Electronics Lab. TNO, Netherlands; Rijckenberg, G. J., Physics and Electronics Lab. TNO, Netherlands; August 1998; 94p; In English; Original contains color illustrations; Sponsored in part by KMA

Contract(s)/Grant(s): A95/KL/756; TNO Proj. 25039

Report No.(s): TD98-0169-Pt-1; FEL98-A077-Pt-1; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG, The Hague, The Netherlands), Hardcopy, Microfiche

The goal of this study is to evaluate the potential of remote sensing for geographical information extraction. We have therefore collected remote sensing data from sensors in different wavelength regions (optical, thermal infrared and microwave) and for two test sites showing a variety of geographical features. The extracted geographical information has been compared with an existing ground database (TERAS) using a selected DIGEST feature list. With resolutions of about 5 meter most features can be detected and with resolution less than I meter most features can be recognized. For extended features like crop land or forest spectral or polarimetric information is more important than the resolution.

Author

Evaluation; Remote Sensing; Geographic Information Systems; Data Bases

19990027996 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Application of pixel segmentation to the low rate compression of complex SAR imagery

Ives, R. W., Department of Energy, USA; Eichel, P., Department of Energy, USA; Magotra, N., Department of Energy, USA; Mar. 31, 1998; 6p; In English; Geosciences and Remote Sensing, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE98-005029; SAND-98-0526C; CONF-980715; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes a technique to identify pixels within a subregion (chip) of a complex or detected SAR image which are to be losslessly compressed while the remainder of the image is subjected to a high compression ratio. This multi-modal compression is required for the intelligent low rate compression of SAR imagery, which addresses the problem of transmitting massive amounts of high resolution complex SAR data from a remote airborne sensor to a ground station for exploitation by an automatic target recognition (ATR) system, in a real time environment, over a narrow bandwidth. The ATR system results might then be presented to an image analyst who, using the contextual information from the SAR image, makes final target determination.

NTIS

Airborne Equipment; Pixels; Radar Imagery; Synthetic Aperture Radar; Target Recognition; Image Processing; Surveillance Radar

19990028175 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Effect of Dissolved NaCl on Freezing Curves of Kaolinite, Montmorillonite, and Sand Pastes

Grant, S. A.; Boltnott, G. E.; Tice, A. R.; Jan. 1999; 38p; In English

Report No.(s): AD-A360406; CRREL-SR-99-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We developed a chemical-thermodynamic procedure for calculating the capillary pressures of aqueous NaCl solutions in a porous medium at temperatures below 0 C by extending the treatment by Brun et al. (1977). Ice in the porous medium was assumed to be a pure phase with thermophysical properties identical to bulk hexagonal ice. The thermophysical properties (and the attendant derivative and integral properties) of the electrolyte solutions were calculated with the Pitzer model as parameterized by Archer (1992). Experiments were conducted to test this procedure. Pastes of kaolinite clay, montmorillonite, and quartz sand were prepared by washing repeatedly with aqueous solutions of 0.1-, 0.01-, and 0.001-mol/kg NaCl. The molar unfrozen water contents of these pastes were measured by pulsed nuclear magnetic resonance (NMR) in the temperature range -0.14 C to -66.6 C. The relationships between ice-solution capillary pressures and specific solution volumes for frozen pastes of each mineral were plotted for all initial solution molalities. While some systemic errors were evident, these plots indicated that the capillary pressure-volume relationships were consistent for pastes of the three minerals and, as expected from theory, unaffected by initial equilibrating solution molality.

DTIC

Sodium Chlorides; Kaolinite; Ice; Aqueous Solutions; Sands; Montmorillonite; Freezing; Thermodynamics

19990028180 Department of Energy, Office of Energy Research, Washington, DC USA

Water vapor measurements by Raman lidar during the ARM 1997 water vapor intensive observation period

Turner, D. D., Department of Energy, USA; Whiteman, D. N., Department of Energy, USA; Schwemmer, G. K., Department of Energy, USA; Evans, K. D., Department of Energy, USA; Melfi, S. H., Department of Energy, USA; Apr. 30, 1998; 5p; In English; Geoscience and Remote Sensing, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE98-052867; SAND-98-8557C; CONF-980715; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Water vapor is the most important greenhouse gas in the atmosphere, as it is the most active infrared absorber and emitter of radiation, and it also plays an important role in energy transport and cloud formation. Accurate, high resolution measurements of this variable are critical in order to improve the understanding of these processes and thus their ability to model them. Because of the importance of water vapor, the Department of Energy's Atmospheric Radiation Measurement (ARM) program initiated a series of three intensive operating periods (IOPs) at its Cloud and Radiation Testbed (CART) site in northern Oklahoma. The goal of these IOPs is to improve and validate the state- of-the-art capabilities in measuring water vapor. to date, two of the planned three IOPs have occurred: the first was in September of 1996, with an emphasis on the lowest kilometer, while the second was conducted from September--October 1997 with a focus on both the upper troposphere and lowest kilometer. The ARM CART site is the home of several different water vapor measurement systems. These systems include a Raman lidar, a microwave radiometer, a radiosonde launch site, and an instrumented tower. During these IOPs, additional instrumentation was brought to the site to augment the normal measurements in the attempt to characterize the CART instruments and to address the need to improve water vapor measurement capabilities. Some of the instruments brought to the CART site include a scanning Raman lidar system from NASA/GSFC, additional microwave radiometers from NOAA/ETL, a chilled mirror that was flown on a tethersonde and kite system, and dewpoint hygrometer instruments flow on the North Dakota Citation. This paper will focus on the Raman lidar intercomparisons from the second IOP.

NTIS

Water Vapor; Radiation Measurement; Dew Point; Hygrometers; Ecosystems

19990028255 Department of Energy, Office of Energy Research, Washington, DC USA

Additional development of remote sensing techniques for observing morphology, microphysics, and radiative properties of clouds and tests using a new, robust CO2 lidar ***Final Report***

Eberhard, W. L., Department of Energy, USA; Brewer, W. A., Department of Energy, USA; Intrieri, J. M., Department of Energy, USA; Sep. 28, 1998; 19p; In English

Report No.(s): DE99-000054; DOE/ER/61760-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A three-year project with a goal of advancing CO2 lidar technology and measurement techniques for cloud studies was successfully completed. An eye safe, infrared lidar with good sensitivity and improved Doppler accuracy was designed, constructed, and demonstrated. Dual-wavelength operation was achieved. A major leap forward in robustness was demonstrated. CO2 lidars were operated as part of two Intensive Operations Periods at the Southern Great Plains CART site. The first used an older lidar and was intended primarily for measurement technique development. The second used the new lidar and was primarily a demonstration and evaluation of its performance. Progress was demonstrated in the development, evaluation, and application of measurement techniques using CO2 lidar.

NTIS

Procedures; Remote Sensing; Morphology; Radar Measurement; Clouds (Meteorology); Accuracy

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

19990026775 Los Alamos National Lab., NM USA

Heatpipe Power System (HPS) and Heatpipe Bimodal System (HBS)

Houts, Michael G., Los Alamos National Lab., USA; Poston, David I., Los Alamos National Lab., USA; Berte, Marc V., Massachusetts Inst. of Tech., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 37-39; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of heatpipe power systems (HPS) and heatpipe bimodal systems (HBS) for advanced exploration of the Moon and Mars, for advanced deep space missions, for defense missions, and for commercial missions are discussed. There is discussion

about the reasons for the low cost of HPS, why it requires less mass, and answers safety concerns in nuclear power. Results of a test of a HPS module are reviewed and summarized. The next steps required to create a HPS are presented.
CASI
Space Missions; Power Plants; Heat Transfer; Nuclear Electric Power Generation; Heat Pipes

19990026778 Arizona Univ., Space Engineering Research Center, Tucson, AZ USA
LORPEX and Other Advanced Technologies for ISRU
Ramonhalli, Kumar, Arizona Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 47-48; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Locally Refueled Planetary Explorer (LORPEX) and other advanced technologies are discussed. LORPEX is an innovative and unique robot that combines high-tech robotics technology with In-Situ Resource Utilization (ISRU). The major concept is the production and usage of energy and power.
CASI
Robotics; Extraterrestrial Resources; Energy Technology

19990026811 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Solid oxide fuel cell distributed power generation
Veyo, S. E., Department of Energy, USA; Dec. 31, 1997; 10p; In English; Distributed Resources, USA
Report No.(s): DE98-051180; DOE/MC/C-98/7292; CONF-980315; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Fuel cells are electrochemical devices that oxidize fuel without combustion to convert directly the fuel's chemical energy into electricity. The solid oxide fuel cell (SOFC) is distinguished from other fuel cell types by its all solid state structure and its high operating temperature (1,000 C). The Westinghouse tubular SOFC stack is process air cooled and has integrated thermally and hydraulically within its structure a natural gas reformer that requires no fuel combustion and no externally supplied water. In addition, since the SOFC stack delivers high temperature exhaust gas and can be operated at elevated pressure, it can supplant the combustor in a gas turbine generator set yielding a dry (no steam) combined cycle power system of unprecedented electrical generation efficiency (greater 70% ac/LHV). Most remarkably, analysis indicates that efficiencies of 60 percent can be achieved at power plant capacities as low as 250 kWe, and that the 70 percent efficiency level should be achievable at the two MW capacity level. This paper describes the individual SOFC, the stack, and the power generation system and its suitability for distributed generation.
NTIS
Solid Oxide Fuel Cells; Fuel Combustion; Electricity

19990026812 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Application of ionic and electronic conducting ceramics in solid oxide fuel cells
Singhal, S. C., Department of Energy, USA; Dec. 31, 1997; 14p; In English; 48th; 192nd; Electrochemical Society Meeting, USA, USA; Sponsored by Electrochemical Society, Inc., USA
Report No.(s): DE98-051218; DOE/FETC/C-98/7302; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Solid oxide fuel cells (SOFCs) offer a pollution-free technology to electrochemically generate electricity at high efficiencies. These fuel cells consist of an oxygen ion conducting electrolyte, electronic or mixed electronic and ionic conducting electrodes, and an electronic conducting interconnection. This paper reviews the ceramic materials used for the different cell components, and discusses the performance of cells fabricated using these materials. The paper also discusses the materials and processing studies that are underway to reduce the cell cost, and summarizes the recently built power generation systems that employed state-of-the-art SOFCs.
NTIS
Solid Oxide Fuel Cells; Ceramics; Fabrication; Ion Currents; Oxygen Ions

19990026813 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA

Effect of pressure on solid oxide fuel cell performance

Virkar, A. V., Department of Energy, USA; Fung, K. Z., Department of Energy, USA; Singhal, S. C., Department of Energy, USA; Dec. 31, 1997; 14p; In English; Region 3 Southeastcon '97, 1997, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE98-051219; DOE/FETC/C-98/7303; CONF-9704176; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Current work in solid oxide fuel cells (SOFCs) is on cathode-supported, anode-supported, or electrolyte-supported cells. In electrode-supported cells, a thin film (5 to 30 microns) of an electrolyte (YSZ) is deposited on a relatively thick, porous electrode. In electrolyte-supported cells, the electrolyte thickness is typically greater than or equal 150 microns upon which thin electrodes are screen printed. Both types of SOFCs are being explored for hybrid applications, that is, in combination with a gas turbine, for which the exit gases from an SOFC generator must be at a high pressure (3 to 15 atm) for input into a gas turbine. It is necessary to examine the expected performance of an SOFC under a high pressure. Work at Westinghouse Ontario Hydro has shown that the performance improvement at high pressures is greater than that can be expected based on an increased Nernst potential alone. This increased performance can in part be attributed to a lower concentration polarization. The objective of this work was to conduct a preliminary analysis of the effect of pressure on the performance of both cathode-supported and electrolyte- supported cells. Flux equations for transport through porous electrodes are formulated and are solved in combination with those for electrochemical operation of an SOFC for cathode-supported and electrolyte-supported cells. The analysis shows that the overall cell performance increases significantly with increasing pressure in the case of cathode-supported cells due to a lowering of concentration polarization at high pressures. Similar effects (not presented here) are also observed on anode-supported cells. by contrast, only a modest improvement is observed in the case of electrolyte-supported cells, commensurate with the fact that in the latter, the ohmic contribution of the electrolyte is the most dominant one, which is not altered by pressure.

NTIS

Solid Oxide Fuel Cells; Pressure Dependence; Electrolytic Cells; Pressure Effects

19990026851 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Approach to the development and analysis of wind turbine control algorithms

Wu, K. C., Department of Energy, USA; Mar. 31, 1998; 87p; In English

Report No.(s): DE98-004399; SAND-98-0668; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this project is to develop the capability of symbolically generating an analytical model of a wind turbine for studies of control systems. This report focuses on a theoretical formulation of the symbolic equations of motion (EOMs) modeler for horizontal axis wind turbines. In addition to the power train dynamics, a generic 7-axis rotor assembly is used as the base model from which the EOMs of various turbine configurations can be derived. A systematic approach to generate the EOMs is presented using d'Alembert's principle and Lagrangian dynamics. A Matlab M file was implemented to generate the EOMs of a two-bladed, free yaw wind turbine. The EOMs will be compared in the future to those of a similar wind turbine modeled with the YawDyn code for verification. This project was sponsored by Sandia National Laboratories as part of the Adaptive Structures and Control Task. This is the final report of Sandia Contract AS-0985.

NTIS

Numerical Control; Wind Turbines; Control Theory; Adaptive Control; Windpower Utilization

19990026873 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Micro-engineered cathode interface studies

Doshi, R., Department of Energy, USA; Kueper, T., Department of Energy, USA; Nagy, Z., Department of Energy, USA; Krumpelt, M., Department of Energy, USA; Aug. 31, 1997; 11p; In English; Fuel Cells 1997

Report No.(s): DE97-054328; ANL/CMT/CP-93995; CONF-970871; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The aim of this work is to increase the performance of the cathode in solid oxide fuel cells (SOFCs) operating at 1,000 C by decreasing the polarization resistance from 0.2 (Omega)sq cm at 300 mA/sq cm. Decreased polarization resistance will allow operation at higher current densities. This work is in support of the Westinghouse tubular SOFC technology using YSZ electrolyte and strontium doped lanthanum manganite (LSM) cathode. The limitations at the cathode/electrolyte interface can be classified into two main areas. First, the ionic conductivity of the LSM cathode material is low which limits the reaction zone to an area very close to the interface, while the rest of the cathode thickness acts essentially as current collector with channels for gas access. Second, the electronic conductivity in YSZ is very low which limits the reaction zone to areas that are the boundaries between LSM and YSZ rather than the YSZ surface away from LSM at the interface. Possible solutions to this problem being pursued are: (1)

introducing an ionic conducting YSZ phase in LSM to form a porous two-phase mixture of LSM and YSZ; (2) applying a thin interlayer between the electrolyte and the cathode where the interlayer has high ionic and electronic conductivity and high catalytic activity for reduction of O2; (3) increasing the ionic conductivity in the LSM by suitable doping; and (4) increasing the electronic conductivity in the electrolyte by doping or by depositing an appropriate mixed conducting layer on the YSZ before applying the cathode.
NTIS
Cathodes; Interfaces

19990026990 Army Construction Engineering Research Lab., Champaign, IL USA
Energy Technology Screening Criteria *Final Report*
Shikari, Yusaf A.; Richards, Mark E.; Taylor, William R.; Aug. 1998; 219p; In English
Report No.(s): AD-A359609; CERL-TR-98/111; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Federal energy policies promote the increased use of clean-burning natural gas for industrial and commercial process applications, and it is anticipated that the Department of Defense (DoD) installations will join in this trend over the next decade. Public and private development efforts over the past few years have resulted in gas energy conversion technologies with improved efficiencies, reduced emission levels, and lower life cycle costs. Advanced natural gas technologies such as ultra-low emission burners, gas turbines, and natural gas cooling systems are likely to play an increasingly important role at DoD facilities. The Government already has a software tool, the Renewable and Energy Efficiency Planning (REEP) program, for evaluating alternative Energy Conservation Opportunities (ECOs) at USA military installations. However, there exists a need to incorporate new and evolving gas-fired energy conversion technologies in its database and to update evaluation algorithms as well as technical and economic performance characteristics for ECOs included in the current version of the REEP program. This report provides DoD facility engineers with a set of performance criteria for selected current and advanced natural gas technologies to be used to develop technology screening agents for the REEP program.
DTIC
Energy Conversion; Natural Gas; Energy Technology; Combustion; Clean Fuels; Renewable Energy

19990027126 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Interim test methods and procedures for determining the performance of small photovoltaic systems
McNutt, P., Department of Energy, USA; Kroposki, B., Department of Energy, USA; Hansen, R., Department of Energy, USA; DeBlasio, R., Department of Energy, USA; Jul. 31, 1998; 22p; In English
Report No.(s): DE98-007057; NREL/TP-520-25077; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document provides test methods and procedures for determining the performance of small stand-alone and utility-grid connected PV systems. The procedures in this document provide a common approach for evaluating whether a given PV system is suitable to perform the function it was designed and manufactured to accomplish and meet the application load. This test document fills a testing void and provides the catalyst and focus for establishing the technical foundation and bridging the institutional barriers needed to reduce uncertainty that a system's performance will be what its designers and builders claim. The need for this document was recently made more apparent with the initiation of a PV Global Approval Program (PVGAP) at the international level and is in response to concerns that PV systems being fielded must meet performance standards and that these standards include system-level performance type tests. The title of these test procedures is prefaced with the word interim because experience in using the procedures is needed before a consensus standard is developed and accepted by the PV community through its activities with the IEEE Standards Coordinating Committee 21 (SCC21) and International Electrotechnical Commission Technical Committee 82 (IEC TC82) national and international standards-making bodies. Both entities have initiated projects to develop test standards and will need the technical basis and validation of test procedures such as those presented in this document before a consensus is achieved by the PV community.
NTIS
Catalysts; Performance Tests

19990027128 Department of Energy, Washington, DC USA
Effective passivation of the low resistivity silicon surface by a rapid thermal oxide/PECVD silicon nitride stack and its application to passivated rear and bifacial Si solar cells
Rohatgi, A., Department of Energy, USA; Narasimha, S., Department of Energy, USA; Ruby, D. S., Department of Energy, USA; Dec. 31, 1998; 5p; In English; 2nd; Photovoltaic Solar Energy Conversion, USA
Report No.(s): DE98-007123; SAND-98-1603C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A novel stack passivation scheme, in which plasma silicon nitride (SiN) is stacked on top of a rapid thermal SiO2 (RTO) layer, is developed to attain a surface recombination velocity (S) approaching 10 cm/s at the 1.3 (Omega)cm p-type (100) silicon surface. Such low S is achieved by the stack even when the RTO and SiN films individually yield considerably poorer surface passivation. Critical to achieving low S by the stack is the use of a short, moderate temperature anneal (in this study 730 C for 30 seconds) after film growth and deposition. This anneal is believed to enhance the release and delivery of atomic hydrogen from the SiN film to the Si-SiO2 interface, thereby reducing the density of interface traps at the surface. Compatibility with this post-deposition anneal makes the stack passivation scheme attractive for cost-effective solar cell production since a similar anneal is required to fire screen-printed contacts. Application of the stack to passivated rear screen-printed solar cells has resulted in V(sub oc)'s of 641 mV and 633 mV on 0.65 (Omega)cm and 1.3 (Omega)cm FZ Si substrates, respectively. These V(sub oc) values are roughly 20 mV higher than for cells with untreated, highly recombinative back surfaces. The stack passivation has also been used to form fully screen-printed bifacial solar cells which exhibit rear-illuminated efficiency as high as 11.6% with a single layer AR coating. NTIS

Passivity; Silicon; Annealing; Silicon Nitrides; Solar Cells; Electrical Resistivity; Silicon Dioxide

19990027135 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Progress toward achieving a commercially viable solar reflective material

Kennedy, C. E., Department of Energy, USA; Smilgys, R. V., Department of Energy, USA; Jun. 30, 1998; 12p; In English; 11th; International Vacuum Web Coating Conference, USA

Report No.(s): DE98-007229; NREL/CP-510-24058; CONF-9711164; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Solar thermal technologies use large mirrors to concentrate sunlight for renewable power generation. The reflector materials must be low in cost and maintain high specular reflectance for extended lifetimes under severe outdoor environments. Production processes associated with candidate materials must be scalable to mass production techniques. A promising low cost construction uses a stainless steel foil substrate with a silver reflective layer protected by an optically transparent oxide topcoat. Thick (2 to 4 micron), dense alumina coatings provide durable protective layers. The excellent performance of alumina-coated reflector materials in outdoor and accelerated testing suggests that a larger field trial of the material is warranted. The key to producing a greater quantity of material for field deployment and testing without incurring substantial capital is the use of a chilled drum coater. An existing chamber is being modified, and the deposition rate will be increased prior to the installation of a drum coater to produce 1-ft wide by 10-ft long strips of solar reflector material. The production and performance of these materials are discussed. NTIS

Solar Reflectors; Composite Materials

19990027139 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA

Manufacturing improvements in the Photovoltaic Manufacturing Technology (PVMaT) Project

Witt, C. E., Department of Energy, USA; Mitchell, R. L., Department of Energy, USA; Thomas, H. P., Department of Energy, USA; Symko, M. I., Department of Energy, USA; King, R., Department of Energy, USA; Aug. 31, 1998; 6p; In English; 2nd; Photovoltaic Solar Energy Conversion, USA

Report No.(s): DE98-007262; NREL/CP-520-24923; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Photovoltaic Manufacturing Technology Project (PVMaT) is a government/ industry research and development (R and D) partnership between the US federal government (through the US Department of Energy (DOE)) and members of the US PV industry. The goals of PVMaT are to help the US PV industry improve module manufacturing processes and equipment; accelerate manufacturing cost reductions for PV modules, balance-of-systems components, and integrated systems; increase commercial product performance and reliability; and enhance the investment opportunities for substantial scale-ups of US-based PV manufacturing plant capacities. The approach for PVMaT has been to cost-share risk taking by industry as it explores new manufacturing options and ideas for improved PV modules and other components, advances system and product integration, and develops new system designs, all of which will lead to overall reduced system life-cycle costs for reliable PV end products. Initial results for the work directed primarily to module manufacture are reported in this paper. Planned R and D areas for the ten focused on module manufacture are described. Finally, government funding, subcontractor cost-sharing, and a comparison of the relative efforts by PV technology throughout the PVMaT project are presented. NTIS

Manufacturing; Technology Assessment; Life Cycle Costs; Photovoltaic Conversion; Electric Power Supplies

19990027140 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Progress in photovoltaic system and component improvements
Thomas, H. P., Department of Energy, USA; Kroposki, B., Department of Energy, USA; McNutt, P., Department of Energy, USA; Witt, C. E., Department of Energy, USA; Bower, W., Department of Energy, USA; Aug. 31, 1998; 7p; In English; 2nd; Photovoltaic Solar Energy Conversion, USA
Report No.(s): DE98-007263; NREL/CP-520-23911; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Photovoltaic Manufacturing Technology (PVMaT) project is a partnership between the US government (through the US Department of Energy (DOE)) and the PV industry. This paper summarizes PV manufacturers' accomplishments in components, system integration, and alternative manufacturing methods. Their approaches have resulted in improved hardware and PV system performance, better system compatibility, and new system capabilities. Results include new products such as Underwriters Laboratories (UL)-listed AC PV modules, modular inverters, and advanced inverter designs that use readily available and standard components. Work planned in Phase 5A1 includes integrated residential and commercial roof-top systems, PV systems with energy storage, and 300-Wac to 4-kWac inverters.
NTIS
Technology Assessment; Commerce; Compatibility; Industries; Manufacturing; Photovoltaic Conversion; Systems Integration; Electric Power Supplies

19990027143 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Photovoltaic industry manufacturing technology *Final Report*
Vanecek, D., Department of Energy, USA; Diver, M., Department of Energy, USA; Fernandez, R., Department of Energy, USA; Aug. 31, 1998; 29p; In English
Report No.(s): DE98-007318; NREL/SR-520-24823; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report contains the results of the Photovoltaic (PV) Industry Manufacturing Technology Assessment performed by the Automation and Robotics Research Institute (ARRI) of the University of Texas at Arlington for the National Renewable Energy laboratory. ARRI surveyed eleven companies to determine their state-of-manufacturing in the areas of engineering design, operations management, manufacturing technology, equipment maintenance, quality management, and plant conditions. Interviews with company personnel and plant tours at each of the facilities were conducted and the information compiled. The report is divided into two main segments. The first part of the report presents how the industry as a whole conforms to 'World Class' manufacturing practices. Conclusions are drawn from the results of a survey as to the areas that the PV industry can improve on to become more competitive in the industry and World Class. Appendix A contains the questions asked in the survey, a brief description of the benefits to performing this task and the aggregate response to the questions. Each company participating in the assessment process received the results of their own facility to compare against the industry as a whole. The second part of the report outlines opportunities that exist on the shop floor for improving Process Equipment and Automation Strategies. Appendix B contains the survey that was used to assess each of the manufacturing processes.
NTIS
Photovoltaic Cells; Technology Assessment; Surveys; Procedures; Manufacturing

19990027144 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Application of CIS to high-efficiency PV module fabrication, Phase 3 *Final Report*
Basol, B. M., Department of Energy, USA; Kapur, V. K., Department of Energy, USA; Leidholm, C. R., Department of Energy, USA; Halani, A., Department of Energy, USA; Roe, R., Department of Energy, USA; Aug. 31, 1998; 23p; In English
Report No.(s): DE98-007319; NREL/SR-520-25218; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

During this research period, researchers at International Solar Electric Technology (ISET) concentrated their efforts on three different areas of research. Within the National CIS R and D Team, ISET participated in the substrate/Mo interactions working group and investigated issues such as Na diffusion from the soda-lime glass substrate into the Mo layers and CIS films. Researchers determined that the Na content within the Mo layers was not a strong function of the nature of the Mo film. However, they found that diffusion through the Mo layers was a function of the Mo film characteristics as well as a very strong function of the CIS growth process itself. Researchers showed conclusively that the Na resided on the grain boundaries of CIS layers. Another team activity involved evaluation of CdS-free CIS solar cells. ZnO/CIS junctions prepared by the two-stage process showed light-soaking effects. Cells left under illumination improved in efficiency and were similar to the CdS/CIS junctions. After storage in the dark, however, efficiency deteriorated greatly for the ZnO/CIS device, most of the decline coming from the open-circuit volt-

age values. Much of the effort during this period was spent on developing a low-cost, non-vacuum CIS deposition technique. The method developed involves particulate deposition and formation of precursor layers followed by the conversion of these layers into CIS. Test modules of 40--60 cm(sup 2) were adapted to understand the issues involved in this novel technology. At the present time, the submodule efficiencies are 6--7%. Single-cell efficiencies are in the 10--13% range.
NTIS
Solar Cells; Research; Sodium; Diffusion; Copper Selenides; Indium Selenides

19990027187 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
NREL photovoltaic program FY 1997 ***Annual Report***
McConnell, R. D., Department of Energy, USA; Hansen, A., Department of Energy, USA; Smoller, S., Department of Energy, USA; Jun. 30, 1998; 563p; In English
Report No.(s): DE98-003896; NREL/BK-210-23607; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report summarizes the in-house and subcontracted research and development (R and D) activities under the NREL PV Program from October 1, 1996, through September 30, 1997 (FY 1997). The NREL PV Program is part of the US Department of Energy's (DOE's) National Photovoltaics Program, as described in the DOE National Photovoltaics Program Plan for 1996--2000. The FY 1997 budget authority for carrying out the NREL PV Program was $39.3 million in operating funds and $0.4 million in capital equipment funds. Subcontract activities represent a major part of the NREL PV Program, with $21.8 million (55% of PV funds) going to some 84 subcontractors. Cost sharing by industry added almost $8.8 million to the subcontract R and D activities with industry.
NTIS
Photovoltaic Conversion; Research and Development; Project Planning; Project Management

19990027188 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Modeling, testing and economic analysis of a wind-electric battery charging station
Gevorgian, V., Department of Energy, USA; Corbus, D. A., Department of Energy, USA; Drouilhet, S., Department of Energy, USA; Holz, R., Department of Energy, USA; Thomas, K. E., Department of Energy, USA; Jul. 31, 1998; 11p; In English; Windpower 1998, USA
Report No.(s): DE98-003906; NREL/CP-500-24920; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Battery charging systems are very important in many developing countries where rural families cannot afford a solar-battery home system or other electricity options, but they can afford to own a battery (in some cases more than one battery) and can pay for it to be charged on a regular basis. Because the typical households that use batteries are located far from the grid, small wind battery charging stations can be a cost-competitive options for charging batteries. However, the technical aspects of charging numerous 12-volt batteries on one DC bus with a small permanent magnet alternator wind turbine suggest that a special battery charging station be developed. NREL conducted research on two different types of wind battery charging stations: a system that uses one charge controller for the entire DC bus and charges batteries in parallel strings of four batteries each, and one that uses individual charge controllers for each battery. The authors present test results for both system configurations. In addition, modeling results of steady-state time series simulations of both systems are compared. Although the system with the single charge controller for the entire bus is less expensive, it results in less efficient battery charging. The authors also include in the paper a discussion of control strategies to improve system performance and an economic comparison of the two alternative system architectures.
NTIS
Wind Turbines; Electric Batteries; Economic Analysis; Battery Chargers

19990027189 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Characterizing wind turbine system response to lightning activity
McNiff, B., Department of Energy, USA; LaWhite, N., Department of Energy, USA; Muljadi, E., Department of Energy, USA; Jul. 31, 1998; 14p; In English; Windpower 1998, USA
Report No.(s): DE98-003907; NREL/CP-500-24790; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A lightning protection research program was instituted by National Renewable Energy Laboratory to minimize lightning damage to wind turbines and to further the understanding of effective damage mitigation techniques. to that end, a test program is under way to observe lightning activity, protection system response, and damage at a wind power plant in the Department of

Energy (DOE) and Electric Power Research Institute (EPRI) Turbine Verification Program. The authors installed Lightning activated surveillance cameras along with a special storm tracking device to observe the activity in the wind plant area. They instrumented the turbines with lightning and ground current detection devices to log direct and indirect strike activity at each unit. They installed a surge monitor on the utility interface to track incoming activity from the transmission lines. Maintenance logs are used to verify damage and determine downtime and repair costs. Actual strikes to turbines were recorded on video and ancillary devices. The test setup and some results are discussed in this paper.
NTIS
Wind Turbines; Lightning; Damage

19990027196 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Carbon composite for a PEM fuel cell bipolar plate
Besmann, T. M., Department of Energy, USA; Klett, J. W., Department of Energy, USA; Burchell, T. D., Department of Energy, USA; Dec. 31, 1997; 8p; In English, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE98-004058; ORNL/CP-96292; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The current major cost component for proton exchange membrane fuel cells is bipolar plate. An option being explored for replacing the current, nominal machined graphite component is a molded carbon fiber material. One face and the volume of the component will be left porous, while the opposite surface and sides are hermetically sealed via chemical vapor infiltration of carbon. This paper will address initial work on the concept.
NTIS
Carbon Fibers; Fiber Composites; Fuel Cells; Bipolarity

19990027205 Department of Energy, Washington, DC USA
Battery evaluation methods and results for stationary applications
Butler, P. C., Department of Energy, USA; Crow, J. T., Department of Energy, USA; Sep. 30, 1997; 10p; In English; Development of test methods and facilities for RAPs battery system evaluation
Report No.(s): DE98-000236; SAND-97-2334C; CONF-971095; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Evaluation of flooded lead-acid, Valve Regulated Lead-Acid (VRLA), and advanced batteries is being performed in the power sources testing labs at Sandia National Laboratories (SNL). These independent, objective tests using computer-controlled testers capable of simulating application-specific test regimes provide critical data for the assessment of the status of these technologies. Several different charge/discharge cycling regimes are performed. Constant current and constant power discharge tests are conducted to verify capacity and measure degradation. A utility test is imposed on some units which consists of partial depths of discharge (pulsed constant power) cycles simulating a frequency regulation operating mode, with a periodic complete discharge simulating a spinning reserve test. This test profile was developed and scaled based on operating information from the Puerto Rico Electric Power Authority (PREPA) 20 MW battery energy storage system. Another test conducted at SNL is a photovoltaic battery life cycle test, which is a partial depth of discharge test (constant current) with infrequent complete recharges that simulates the operation of renewable energy systems. This test profile provides renewable system designers with critical battery performance data representative of field conditions. This paper will describe the results of these tests to date, and include analysis and conclusions.
NTIS
Lead Acid Batteries; Valves

19990027331 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Electrochemical characteristics of lithium-ion cells
Nagasubramanian, C., Department of Energy, USA; Roth, P., Department of Energy, USA; Jungst, R. G., Department of Energy, USA; Clark, N., Department of Energy, USA; Jan. 31, 1998; 19p; In English; 15th; Primary and secondary batteries, USA
Report No.(s): DE98-002725; SAND-98-0246C; CONF-980327; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors describe below the electrochemical performance characteristics, including charge-discharge characteristics at different rates, of cylindrical 18650 (18 mm diameter, 65 mm high) and prismatic lithium ion cells at ambient and sub-ambient temperatures. Ragone plots of power and energy data for these cells are compared and indicate that at room temperature the prismatic lithium ion cells (approximately 500 mAh) exhibit higher specific power and power density than the 18650 cells (approx. 1,100 mAhr). The cell impedance was measured between 35 C and -40 C at three open circuit voltages: 4.1 v (fully charged), 3.6 v (partially discharged), and 3.1 v (almost completely discharged) . Over the temperature range from 35 C to -20 C, the cell

impedance is nearly constant for both cell types and increases by 2 to 3 times at -40 C. The impedance doesn't vary significantly with open circuit voltage (OCV). These cells show very little voltage drop at room temperature for current pulses up to 1 A. The charge-discharge characteristics of the cells are being studied at different rates as a function of temperature to compute the power, energy, and capacity outputs. This will not only broaden the database on lithium ion cells, but will also allow us to evaluate the suitability of the cells as power sources for low temperature applications. Other electrochemical characteristics of these cells including pulse response are being evaluated. Impedance measurements of the cells under load are planned to make meaningful correlations between the voltage drop and the current pulse amplitude.
NTIS
Lithium; Metal Ions; Electrochemistry

19990027449 Naval Postgraduate School, Monterey, CA USA
The Closed-Loop Control of a Three-Phase Inverter Using a DSPACE DS1102 DSP Board
Frasz, Derek P.; Dec. 1998; 78p; In English
Report No.(s): AD-A360061; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Due to enhanced reliability, reductions in cost, and ease of maintenance, the U.S. Navy has decided to shift from radial electrical distribution to DC zonal distribution for shipboard use. Correspondingly, the construction of newer classes of combatant vessels will replace bulky transformers with semiconductor switching DC-DC converters and DC-AC inverters. Electrical Control Units, ECUs, control these converters and inverters. Development of an ECU begins with a prototype design, used by the engineer to test the ability of an experimental algorithm to control a physical system. This thesis research examines the use of the DSPACE DS1102 DSP board as a prototype ECU for a three-phase inverter. A DS1102 monitored currents at the output of a three-phase power MOSFET bridge, performed the signal processing, and accordingly provided the MOSFET gating signals. This research compared several different algorithms, time steps and integration methods implemented by the DSP board. In the experiments, the inverter powered a simple RL load and an induction motor. For the closed-loop control of the induction motor, a speed control algorithm provided command inputs to the previously tested inverter. This thesis research demonstrates that the DS1102 can quickly and effectively prototype the signal processing and control units of the electrical power distribution systems of future U.S. Navy ships.
DTIC
Feedback Control; Circuit Boards; Inverters; Semiconductor Devices

19990027485 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Improved performance of self-aligned, selective-emitter silicon solar cells
Ruby, D. S., Department of Energy, USA; Yang, P., Department of Energy, USA; Zaidi, S., Department of Energy, USA; Brueck, S., Department of Energy, USA; Roy, M., Department of Energy, USA; Dec. 31, 1998; 4p; In English; 2nd; Photovoltaic solar energy conversion, USA
Report No.(s): DE98-003867; SAND-98-1761C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors improved a self-aligned emitter etchback technique that requires only a single emitter diffusion and no alignment to form self-aligned, patterned-emitter profiles. Standard commercial screen-printed gridlines mask a plasma-etchback of the emitter. A subsequent PECVD-nitride deposition provides good surface and bulk passivation and an antireflection coating. They used full-size multicrystalline silicon (mc-Si) cells processed in a commercial production line and performed a statistically designed multiparameter experiment to optimize the use of a hydrogenation treatment to increase performance. They obtained an improvement of almost a full percentage point in cell efficiency when the self-aligned emitter etchback was combined with an optimized 3-step PECVD-nitride surface passivation and hydrogenation treatment. They also investigated the inclusion of a plasma-etching process that results in a low-reflectance, textured surface on multicrystalline silicon cells. Preliminary results indicate reflectance can be significantly reduced without etching away the emitter diffusion.
NTIS
Alignment; Emitters; Solar Cells; Silicon

19990027548 Department of Energy, Office of Energy Research, Washington, DC USA
Photochemical approaches to conversion of light of electricity or fuel ***Final Report, 1 Apr. 1991 - 30 Apr. 1995***
Wrighton, M. S., Department of Energy, USA; Jun. 30, 1998; 8p; In English
Report No.(s): DE98-006378; DOE/ER/13914-1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Research supported by the Department of Energy focused on the development of molecular and semiconductor based approaches to the conversion of light to electricity or fuels. Studies of molecular systems included the preparation and characterization of new molecules which could serve as light absorbers and/or as elements that bring about charge separation following

photoexcitation. Ring-opening metathesis polymerization, in particular, was demonstrated to be useful in preparing new functional polymers of importance in developing fundamental understanding of the excited state dynamics of multicomponent polymers for light absorption and charge separation. Charge separation and ultimate collection is essential to the development of efficient systems for the conversion of light to electricity or fuel. Molecular materials such as poly(p-phenylene-ethynylene)s represent possible semiconductor photovoltaic materials that can be both efficient and low cost. Study of the optical and electrical characteristics and excited state behavior of such new materials contributed to an understanding of the design parameters needed for efficient photovoltaic devices based on such materials. Approaches to functionalization of electrode, including photoelectrode, surfaces for the purpose of improving interface energetics and kinetics in photoelectrochemical devices show that a wide range of molecular chemistry can be applied to tailoring the properties of electrode/electrolyte interfaces.
NTIS
Photochemical Reactions; Fuels; Electricity; Molecules; Electromagnetic Absorption

19990027589 Sundstrand Corp., Rockford, IL USA
Advanced Cooling for High Power Electric Actuators ***Final Report, Jan. 1993 - Oct. 1998***
Schneider, Michael G.; Domberg, Daniel P.; Oct. 1998; 73p; In English
Contract(s)/Grant(s): F33615-91-C-2139; AF Proj. 3145
Report No.(s): AD-A360644; AFRL-PR-WP-TR-1998-2147; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The development of more electric technologies for future military aircraft promises to provide significant redundancy reliability maintainability, and performance benefits. Advanced Cooling For High Power Electric Actuators particularly address the use of electro-mechanical actuators (EMAs), and an approach for cooling EMAs using the combined concepts of passive reflux cooling and phase change materials (POMs) for energy storage. This report presents results from tests on a motor cooler, and on two different motor drive coolers.
DTIC
Electromechanical Devices; Actuators

19990027626 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Aeroelastic tailoring in wind-turbine blade applications
Veers, P., Department of Energy, USA; Lobitz, D., Department of Energy, USA; Bir, G., Department of Energy, USA; Apr. 30, 1998; 15p; In English; Windpower '98, 1998, USA
Report No.(s): DE98-005540; SAND-98-1208C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper reviews issues related to the use of aeroelastic tailoring as a cost-effective, passive means to shape the power curve and reduce loads. Wind turbine blades bend and twist during operation, effectively altering the angle of attack, which in turn affects loads and energy production. There are blades now in use that have significant aeroelastic couplings, either on purpose or because of flexible and light-weight designs. Since aeroelastic effects are almost unavoidable in flexible blade designs, it may be desirable to tailor these effects to the authors advantage. Efforts have been directed at adding flexible devices to a blade, or blade tip, to passively regulate power (or speed) in high winds. It is also possible to build a small amount of desirable twisting into the load response of a blade with proper asymmetric fiber lay up in the blade skin. (Such coupling is akin to distributed (delta)(sub 3) without mechanical hinges.) The tailored twisting can create an aeroelastic effect that has payoff in either better power production or in vibration alleviation, or both. Several research efforts have addressed different parts of this issue. Research and development in the use of aeroelastic tailoring on helicopter rotors is reviewed. Potential energy gains as a function of twist coupling are reviewed. The effects of such coupling on rotor stability have been studied and are presented here. The ability to design in twist coupling with either stretching or bending loads is examined also.
NTIS
Wind Turbines; Aeroelasticity; Turbine Blades; Potential Energy; Loads (Forces); Blade Tips; Angle of Attack

19990027635 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Thin-film amorphous silicon alloy research partnership ***Progress Report No. 2, 2 fEB. 1995 - 28 fEB. 1998***
Guha, S., Department of Energy, USA; May 31, 1998; 70p; In English
Report No.(s): DE98-005493; NREL/SR-520-24723; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report describes the status and accomplishments of work performed by United Solar Systems Corp. under this subcontract. Investigations were carried out on Ag/ZnO, Ag/TiO2/ZnO and Ag/MgF2/ZnO back reflectors to assess their suitability for use in cell structures. Arrays of high-efficiency component cells were made over 1-sq ft areas. Single-junction top cells were made with an average stabilized power density of 5.4 mW/sq measured under global AM1.5 illumination. Single-junction middle cells

were optimized to give average stabilized power density of 3.6 mW/sq cm under global AM1.5 illumination with a cut-on filter with (lambda) alpha amp; amp greater than 530 nm. Arrays of high- efficiency triple-junction cells of 0.25-sq cm active area were fabricated over 1-sq ft area with average stabilized efficiency of 12% as measured under AM1.5 illumination. A triple-junction module of a 416-sq cm aperture area was fabricated with an initial efficiency of 11.7% and stabilized efficiency of 10.24%. A 922-sq cm aperture-area module exhibited an initial efficiency of 11.5%. The novel laser-drilling approach was used successfully to fabricate modules of 1-sq ft area with shadow loss of approximately 1%. Using this laser-drilling approach, an initial total-area efficiency of 11.5% was achieved in a triple-cell structure of 12.6 sq cm area. An initial total-area efficiency of 10.6% was achieved in a module of 300-sq cm area. Reliability studies based on NREL's Interim Qualification Testing were carried out to confirm the suitability of the module encapsulation materials and processes.
NTIS
Thin Films; Amorphous Silicon; Silicon Alloys; Solar Cells

19990028190 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA
Spectral utilization in thermophotovoltaic devices
Clevenger, M. B., Department of Energy, USA; Murray, C. S., Department of Energy, USA; Dec. 31, 1997; 7p; In English; Sponsored by Materials Research Society, USA
Report No.(s): DE99-000478; WAPD-T-3172; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Multilayer assemblies of epitaxially-grown, III-V semiconductor materials are being investigated for use in ThermoPhoto-Voltaic (TPV) energy conversion applications. It has been observed that thick, highly-doped semiconductor layers within cell architectures dominate the parasitic Free-Carrier Absorption (FCA) of devices at wavelengths above the bandgap of the semiconductor material. In this work, the wavelength-dependent, free-carrier absorption of p- and n-type InGaAs layers grown epitaxially onto semi-insulating (SI) InP substrates has been measured and related to the total absorption of long- wavelength photons in thermophotovoltaic devices. The optical responses of the TPV cells are then used in the calculation of spectral utilization factors and device efficiencies.
NTIS
Research; Spectra; Utilization; Thermophotovoltaic Conversion; Epitaxy; Semiconductors (Materials); Energy Conversion

19990028262 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Purification of (238)PuO2 scrap for heat source fuel
Schulte, L. D., Department of Energy, USA; Purdy, G. M., Department of Energy, USA; Jarvinen, G. D., Department of Energy, USA; Ramsey, K., Department of Energy, USA; Silver, G. L., Department of Energy, USA; Oct. 31, 1997; 9p; In English; 10th; Separation science and technology for energy applications, USA
Report No.(s): DE98-003417; LA-UR-97-4695; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Nuclear Materials Technology (NMT) Division of Los Alamos National Laboratory has initiated a development program to recover and purify plutonium-238 oxide from impure feed sources in a glove box environment. A glove box line has been designed and a chemistry flowsheet developed to perform this recovery task at large scale. The initial demonstration effort focused on purification of (238)PuO2 fuel by HNO3/HF dissolution, followed by plutonium(III) oxalate precipitation and calcination to an oxide. Decontamination factors for most impurities of concern in the fuel were very good, producing (238)PuO2 fuel significantly better in purity than specified by General Purpose Heat Source (GPHS) fuel powder specifications. A sufficient quantity of purified (238)PuO2 fuel was recovered from the process to allow fabrication of a GPHS unit for testing. The results are encouraging for recycle of relatively impure plutonium-238 oxide and scrap residue items into fuel for useful applications. The high specific activity of plutonium-238 magnifies the consequences and concerns of radioactive waste generation. This work places an emphasis on development of waste minimization technologies to complement the aqueous processing operation. Results from experiments on neutralized solutions of plutonium-238 resulted in decontamination to about 1 millicurie/L. Combining ultrafiltration treatment with addition of a water soluble polymer designed to coordinate Pu, allowed solutions to be decontaminated to about 1 microcurie/L. Efforts continue to develop a capability for efficient, safe, cost effective, and environmentally acceptable methods to recover and purify (238)PuO2 fuel.
NTIS
Purification; Plutonium 238; Scrap; Heat Sources; Fuels; Plutonium Oxides

19990028272 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Use of hybrid-power sources for improved performance with pulsed loads

Roth, E. P., Department of Energy, USA; Nagasubramanian, G., Department of Energy, USA; Apr. 30, 1998; 6p; In English; 38th; Power Sources, USA

Report No.(s): DE98-004744; SAND-98-0941C; CONF-980644; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Electrical characteristics of hybrid power sources consisting of Li-ion cells and double layer capacitors were studied at 25 C and -20 C. The cells were initially evaluated for pulse performance and then measured in hybrid modes of operation. Cells manufactured by Panasonic delivered pulses up to 3 A and cells from A and T delivered 4 A at 25 C before cell capacity dropped. Measured cell resistances were 0.15 ohms and 0.12 ohms, respectively. These measurements were repeated at -20 C. Direct coupling of the cells and capacitors (dumb hybrid) extended the pulse limits to 5.6 A using the Panasonic cells and 9 A for the A and T cells. Operation in a smart hybrid mode using uncoupled cell/capacitor discharge allowed full cell capacity usage at 25 C and showed a factor of 5 improvement in delivered capacity at -20 C.

NTIS

Research; Electrical Properties; Electric Batteries; Energy Storage

19990028275 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Miniature shock-activated thermal battery for munitions applications

Guidotti, R. A., Department of Energy, USA; Kirby, D. L., Department of Energy, USA; Reinhardt, F. W., Department of Energy, USA; Apr. 30, 1998; 6p; In English; 38th; Power Sources, USA

Report No.(s): DE98-004741; SAND-98-0940C; CONF-980644; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The feasibility of a small, fast-rise thermal battery for non-spinning munitions applications was examined by studying the response of conventional thermal cells to impact (mechanical) energy to simulate a setback environment. This is an extension of earlier work that demonstrated that shock activation could be used to produce power from a conventional thermal-battery cell. The results of tests with both single and multiple cells are presented, along with data for a 5-cell miniature (5-mm diameter) thermal battery. The issues needing to be resolved before such a device can become a commercial reality are also discussed.

NTIS

Thermal Batteries; Shock Waves; Miniaturization; Research; Performance Tests

19990028276 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Study of the ignition processes in a center-hole-fired thermal battery

Guidotti, R. A., Department of Energy, USA; Reinhardt, F. W., Department of Energy, USA; Apr. 30, 1998; 6p; In English; 38th; Power Sources, USA

Report No.(s): DE98-004740; SAND-98-0937C; CONF-980644; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The ignition processes that take place during activation of a 16 cell, center hole fired thermal battery were examined by monitoring the voltage of each cell during activation. The average rise time of each cell to a voltage of 1.125 V was determined for the LiSi/LiCL-LiBr-LiF/FeS2 electrochemical system. The effects of heat pellet composition, center hole diameter, and the load on the activation parameters were examined for three different igniters. A large variability in individual cell performance was evident along with cell reversal, depending on the location of the cell in the stack. It was not possible to draw detailed statistical information of the relative ignition sequence due to the intrinsic large scatter in the data.

NTIS

Thermal Batteries; Research; Ignition; Electrolytic Cells; Hole Geometry (Mechanics); Lithium Chlorides

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ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990026830 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Trends in visibility, PM-2.5, and deposition expected from the Acid Rain Provisions of the 1990 Clean Air Act Amendments
Shannon, J. D., Department of Energy, USA; Hanson, D. A., Department of Energy, USA; Aug. 31, 1997; 9p; In English; Visual air quality, aerosols, and global radiation balance
Report No.(s): DE97-054043; ANL/ER/CP-92701; CONF-9709194; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Acid Rain Provisions (Title IV) of the 1990 Clean Air Act Amendments (CAAA) are designed to reduce the deposition of SO2 and sulfate and, to a lesser extent, the deposition of NOx and nitrate through reduction of SO2 and NOx emissions. However, other important benefits are anticipated from the emission control strategies, including improvement of regional visibility and reductions in concentrations of fine particles (PM-2.5). In this study, the authors coupled utility emissions forecasts with the Advanced Statistical Trajectory Regional Air Pollution (ASTRAP) model and the Visibility Assessment Scoping Model (VASM) to calculate and compare the relative improvements by 2010 in visual impairment, PM-2.5 concentrations, and sulfate wet deposition at selected sites in the eastern USA.
NTIS
Acid Rain; Trends; Visibility; Environment Models; Air Pollution; Air Quality

19990026867 Department of Energy, Washington, DC USA
Finnish remote environmental monitoring field demonstration
Toivonen, H., Department of Energy, USA; Leppaenen, A., Department of Energy, USA; Ylaetalo, S., Department of Energy, USA; Lehtinen, J., Department of Energy, USA; Hokkinen, J., Department of Energy, USA; Oct. 31, 1997; 25p; In English; International safeguards; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): DE98-000184; SAND-97-2104C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Radiation and Nuclear Safety Authority (STUK), Helsinki, Finland and Sandia National Laboratories (SNL), working under the Finnish Support Program to International Atomic Energy Agency (IAEA) Safeguards and the USA Department of Energy (DOE) funded International Remote Monitoring Program (Task FIN E 935), have undertaken a joint effort to demonstrate the use of remote monitoring for environmental air sampling and safeguards applications. The results of the task will be used by the IAEA to identify the feasibility, cost-effectiveness, reliability, advantages, and problems associated with remote environmental monitoring. An essential prerequisite for a reliable remote air sampling system is the protection of samples against tampering. Means must be developed to guarantee that the sampling itself has been performed as designed and the original samples are not substituted with samples produced with other equipment at another site. One such method is to label the samples with an unequivocal tag. In addition, the inspection personnel must have the capability to remotely monitor and access the automated environmental air sampling system through the use of various sensors and video imagery equipment. A unique aspect to this project is the network integration of remote monitoring equipment with a STUK radiation monitoring system. This integration will allow inspectors to remotely view air sampler radiation data and sensor/image data through separate software applications on the same review station. A sensor network and video system will be integrated with the SNL developed Modular Integrated Monitoring System (MIMS) to provide a comprehensive remote monitoring approach for safeguards purposes. This field trial system is being implemented through a multiphase approach for use by STUK, SNL, and for possible future use by the IAEA.
NTIS
Remote Control; Air Sampling; Environmental Monitoring; Remote Sensors

19990027078 Department of Energy, Office of Energy Research, Washington, DC USA
Atmospheric sciences transfer between research advances and energy-policy assessments (ASTRAEA) ***Final Report, 1 Apr. 1996 - 31 Dec. 1997***
Slinn, W. G. N., Department of Energy, USA; Dec. 10, 1997; 92p; In English
Report No.(s): DE98-006456; DOE/ER/62180-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Consistent with the prime goal of the ASTRAEA project, as given in its peer-reviewed proposal, this final report is an informal report to DOE managers about a perceived DOE management problem, specifically, lack of vision in DOE's Atmospheric Chemistry Program (ACP). After presenting a review of relevant, current literature, the author suggests a framework for conceiving new visions for ACP, namely, multidisciplinary research for energy policy, tackling tough (e.g., nonlinear) problems as a team, ahead of political curves. Two example visions for ACP are then described, called herein the CITIES Project (the Comprehensive Inven-

tory of Trace Inhalants from Energy Sources Project) and the OCEAN Project (the Ocean-Circulation Energy-Aerosol Nonlinearities Project). Finally, the author suggests methods for DOE to provide ACP with needed vision.
NTIS
Atmospheric Chemistry; Atmospheric Physics; Energy Policy

19990027091 Naval Facilities Engineering Command, Engineering Field Activity West, San Bruno, CA USA
Draft Environmental Assessment: Travis Air Force Base Burke Property Housing
Feb. 04, 1999; 190p; In English
Report No.(s): AD-A359904; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

In support of previously reviewed, approved, and implemented Base Realignment and Closure (BRAC) actions, Travis Air Force Base (AFB) proposes to construct military family housing on the 101-acre Burke Property on the north side of the base. The use of the property for that purpose was previously reviewed and approved along with the other BRAC actions in an Environmental Impact Statement (EIS), from which this Environmental Assessment (EA) is tiered (40 CFR 1502.20). to meet the BRAC-related housing needs, a design for the construction of 281 units has been developed and is evaluated in this EA. A 226-unit alternative that could minimally satisfy Air Force policies is also considered, along with No Action, in this EA. This EA focuses on Site Contamination, Biological Resources, and Cultural Resources. For other resource and issue areas, impacts and, where appropriate, mitigation measures associated with the construction of housing on the Burke Property were adequately described in the BRAC ElS and Record of Decision (ROD) (USAF 1994a,b). This EA finds that there are no potentially significant areas of site contamination or cultural resources on the site. With respect to Biological Resources, the 281-unit design would eliminate 2.81 acres of wetland and aquatic habitats, including some areas that may support threatened and endangered species. The 226-unit alternative would eliminate 1.18 acre of wetland and aquatic habitats while avoiding wetlands that may support threatened and endangered species. This EA identifies mitigation measures that, subject to further discussion with the U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers, would mitigate these impacts to less than significance. Other potential short- and long-term impacts associated with the construction and use of housing in proximity to wetland and aquatic habitats on the site would be mitigated to insignificance through measures described in this EA.
DTIC
Environmental Surveys; Military Air Facilities; Environment Effects; Housings

19990027127 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Portable battery-powered continuous airborne Rn-222 sampler
Scarpitta, S., Department of Energy, USA; Kadnar, M., Department of Energy, USA; Apr. 30, 1998; 28p; In English
Report No.(s): DE98-007064; EML-593; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Polyport, designed at the Environmental Measurements Laboratory (EML) for deployment in atmospheric balloons or remote areas, was laboratory and field tested to determine its effectiveness in collecting Rn-222 gas in dry and humid air. Twelve 6 cm long tubes containing 0.4 g of Carboxen(trademark)-564 a hydrophobic beaded carbon molecular sieve (BCMS) material efficiently adsorbs airborne Rn-222 under dynamic sampling conditions of 1--2 hr duration. The exposed sorbent is later weighed for water uptake, transferred and counted in a low background liquid scintillation (LS) counter that can detect alpha and beta emitting Rn-222 progeny with a maximum counting efficiency of 5 cpm per dpm. Each sorbent tube can be gamma counted if it contains sufficient adsorbed Pb-214 and Bi-214 activity. The variables tested were sampling flow rate, temperature, sampling time and relative humidity (RH).
NTIS
Electric Batteries; Radon Isotopes; Portable Equipment; Air Sampling

19990027308 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
PEAC(TM) value-added project ***Final Report***
Sheesley, D., Department of Energy, USA; Sep. 30, 1997; 17p; In English
Report No.(s): DE98-058024; DOE/MC/30126-30-09/97; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Chemical spill emergencies are exacerbated by a lack of information at the scene with which to quickly assess the situation and determine the appropriate protective action. WRI has concluded that the most successful emergency tools (models) for predicting toxic cloud behavior are those that use field test data as part of their development. After analyzing more than 100 real-world chemical spill accidents and field test releases, WRI has also concluded that information from dense gas/toxic models must be communicated in a fast, simple way to emergency responders or it will not be used. In an effort to address this technology gap, WRI has developed PEAC(TM) (Palmtop Emergency Action for Chemicals). PEAC is an innovative tool that combines hardware,

software, data bases developed by WRI and other organizations, and a unique approach to modeling protective action distances tested with actual field data. PEAC brings modeling data and other reference sources together in a single piece of portable equipment to help emergency responders evaluate a chemical spill incident and quickly determine protective action distances.
NTIS
Toxicity; Spilling; Chemicals; Accidents; Wastes; Emergencies

19990027430 NASA Langley Research Center, Hampton,VA USA
Air Force F-16 Aircraft Engine Aerosol Emissions Under Cruise Altitude Conditions
Anderson, Bruce E., NASA Langley Research Center, USA; Cofer, W. Randy, III, NASA Langley Research Center, USA; McDougal, David S., NASA Langley Research Center, USA; Mar. 1999; 58p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 538-08-12-01
Report No.(s): NASA/TM-1999-209102; L-17804; NAS 1.15:209102; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Selected results from the June 1997 Third Subsonic Assessment Near-Field Interactions Flight (SNIF-III) Experiment are documented. The primary objectives of the SNIF-III experiment were to determine the partitioning and abundance of sulfur species and to examine the formation and growth of aerosol particles in the exhaust of F-16 aircraft as a function of atmospheric and aircraft operating conditions and fuel sulfur concentration. This information is, in turn, being used to address questions regarding the fate of aircraft fuel sulfur impurities and to evaluate the potential of their oxidation products to perturb aerosol concentrations and surface areas in the upper troposphere. SNIF-III included participation of the Vermont and New Jersey Air National Guard F-16's as source aircraft and the Wallops Flight Facility T-39 Sabreliner as the sampling platform. F-16's were chosen as a source aircraft because they are powered by the modern F-100 Series 220 engine which is projected to be representative of future commercial aircraft engine technology. The T-39 instrument suite included sensors for measuring volatile and non-volatile condensation nuclei (CN), aerosol size distributions over the range from 0.1 to 3.0 (micro)m, 3-D winds, temperature, dewpoint, carbon dioxide (CO2), sulfur dioxide (SO2), sulfuric acid (H2SO4), and nitric acid (HNO3).
Derived from text
F-16 Aircraft; Aerosols; Aircraft Engines; Exhaust Emission; Commercial Aircraft; Exhaust Gases; Particle Emission; Flight Altitude

19990027473 Department of Energy, Office of Energy Research, Washington, DC USA
Nitrogen Deposition: A Component of Global Change Analyses
Norby, R. J., Department of Energy, USA; Sep. 30, 1997; 37p; In English; 3rd; New phytologist, USA
Report No.(s): DE98-001912; ORNL/CP-95601; CONF-9709184; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The global cycles of carbon and nitrogen are being perturbed by human activities that increase the transfer from large pools of nonreactive forms of the elements to reactive forms that are essential to the functioning of the terrestrial biosphere. The cycles are closely linked at all scales, and global change analyses must consider carbon and nitrogen cycles together. The increasing amount of nitrogen originating from fossil fuel combustion and deposited to terrestrial ecosystems as nitrogen oxides could increase the capacity of ecosystems to sequester carbon thereby removing some of the excess carbon dioxide from the atmosphere and slowing the development of greenhouse warming. Several global and ecosystem models have calculated the amount of carbon sequestration that can be attributed to nitrogen deposition based on assumptions about the allocation of nitrogen among ecosystem components with different carbon-nitrogen ratios. They support the premise that nitrogen deposition is responsible for a an increasing terrestrial carbon sink since industrialization began, but there are large uncertainties related to the continued capacity of ecosystems to retain exogenous nitrogen. Whether terrestrial ecosystems continue to sequester additional carbon will depend in part on their response to increasing atmospheric carbon dioxide concentrations, which is widely thought to be constrained by limited nitrogen availability. Ecosystem models generally support the conclusion that the responses of ecosystems to increasing concentrations of carbon dioxide will be larger, and the range of possible responses will be wider, in ecosystems with increased nitrogen inputs originating as atmospheric deposition.
NTIS
Nitrogen; Deposition; Atmospheric Composition; Environment Models; Climate Change

19990027553 Department of Energy, Office of Energy Research, Washington, DC USA

Study of longwave radiation codes for climate studies: Validation with ARM observations and tests in general circulation models ***Final Report, 15 Sep. 1990 - 31 Oct. 1994***

Ellingson, R. G., Department of Energy, USA; Baer, F., Department of Energy, USA; Dec. 31, 1998; 17p; In English

Report No.(s): DE98-006420; DOE/ER/61075-T3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

DOE has launched a major initiative -- the Atmospheric Radiation Measurements (ARM) Program -- directed at improving the parameterization of the physics governing cloud and radiative processes in general circulation models (GCMs). One specific goal of ARM is to improve the treatment of radiative transfer in GCMs under clear-sky, general overcast and broken cloud conditions. In 1990, the authors proposed to contribute to this goal by attacking major problems connected with one of the dominant radiation components of the problem -- longwave radiation. In particular, their long-term research goals are to: develop an optimum longwave radiation model for use in GCMs that has been calibrated with state-of-the-art observations, assess the impact of the longwave radiative forcing in a GCM, determine the sensitivity of a GCM to the radiative model used in it, and determine how the longwave radiative forcing contributes relatively when compared to shortwave radiative forcing, sensible heating, thermal advection and expansion.

NTIS

Long Wave Radiation; Climate; Atmospheric General Circulation Models; Cloud Physics; Atmospheric Radiation; Radiation Transport; Clouds (Meteorology)

19990027646 Department of Energy, Office of Energy Research, Washington, DC USA

Greenhouse gas indices ***Final Report***

Jacoby, H. D., Department of Energy, USA; Prinn, R. G., Department of Energy, USA; Dec. 31, 1998; 15p; In English

Report No.(s): DE98-006283; DOE/ER/61713-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this research has been to analyze the various components of a relative gas index, and to seek a procedure that is simple and transparent but still representative of the relationship among gases. to compare the relative effects on climate change of emissions of various kinds, including aerosol precursors, the approach pursued in this research has been to develop a computer algorithm encompassing the critically-linked elements which determine gas lifetimes and radiative influence, and the resulting climate effects. Elements to be considered in the course of work have included the following: regional economic growth and emissions, and the influence of mitigation measures; the latitudinal distribution of emissions; chemical auto-feedbacks; chemical-chemical feedback; multiple gases and aerosols, and their interactions; and the linking of gas effects to damage measures, to seek an economic definition of relative weights. As an outcome of this research, new capacity has been developed for analysis of these multi-gas issues as they relate to climate change. This report covers the accomplishments on this task. Publications and reports that have resulted in whole or in part from this research grant are listed in Section 3, and are included as attachments to this report.

NTIS

Greenhouse Effect; Climate Change

19990027851 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA

Photochemical Plume-in-Grid Simulations of Major Point Sources in the Community Multiscale Air Quality (CMAQ) Modeling System

Godowitch, J. M., National Oceanic and Atmospheric Administration, USA; Gillani, N. V., Alabama Univ., USA; Biazar, A., Alabama Univ., USA; Wu, Y., Alabama Univ., USA; Imhoff, R. E., Tennessee Valley Authority, USA; 1998; 8p; In English

Report No.(s): PB99--121451; EPA/600/A-98/130; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A cooperative research and development effort has been conducted to design and implement a plume-in-grid (PinG) modeling techniques into the Models-3 Community Multiscale Air Quality (CMAQ) modeling system in order to address the need for an improved modeling approach to treat major point source emissions. Objectives are to provide an improved characterization of the near-source concentration field and a better far-field regional pollutant pattern due to the impact of the plume-in-grid approach. The conceptual design and an overview of the science processes contained in the PDM in PinG algorithms are briefly presented. Test simulations with and without the PinG treatment for a major No(x) point source are described, and an O3 concentration pattern from the grid model reveals the impact of the plume-in-grid approach. Subgrid scale plume cell O3 concentrations are also shown.

NTIS

Environment Models; Photochemical Reactions; Point Sources; Air Quality; Ozone; Plumes; Computerized Simulation; Coordinates

19990027852 Arizona Univ., Soil, Water and Environmental Science Dept., Tucson, AZ USA

Field Test of Cyclodextrin for Enhanced In-situ Flushing of Multiple-Component Immiscible Organic Liquid Contamination: Project Overview and Initial Results

Brusseau, Mark L., Arizona Univ., USA; McCray, John E., Arizona Univ., USA; Johnson, Gwynn R., Arizona Univ., USA; Wang, Xiaojiang, Arizona Univ., USA; Wood, A. L., Environmental Protection Agency, USA; Feb. 1998; 32p; In English

Report No.(s): PB99--121428; EPA/A-98/132; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this paper is to present an overview and the initial results of a pilot-scale experiment designated to test the use of cyclodextrin for enhanced in-situ flushing of an aquifer contaminated by immiscible liquid. This is the first field test of this technology, termed a complexing sugar flush (CSF). The field test was conducted within a solvent and fuel disposal site at Hill Air Force Base, UT. The cyclodextrin solution increased the aqueous concentrations of all the target contaminants to values from about 100 to more than 20000 times the concentrations obtained during the water flush conducted prior to the CSF. Concomitantly, the CSF greatly enhanced the rate of mass removal during the 8 pore-volume flush, which resulted in a 41% reduction in contaminant mass. Based on these results, it is clear that the CSF technology was successful in enhancing the remediation of the immiscible-liquid contaminated site.

NTIS

Field Tests; Flushing; Organic Liquids; Contamination

19990028178 Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC USA

Approach to ensuring quality in environmental software

Gelston, G. M., Department of Energy, USA; Lundgren, R. E., Department of Energy, USA; McDonald, J. P., Department of Energy, USA; Hoopes, B. L., Department of Energy, USA; May 31, 1998; 62p; In English

Report No.(s): DE98-054110; PNNL-11880; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Environmental software is often used to determine impacts to the public, workers, and the environment from environmental contamination. It is vital, therefore, that the modeling results, and the software that provides them, be scientifically defensible and capable of withstanding the most rigorous of technical reviews. The control and assurance of quality is a critical factor for the project team that develops environmental software at the Pacific Northwest National Laboratory. This document describes the philosophy, process, and activities that ensure a quality product throughout the life cycle of requirements analysis, design, programming, modification, testing, and implementation of environmental software. Environmental software developed by the project team is designed using an object-oriented approach. This software offers increased benefits, such as ease of maintenance and retention of the development and testing legacy of individual components, over traditional hard wired software. These benefits allow the design and testing of the models and future additions to be faster and less costly. This software is developed using a modular framework concept that allows a variety of models to work within a single construct. This software has two parts: an overall system framework and a set of modules. Each module has up to three components: a user interface, a scientific model, and pre/post-processors. Each of these pieces has a different set of quality criteria associated with it. However, whatever form this software might take for a particular client, standard processes apply to protect the information from inappropriate use. The information contained within this document can be applied to most environmental software to analyze risk in multiple environmental media.

NTIS

Environmental Quality; Object-Oriented Programming; Modules; Computer Programs

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GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see 93 Space Radiation.

19990026876 NASA Ames Research Center, Moffett Field, CA USA

Tropospheric- Stratospheric Measurement Studies Summary, *1998-1999*

Browen, Stuart W., NASA Ames Research Center, USA; May 05, 1998; 99p; In English

Contract(s)/Grant(s): NCC2-211; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The two high altitude aircraft, ER-2 NASA #706 and 709 and the DC-8 NASA #717 are in active use in several programs of upper atmospheric research to study polar ozone changes, stratospheric-tropospheric exchange processes and atmospheric effects of aviation aircraft. The ER-2 has participated in seven major missions which mainly concentrated on vortex dynamics and the large losses of Ozone in the Polar regions (Ozone hole) observed in the spring. One mission verified the complex dynami-

cal chemical and physical processes that occur during sunrise and sunset. Stratospheric Tracers of Atmospheric Transport (STRAT) obtained background measurements using the full ER-2 suite of instruments. Photochemistry of Ozone Loss in the Arctic Region in Summer (POLARIS) in 1997 assisted in understanding the mid-latitude and Arctic Ozone losses during the Northern Summer. The DC-8 with the Meteorological Measurement System (MMS) has participated in the Subsonic Aircraft: Cloud and Contrail Effects Special Study (SUCCESS), in 1996 and the Subsonic assessment Ozone and Nitrogen oxide experiment (SONEX) in 1997 missions. The MMS with its sophisticated software accurately measures ground speed and attitude, in-situ static and dynamic pressure total temperature, which are used to calculate the three dimensional wind fields, static pressure, temperature and turbulence values to meteorological accuracy. The meteorological data is not only of interest for its own sake in atmospheric dynamical processes such as mountain waves and flux measurements; but is also required by other ER-2 experiments that simultaneously measure water vapor, O3, aerosols, NO, HCl, CH4, N2O, ClO, BrO, CO2, NOy, HOx and temperature gradients. MMS products are extensively used to assist in the interpretation of their results in understanding the importance of convective effects relative to in-situ chemical changes, as may be noted by examining the list of references attached. The MMS consists of three subsystems: (a) aircraft instrumentation, inertial navigation system (INS), static and dynamic pressure taps, (b) additional dedicated instrumentation measuring angle of attack, yaw, total temperature, and a GPS which on the DC-8 measures position, velocity and attitude (c) an on board data, storage and computing acquisition system. This instrumentation and the associated software requires both an on-going laboratory ground calibration procedure for the total air temperature, static and total pressure inputs, verification of the INS dynamic response and also extensive air measurements and intercomparisons which ultimately verify and calibrate the complete system and its software. More than the usual accuracy is required because of the near cancellation occurring in the difference between the ground speed and true airspeed vectors used to give the wind vector. In the past year we have redesigned, recalibrated and used the MMS system on the NASA DC-8 that was previously used in the SUCCESS mission for the SONEX mission. Two papers were co-authored based on SUCCESS flights. Several reports and handouts were written for SONEX. Calibrations of the DC-8 pressure transducer temperature measuring thermistors was completed and an extensive analysis spanning several years of data files of the DC-8 Rosemount pressure transducer calibrations was done.
Derived from text

Calibrating; Troposphere; Stratosphere; Ozone Depletion; Meteorological Instruments; Aircraft Maneuvers; Meteorological Parameters; Pressure Sensors; Turbulence; Wind Direction

19990027244 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Interannual Variability of Total and Zonally Asymmetric Atmospheric Fields ***Manobras Com Dois e Tres Impulsos Para Satelites Artificiais***

deFelipe, Gislaine, Instituto Nacional de Pesquisas Espacias, Brazil; BertachinideAlmeidaPrado, Antonio Fernando, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 16p; In Portuguese; 14th; Engenharia Mecanica, 8-12 Dec. 1997, Bauru, Brazil
Report No.(s): INPE-6778-PRE/2786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Interannual variability of total and zonally asymmetric atmospheric fields is studied through analyses of variances and Empirical Orthogonal Function (EOF) patterns as well as using correlation maps between principal component time series and filtered anomalous time series of some variables for DJF and JJA periods. The period of study spans from 1979 to 1995. The domain of the study covers all longitudes but it is latitudinally limitated by the parallels 80 deg S and 800 deg N. Variance analyses (total, interannual and their ratios) were done for the total sea level pressure (SLP), zonal wind at 200 hPa, geopotential height at 500 hPa, vertical velocity in pressure coordinates at 500 hPa, outgoing longwave radiation (OLR) and temperature at 925 hPa and for asymmetric geopotential height at 500 hPa. These analyses suggest that the high variability in the tropics is related to El Nino-Southern Oscillation (ENSO) cycle. Seasonality is evident in the variance patterns for all variables, with the highest variability in middle and high latitudes of the winter hemisphere, except for OLR and vertical velocity. For these two variables, highest variability was seen in the tropics and during the austral summer. The first mode of the SLP shows a wavenumber one pattern in the tropical and extratropical regions, which describes features consistent with the extremes in the Southern Oscillation (SO). The correlation patterns for the other variables show seasonal differences possibly related to the periods when the extremes in the SO occur. The most important features are related to wave train pattern found for the total and asymmetric correlation fields of zonal wind at 200 hPa and geopotential height at 500 hPa. In DJF, the asymmetric of these variables show a wave train pattern in Atlantic/Africa region. In JJA wave pattern for asymmetric zonal wind at 200 hPa in the South Pacific is observed. The distinct features of the atmospheric patterns of asymmetric and total fields of zonal wind at 200 hPa and geopotential height at 500 hPa, suggest that possibly the asymmetric part of these variables plays an important role in the interactions of extratropical and tropical circulations.
Author

Research; Asymmetry; Atmospheric Effects; Variability; Wind (Meteorology); Long Wave Radiation; Orthogonal Functions

19990027272 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Study of the wave parameters by simultaneous measurements Using MU Radar and photometer at Shigaraki (35 deg N, 136 deg E), Japan ***Estudo de Parametros de Ondas de Gravidade por Medidas Simultaneas de Radar MU e Fotometro em Shigaraki (35 deg N, 136 deg L), Japao***

BuritideCosta, Ricardo Arlen, Instituto Nacional de Pesquisas Espacias, Brazil; Mar. 1997; 203p; In Portuguese

Report No.(s): INPE-6647-TDI/624; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The goal of this thesis is to calculate some parameters, such as horizontal and vertical wavelength, observed and intrinsic periods, velocity of propagation, etc., of atmospheric waves by simultaneous observations of intensity and rotational temperature of OH(6,2) by a scanning photometer and winds near the mesopause (between 80 and 100 km) by MU radar, at Shigaraki (35 deg N, 136 deg E), Japan. These parameters lead us to want to know about the propagation of these waves through the atmosphere, besides the interaction between airglow and waves. The observations were carried out in November, 1994 and from July to September in 1995. The photometer was built at Lume/INPE laboratory and its main objective is to measure the intensity and temperature in 8 positions (azimuths) of the sky with 6 minutes of temporal resolution. The MU radar is an array of 475 antennas inside a circular area with a diameter of 108 in. The meteor mode permits the measurement of wind by tracing movement of a meteor ionized line which is formed by the entrance of a meteoroid in the atmosphere. From the analysis of the nocturnal variations of both the airglow and wind data, it is shown that waves propagating through the atmosphere and the physical parameters were determined. The waves, studied in the thesis, were in the 500 to 2960 km range horizontal wavelength and from 3.5 to 9.5 hours. Under normal circumstances, the difference was small between observed and intrinsic, wind formations but in one of the nights, this difference was about 100%. In one of the nights (Nov. 04, 1994)which was analyzed, a gravity wave was identified with the period of 9 hours and a short period (3 hours) wave superposed on the long period wave.

Author

Gravity Waves; Mesopause; Meteoroids; Nocturnal Variations; Propagation Velocity

19990027334 Department of Energy, Washington, DC USA

Source and Path Effects on Regional Phases in China

Phillips, W. S., Department of Energy, USA; Dec. 31, 1997; 13p; In English; Monitoring a comprehensive test ban treaty

Report No.(s): DE98-000602; LA-UR-97-2643; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As part of the CTBT Research and Development regional characterization effort, we are assembling, organizing and analyzing geological, geophysical,and seismic data for inclusion in a knowledge base for China. We have collected seismic data from 11 Chinese Digital Seismic Network (CDSN) stations as well as IRIS stations AAK, TLY, ULN and NIL from adjoining regions. Using the published event locations and origin times, we identify Pn, Pg, Sn, and Lg phases, construct travel time curves, and estimate apparent velocities from broadband and short period seismograms. Following this, we collect amplitudes of regional seismic phases and associated noise levels using bandpassed waveforms. Studies of path specific propagation of the seismic phases have mapped blockages and have generated corrections useful in reducing scatter in magnitude estimates and in discriminant ratios. Such path corrections reduce RMS distance and mb-corrected Lg amplitude to as much as 60% of its original level log(base 10) domain. Path corrections are less effective with Pn data. We also study source scaling effects on these data which will allow us to refine path corrections further.

NTIS

Geology; Geophysics; Seismology

19990027388 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Ionosphere-Thermosphere System Response to Magnetic Storms on the South-American Region ***Resposta do Sistema Ionosfera-Termosfera a Tempestades Magneticas no Setor Sul-Americano***

Pincheira, Ximena Andera Torres, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 181p; In Portuguese

Report No.(s): INPE-6743-TDI/633; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

We show case studies of magnetic storm events during low, (i.e., 1986) and high, (i.e., 1989-1990) solar activity years using a chain of ionospheric South American stations in low, mid, and high latitudes. Using Fortaleza (FZ) and Cachoeira Paulista (CP) for low latitudes; Concepcion (CON) for midlatitudes; and Ilha Rei Jorge (IRJ) for high latitudes, we studied the ionosphere-thermosphere system interrelation during those periods and described the physical processes causing disturbances in a region, where the magnetic field configuration shows high declination angle and field intensity variability. We investigated the responses of the ionosphere-thermosphere system to the disturbance. We expected to find some latitudinal and longitudinal dependencies. We studied the disturbed thermospheric wind pattern and the negative phases in foF2 using ionosonde data and the FLIP Model (Field Line Interhemispheric Model). Ionospheric effects of magnetic storms are higher during solar minimum than during solar maximum conditions. Seasonal effects are more important than solar cycle effects at high latitudes. The modeled wind patterns have

the same variation as h(sub max) and their magnitude are higher at midlatitudes. We saw a clearly perturbed wind propagation associated with the onset of sub-storms. There are a series of local factors that can induce changes in the ionosphere, during latitudinal and longitudinal propagation of a magnetic storm disturbance. The negative phases in foF2 over IRJ are caused by neutral atmosphere composition changes, (i.e., the variation in the ratio [O]/[N2] can be as high as 80%). In CON, the negative phases can not be completely explained by neutral atmospheric changes. In this middle latitude station, wind action is more effective in determining the h(sub max) variations. In CP, electric fields and zonal winds are both very important for the h(sub max) variations. Author (revised)

Ionospheric Storms; Magnetic Storms; Solar Activity Effects; Solar Cycles; Thermosphere; Earth Ionosphere; Sunspot Cycle; South America

19990027394 Royal Netherlands Meteorological Inst., De Bilt, Netherlands

Temperature Corrections on Radiation Measurements Using Modtran 3

Bunskoek, D. A., Royal Netherlands Meteorological Inst., Netherlands; vanLammeren, A. C. A. P., Royal Netherlands Meteorological Inst., Netherlands; Feijt, A. J., Royal Netherlands Meteorological Inst., Netherlands; 1998; ISSN 0169-1708; 49p; In English

Report No.(s): KNMI-TR-204; ISBN 90-369-2137-6; Copyright; Avail: Issuing Activity (KNMI, PO Box 201, Wilhelminalaan 10, De Bilt, The Netherlands), Hardcopy, Microfiche

Temperatures obtained from radiation measurements on clouds need to be corrected for the radiative properties of the atmospheric layer between the clouds and the sensor. This can be done using the radiative transport model Modtran 3. In order to simplify and automate the use of this model, an interface has been developed. This interface uses radiosonde data to parameterize the atmosphere, and calculates a correction table for radiation measurements. A number of cases were analysed. It was concluded, that using this correction, a better cloud description is obtained, because of a more accurate estimate of the cloud base and top temperatures and hence the cloud base height. Furthermore, it is now possible to use Modtran 3 routinely for temperature corrections on radiation measurements.

Author

Radiant Heating; Temperature Compensation; Correction; Radiation Dosage

19990027432 NASA Goddard Space Flight Center, Greenbelt, MD USA

Boundary Layer Formation in the Magnetotail: Geotail Observations and Comparisons with a Global MHD Simulation

Raeder, J., California Univ., USA; Berchem, J., California Univ., USA; Ashour-Abdalla, M., California Univ., USA; Frank, L. A., Iowa Univ., USA; Paterson, W. R., Iowa Univ., USA; Ackerson, K. L., Iowa Univ., USA; Kokubun, S., Nagoya Univ., Japan; Yamamoto, T., Tokyo Univ., Japan; Slavin, J. A., NASA Goddard Space Flight Center, USA; Geophysical Research Letters; Apr. 15, 1997; ISSN 0094-8534; Volume 24, No. 8, pp. 951-954; In English

Contract(s)/Grant(s): NAGw-4543; NAGw-1100; NAG5-2371

Report No.(s): IGPP-Publ-4647; Paper-97GL00218; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present Geotail plasma and field observations from the middle magnetotail near X(sub GSE) = -46 R(sub E) for the time period 1400 to 1800 UT on December 14, 1994. During that period, the Wind satellite monitored the solar wind plasma and interplanetary magnetic field (IMF) upstream of the bow shock. The IMF was northward and the plasma parameters near average. Geotail observed slow tailward flows and a northward field. The plasma and field parameters indicate that Geotail is either in the plasma sheet or in a boundary layer. We used the Wind solar wind plasma and IMF data as input for a global simulation of that time interval. Comparison of the simulation results with the observational data show very good overall agreement of the magnitudes of the plasma and field parameters. In particular, the simulation reproduces the slow tailward flows and northward field found at Geotail. Small scale temporal, variations are less well reproduced. The simulation shows the formation of a broad boundary layer (which we call tail flank boundary layer, TFBL) that consists of closed flux which is formed by magnetic magnetic reconnection of IMF and lobe field lines. The simulation results indicate that Geotail is located very close to the TFBL and may have entered the TFBL proper. We show that the TFBL plays an important role in energy transport from the solar wind into the magnetosphere during northward IMF conditions.

Author

Geomagnetic Tail; Solar Wind; Magnetic Field Reconnection; Magnetohydrodynamics; Bow Waves; Energy Transfer; Interplanetary Magnetic Fields

19990027433 NASA Goddard Inst. for Space Studies, New York, NY USA

Uncertainties in Carbon Dioxide Radiative Forcing in Atmospheric General Circulation Models

Cess, R. D., State Univ. of New York, USA; Zhang, M.-H., State Univ. of New York, USA; Potter, G. L., California Univ., Lawrence Livermore Lab., USA; Gates, W. L., California Univ., Lawrence Livermore Lab., USA; Taylor, K. E., California Univ., Lawrence Livermore Lab., USA; Barker, H. W., Canadian Climate Centre, Canada; Colman, R. A., Bureau of Meteorology, Australia; Fraser, J. R., Bureau of Meteorology, Australia; McAvaney, B. J., Bureau of Meteorology, Australia; Dazlich, D. A., Colorado State Univ., USA; Randall, D. A., Colorado State Univ., USA; DelGenio, A. D., NASA Goddard Inst. for Space Studies, USA; Lacis, A. A., NASA Goddard Inst. for Space Studies, USA; Esch, M., Max-Planck-Inst. fuer Meteorologie, Germany; Roeckner, E., Max-Planck-Inst. fuer Meteorologie, Germany; Galin, V., Russian Academy of Natural Sciences, Russia; Hack, J. J., National Center for Atmospheric Research, USA; Kiehl, J. T., National Center for Atmospheric Research, USA; Ingram, W. J., Meteorological Office, UK; LeTreut, H., Laboratoire de Meteorologie Dynamique, France; Science; Nov. 19, 1993; Volume 262, pp. 1252-1255; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Global warming, caused by an increase in the concentrations of greenhouse gases, is the direct result of greenhouse gas-induced radiative forcing. When a doubling of atmospheric carbon dioxide is considered, this forcing differed substantially among 15 atmospheric general circulation models. Although there are several potential causes, the largest contributor was the carbon dioxide radiation parameterizations of the models.

Author

Atmospheric General Circulation Models; Gas Composition; Greenhouse Effect; Atmospheric Composition; Carbon Dioxide Concentration

19990027438 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Distant Tail at 200 R(sub E): Comparison Between Geotail Observations and the Results from a Global Magnetohydrodynamic Simulation

Berchem, J., California Univ., USA; Raeder, J., California Univ., USA; Ashour-Abdalla, M., California Univ., USA; Frank, L. A., Iowa Univ., USA; Paterson, W. R., Iowa Univ., USA; Ackerson, K. L., Iowa Univ., USA; Kokubun, S., Nagoya Univ., Japan; Yamamoto, T., Tokyo Univ., Japan; Lepping, R. P., NASA Goddard Space Flight Center, USA; Journal of Geophysical Research; May 01, 1998; ISSN 0148-0227; Volume 103, No. A5, pp. 9121-9141; In English; Original contains color illustrations

Contract(s)/Grant(s): NAGw-1100; NAGw-4541; NAGw-4543; NAG5-2371

Report No.(s): IGPP Publ-4876; Paper-97JA02926; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper reports a comparison between Geotail observations of plasmas and magnetic fields at 200 R(sub E) in the Earth's magnetotail with results from a time-dependent, global magnetohydrodynamic simulation of the interaction of the solar wind with the magnetosphere. The study focuses on observations from July 7, 1993, during which the Geotail spacecraft crossed the distant tail magnetospheric boundary several times while the interplanetary magnetic field (IMF) was predominantly northward and was marked by slow rotations of its clock angle. Simultaneous IMP 8 observations of solar wind ions and the IMF were used as driving input for the MHD simulation, and the resulting time series were compared directly with those from the Geotail spacecraft. The very good agreement found provided the basis for an investigation of the response of the distant tail associated with the clock angle of the IMF. Results from the simulation show that the stresses imposed by the draping of magnetosheath field lines and the asymmetric removal of magnetic flux tailward of the cusps altered considerably the shape of the distant tail as the solar wind discontinuities convected downstream of Earth. As a result, the cross section of the distant tail was considerably flattened along the direction perpendicular to the IMF clock angle, the direction of the neutral sheet following that of the IMF. The simulation also revealed that the combined action of magnetic reconnection and the slow rotation of the IMF clock angle led to a braiding of the distant tail's magnetic field lines along the axis of the tail, with the plane of the braid lying in the direction of the IMF.

Author

Geomagnetic Tail; Magnetohydrodynamics; Interplanetary Magnetic Fields; Time Series Analysis; Time Dependence; Solar Wind; Magnetic Flux; Plasmas (Physics)

19990027452 Aerospace Corp., Technology Operations, El Segundo, CA USA

Cusp Energetic Ions: A Bow Shock Source

Chang, S. -W.; Scudder, J. D.; Fuselier, S. A.; Fennell, J. F.; Trattner, K. J.; Dec. 20, 1998; 11p; In English

Contract(s)/Grant(s): F04701-93-C-0094

Report No.(s): AD-A360068; TR-99(8570)-1; SMC-TR-99-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent interpretations of cusp energetic ions observed by the POLAR spacecraft have suggested a new energization process in the cusp Chen et al., 1997, 1998. Simultaneous enhancement of H(+), He(+2), and O(+2) fluxes indicates that they are of solar wind origin. In the present study, we examine H(+) and He(+2) energy spectra from 20 eV to several 100 keV measured by the

Hydra, Toroidal Imaging Mass-Angle Spectrograph (TIMAS), and Charge and Mass Magnetospheric Ion Composition Experiment (CAMMICE) on POLAR. The combined spectrum for each species is shown to be continuous with a thermal distribution below 10 keV and an energetic component above 20 keV/e. Energetic ions with comparable fluxes and a similar spectral shape are commonly observed downstream from the Earth's quasi-parallel bow shock. In addition to the similarity in the ion spectra, electric and magnetic field noise and turbulence detected in the cusp by the Plasma Wave Instrument (PWI) and Magnetic Field Experiment (MFE) onboard POLAR are similar to the previously reported observations at the bow shock. The waves appear to be coincidental to the cusp energetic ions rather than causal. We suggest that these ions are not accelerated locally in the cusp. Rather, they are accelerated at the quasi-parallel bow shock and enter the cusp along open magnetic field lines connecting both regions.
DTIC
Magnetospheres; Solar Wind; Bow Waves; Ions; Shock Waves; Plasma Waves

19990027453 California Univ., Los Angeles, CA USA
Theoretical Investigation of the High-Altitude Cusp Region using Observations from Interball and ISTP Spacecraft ***Final Report, 1 Mar. 1997 - 31 Oct. 1998***
Ashour-Abdalla, Maha, California Univ., USA; 1998; 3p; In English
Contract(s)/Grant(s): NAG5-4067; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A fundamental goal of magnetospheric physics is to understand the transport of plasma through the solar wind-magnetosphere-ionosphere system. To attain such an understanding, we must determine the sources of the plasma, the trajectories of the particles through the magnetospheric electric and magnetic fields to the point of observation, and the acceleration processes they undergo enroute. This study employed plasma distributions observed in the near-Earth plasma sheet by Interball and Geotail spacecraft together with theoretical techniques to investigate the ion sources and the transport of plasma. We used ion trajectory calculations in magnetic and electric fields from a global Magnetohydrodynamics (MHD) simulation to investigate the transport and to identify common ion sources for ions observed in the near-Earth magnetotail by the Interball and Geotail spacecraft. Our first step was to examine a number of distribution functions and identify distinct boundaries in both configuration and phase space that are indicative of different plasma sources and transport mechanisms. We examined events from October 26, 1995, November 29-30, 1996, and December 22, 1996. During the first event Interball and Geotail were separated by approximately 10 R(sub E) in z, and during the second event the spacecraft were separated by approximately 4(sub RE). Both of these events had a strong IMF By component pointing toward the dawnside. On October 26, 1995, the IMF B(sub Z) component was northward, and on November 1-9-30, 1996, the IMF B sub Z) component was near 0. During the first event, Geotail was located near the equator on the dawn flank, while Interball was for the most part in the lobe region. The distribution function from the Coral instrument on Interball showed less structure and resembled a drifting Maxwellian. The observed distribution on Geotail, on the other hand, included a great number of structures at both low and high energies. During the third event (December 22, 1996) both spacecraft were in the plasma sheet and were separated bY approximately 20 R(sub E) in the y direction. During this event the IMF was southward.
Author
Plasma Layers; Plasmas (Physics); Solar Wind; Magnetosphere-Ionosphere Coupling; Earth Magnetosphere; Earth Ionosphere

19990027490 Department of Energy, Office of Energy Research, Washington, DC USA
Robust economic technique for crosswell seismic profiling ***Final Report***
Hardage, B. A., Department of Energy, USA; Simmons, J. L., Department of Energy, USA; Jan. 31, 1998; 50p; In English
Report No.(s): DE98-007333; DOE/ER/14504-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this research program was to investigate a novel way to acquire crosswell tomographic data, that being to use a standard surface-positioned seismic energy source stationed inline with two wells that have downhole receiver arrays. This field technique differs from the traditional way that crosswell tomography is done, which requires that a downhole receiver array be in one well and that a downhole seismic source be in a second well. The purpose of the research effort was to evaluate the relative merits of the potential advantages and pitfalls of surface-source crosswell tomography, which some also refer to as twin-receiver-well crosswell tomography. The principal findings were: (1) surface-source crosswell tomography is a viable technology and can be used in appropriate reservoir conditions, (2) raypath modeling should be done to determine if the targeted interwell space is properly illuminated by surface-generated wavefields before proceeding to collect surface-source tomographic data, (3) crosswell data generated by a surface- based source are subject to a greater range of traveltime errors than are data generated by a downhole source, primarily due to shot statics caused by variable weathered layers, and (4) the accuracy and reliability of the interwell tomogram increase as more independent velocity information (sonic logs, velocity checkshots, vertical seismic profiles, downhole-

source crosswell data) is available to constrain the inversion. The surface-source approach to crosswell tomography was evaluated by recording twin-receiver well data at the Texaco Borehole Test Site in Humble, Texas.
NTIS
Tomography; Robustness (Mathematics); Procedures; Economics; Seismic Energy; Range Errors

19990027598 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Magnetotail Structure and its Internal Particle Dynamics During Northward IMF
Ashour-Abdalia, M., California Univ., USA; El-Alaoui, M., California Univ., USA; Peroomian, V., California Univ., USA; New Perspectives on the Earth's Magnetotail; 1998, pp. 77-95; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-1100; NAGw-4553
Report No.(s): Geophysical Monograph-105; UCLA/IGPP-Pub-4934; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This study uses Global magnetohydrodynamic (MHD) simulations driven by solar wind data along with Geotail observations of the magnetotail to investigate the magnetotail's response to changes in the interplanetary magnetic field (IMF); observed events used in the study occurred on March 29, 1993 and February 9, 1995. For events from February 9, 1995, we also use the time-dependent MHD magnetic and electric fields and the large-scale kinetic (LSK) technique to examine changes in the Geotail ion velocity distributions. Our MHD simulation shows that on March 29, 1993, during a long period of steady northward IMF, the tail was strongly squeezed and twisted around the Sun-Earth axis in response to variations in the IMF B(sub y) component. The mixed (magnetotail and magnetosheath) plasma observed by Geotail results from the spacecraft's close proximity to the magnetopause and its frequent crossings of this boundary. In our second example (February 9, 1995) the IMF was also steady and northward, and in addition had a significant B(sub y) component. Again the magnetotail was twisted, but not as strongly as on March 29, 1993. The Geotail spacecraft, located approximately 30 R(sub E) downtail, observed highly structured ion distribution functions. Using the time-dependent LSK technique, we investigate the ion sources and acceleration mechanisms affecting the Geotail distribution functions during this interval. At 1325 UT most ions are found to enter the magnetosphere on the dusk side earthward of Geotail with a secondary source on the dawn side in the low latitude boundary layer (LLBL). A small percentage come from the ionosphere. by 1347 UT the majority of the ions come from the dawn side LLBL. The distribution functions measured during the later time interval are much warmer, mainly because particles reaching the spacecraft from the dawnside are affected by nonadiabatic scattering and acceleration in the neutral sheet.
Author
Interplanetary Magnetic Fields; Magnetohydrodynamics; Magnetosheath; Geomagnetic Tail; Plasmas (Physics); Ion Distribution; Boundary Layers

19990027599 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Global MHD Simulations of the Substorm Current Wedge and Dipolarization
Raeder, J., California Univ., USA; McPherron R. L., California Univ., USA; Substorms; [1998]; Volume 4, pp. 343-348; In English
Contract(s)/Grant(s): NAGw-4684; NSF ATM-87-13449; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents results from global MHD simulations showing the evolution of the plasma and field in the near-Earth tail during the substorm phases. The late growth phase is characterized by pronounced thinning of the plasma sheet and stretching of the field in the region between approximately -6 R(sub E) to -30 R(sub E). A pre-existing X-line moves tailward to beyond -50 R(sub E). Close to onset, a new X-line forms near -18 R(sub E) in the midnight sector. Earthward flows emanating from this X-line dipolarize the near-Earth field, leading to a reduction of the cross-tail current in the midnight sector, but not elsewhere. The magnetic shear between the dipolarized field near midnight and the stretched field elsewhere is equivalent to currents flowing through the ionosphere in a region I sense, and so forming the current wedge. Later in the expansion phase, the dipolarization spreads in local time at a rate of about 0.3 hours MLT per minute. A strong electric field and a rapid increase of the plasma pressure is associated with the dipolarization. Near midnight the dipolarization appears to occur at all distances between 6.6 and 13 R(sub E) at the same time within the resolution (+/- 2 min) of our model. However, the model results indicate that dipolarization starts before ground onset in the pre-midnight sector and propagates both earthward and eastward.THus, dipolarization may be much more complex than simple earthward/tailward and/or azimuthal expansion.
Author
Magnetohydrodynamics; Plasmas (Physics); Plasma Layers; Magnetic Storms; Electric Fields; Ionospheric Currents

19990027727 Technion - Israel Inst. of Tech., Asher Space Research Inst., Haifa Israel
Investigation of the Ionospheric Short-term Variability ***Final Report, Apr. 1997 - Apr. 1998***
Houminer, Zwi; Shaviv, G.; Nov. 1998; 19p; In English
Contract(s)/Grant(s): N68171-97-C-9026
Report No.(s): AD-A359644; R/D-8242-EE-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Reliable High Frequency (HF) communications require propagation assessment. Such assessment could be facilitated with the monitoring of ionospheric characteristics by continuously available passive means, i.e, measurements of the total electron content(TEC) using satellite-emitted signals without a need for burdening the electromagnetic spectrum. With the Global Positioning System (GPS) providing instantaneous time delay, or equivalently, TEC, values when needed, an assessment of HF propagation may be available on a near realtime basis. to assess this possibility a one year study of the correlation between TEC and foF2 using GPS time delay observation taken at Matera, Italy was undertaken during 1995-1996. This is a period of minimum solar activity with sunspot numbers varying between 6-18. The observed correlation coefficient varied between 0.55 in the winter of 1996 to about 0.75-0.8 during the summer of 1995. In addition to the seasonal variability of the correlation coefficient, a diurnal variability is also present with the coefficient normally maximizing during the day and minimizing in the predawn periods. The predawn minimum may be due to the contribution of plasmaspheric electron content. The correlation coefficient appears to increase with magnetic activity, indicating that TEC and foF2 behave similarly during magnetically active periods. Distribution of errors between measured foF2 values and predicted ones using a) standard predictions algorithms and b) TEC measurements converted to foF2 from a model of slab thickness, show that the errors are reduced when using TEC observations. The errors would be further reduced if the satellite subionospheric point would approach the location of the foF2 actual measurements.
DTIC
Variability; Radio Transmission; Ionospheres

19990027969 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Using Global Simulations of the Magnetosphere for Multi-Satellite Mission Planning and Data Analysis
Raeder, Joachim, California Univ., USA; Angelopoulos, Vassilis, California Univ., USA; Science Closure and Enabling Technologies for Constellation Class Missions; 1998, pp. 78-83; In English
Contract(s)/Grant(s): NAG5-4684; NSF ATM-97-13449
Report No.(s): IGG-Publ-5223; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We use global simulations of Earth's magnetosphere to assess the scientific return from a multi-satellite mission in the magnetosphere. We examine 4 different scenarios with 20, 40, 80, and 160 satellites, respectively. The satellite orbits are randomized with perigee distances ranging from 2 to 5R(sub E), apogee distances between 10 and 50 R(sub E), and within +/-5R(sub E) of the geocentric solar ecliptic (GSE) equator. For each of these satellite configurations we examine the expected observations during a typical substorm by using time traces obtained from a global simulation at the satellite positions. The 160 satellite configuration yields sufficient information to distinguish between different substorm models without any temporal/spatial ambiguities. An 80 satellite configuration still provides sufficient information for this task, however for fewer events with good satellite conjunctions and with less statistical certainty. For constellations with fewer than 40 satellites time-space ambiguities are likely to remain in the observation. However, any multi-satellite constellation would be a quantum leap in magnetospheric research because of the unprecedented coverage of other regions, because it would enable new measurement techniques that are unique to multi-satellite missions, and because it would enable the use of data assimilation techniques in global models for the first time.
Author
Earth Magnetosphere; Satellite Configurations; Magnetic Storms; Mission Planning; Assimilation; Simulation

19990027970 California Univ., Space Sciences Lab., Berkeley, CA USA
On the Necessity and Feasibility of an Equatorial Magnetospheric Constellation
Angelopoulos, V., California Univ., USA; Carlson, C. W., California Univ., USA; Curtis, D. W., California Univ., USA; Harvey, P., California Univ., USA; Lin, R. P., California Univ., USA; Mozer, F. S., California Univ., USA; Pankow, D. H., California Univ., USA; Raeder, J., California Univ., USA; Russell, C. T., California Univ., USA; Science Closure and Enabling Technologies for Constellation Class Missions; 1998, pp. 14-21; In English
Contract(s)/Grant(s): NAGw-5019; CS-55-97; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Synthesizing multi-point in-situ observations from the magnetosphere is the only way that we can retain an accurate knowledge of the driving mechanisms of convection and energy flow while "imaging" its vast volume. In addition to measuring the wavenumber of plasma instabilities thus opening up for study a previously unexplored domain of space plasma physics the Constellation mission can afford us a view of the rapid topological reconfigurations and the energy circulation throughout the astrophysical laboratory closest to human space activity. In this paper we argue that the deployment of approximately 80 autono-

mous micro-satellites (probes) to monitor the Earth's magnetosphere and measure the plasma and magnetic field in the near-equatorial magnetosphere is a necessary and sufficient condition for answering long standing, high priority questions regarding magnetospheric stability and dynamics. The proposed mission concept is technically feasible and fiscally modest. The probes can be raised from a Geosynchronous Transfer orbit to their final elliptical orbits with perigee approximately 3R(sub E)and apogees ranging from 12 to 42 R(sub E) by a single dispenser propelled by an ion engine. Each probe will weigh approximately 5 kg. The mission can form a cornerstone of an incrementally deployed Solar Terrestrial Probe Line Magnetospheric Constellation, as it requires no new technologies in the areas of spacecraft subsystems and instruments, but some development in the areas of dispenser design, probe packaging, mechanical release and spin-up. The technology developed can be utilized by follow-on Constellation class missions as well.
Author
Constellations; Magnetohydrodynamic Stability; Earth Magnetosphere; Feasibility; Imaging Techniques; Mission Planning

19990027971 NASA Goddard Space Flight Center, Greenbelt, MD USA
Magnetospheric Constellation and Tomography Mission Concept
Ergun, R. E., California Univ., USA; Larson, D. E., California Univ., USA; Phan, T., California Univ., USA; McFadden, J. P., California Univ., USA; Carlson, C. W., California Univ., USA; Roth, I., California Univ., USA; Delory, G. T., California Univ., USA; Bale, S., California Univ., USA; Angelopoulos, V., California Univ., USA; Strangeway, R. J., California Univ., USA; Russell, C. T., California Univ., USA; Raeder, J., California Univ., USA; Bernhardt, P. A., Naval Research Lab., USA; Bougeret, J.-L., Observatoire de Paris-Meudon, France; Manning, R., Observatoire de Paris-Meudon, France; Wygant, J., Minnesota Univ., USA; Goetz, K., Minnesota Univ., USA; Benson, R., NASA Goddard Space Flight Center, USA; Green, J., NASA Goddard Space Flight Center, USA; Science Closure and Enabling Technologies for Constellation Class Missions; 1998, pp. 29-35; In English
Contract(s)/Grant(s): NAG5-3916; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We describe the basic principles, instrumentation, and feasibility of a multi-satellite mission that combines in situ observations of plasma and electromagnetic fields with radio tomography imaging. We show that a 16-satellite radio tomography experiment can produce two-dimensional images of plasma density in the earth's magnetosphere at sufficient spatial (1/2 R(sub E)) and temporal (approximately 10s) resolution to address key problems of magnetospheric physics. The same mission can incorporate electron and ion analyzers, magnetometers, and electric field instruments on the same spacecraft. We suggest that the large-scale images are more valuable when combined with in situ observations, supporting an unambiguous interpretation of the in situ data and an investigation of the interdependence of small- and large-scale plasma processes.
Author
Constellations; Earth Magnetosphere; Tomography; Mission Planning; Imaging Techniques; Magnetometers

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990026844 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Moisture Analysis of a Type I Cloud-Topped Boundry Layer from Doppler Radar and Rawinsonde Observations
Dreher, John P.; Jan. 20, 1999; 49p; In English
Report No.(s): AD-A360084; AFIT-FY99-48; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Moisture data from radar and rawinsonde observations during three lake effect snow events are analyzed to determine entrainment rates. Gathered during the winter of 1990, the data is a subset from the Lake Ontario Winter Storms (LOWS) Project, which deployed a mesoscale network of sensors. Doppler wind profiler signal-to-noise ratio (SNR) data is used to derive humidity structure function parameter (C(sub q)(exp 2)) time-height series analysis, which is then compared to rawinsonde specific humidity (q) plots. Visual comparison of log(C(sub q)(exp 2)) and q analysis indicated a strongly positive correlation. Radar-derived humidity analysis is used to estimate the depth of the Type I, cloud-topped boundary layer (CTBL), which corresponded well with results from LOWS rawinsonde data. Calculations of the contribution of (C(sub q)(exp 2)) to the refractive index structure parameter (C(sub n)(exp 2)) showed the humidity correction factor (alpha(sub r)(exp 2)) to range from 1.03 to 1.04 within the CTBL, consistent with previous findings for Type II CTBLs. A comparison of entrainment rates, computed via two different methods, were in agreement.
DTIC
Atmospheric Moisture; Doppler Radar; Mesoscale Phenomena; Radar Tracking; Rawinsondes; Cloud Cover

19990027158 Arctic and Antarctic Scientific Research Inst., Saint Petersburg, Russia

Investigation of Air-Sea Interaction in the Arctic on the Basis of Historical Data ***Final Report***

Makshtas, Alexander; Jun. 1998; 32p; In English

Contract(s)/Grant(s): N68171-96-C-9036

Report No.(s): AD-A359479; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Based on both the analysis of the results of the experimental observations carried out at the Russian <North Pole - 4,5,6,28>> drifting stations in 1955 - 1956 and in 1987 and on modem methods for calculating turbulent and radiation heat fluxes, the seasonal variability for parameters of air - sea ice interaction and features of heat conditions in the snow - ice cover are investigated. New results on atmospheric radiation including investigation of the role of low and upper cloudiness in formation of long-wave radiation and new parameterization of downwelling long-wave radiation are obtained. New method for estimating the characteristics of the atmospheric boundary layer together with new archive sounding data are used for estimating the characteristics of the atmospheric boundary layer in the Arctic Basin. Some new data about the temporal - spatial variability of wind drift coefficients are received. The generalization of experience of previous experimental investigations on the drifting ice flows were used in the SHEBA planing.

DTIC

Air Water Interactions; Arctic Regions; Sea Ice; Meteorological Parameters; Annual Variations; Atmospheric Boundary Layer

19990027410 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Model of Rain-Flow Real-Time Counting Method

Yan, Chuliang, Beijing Univ. of Aeronautics and Astronautics, China; Zhuo, Ningsheng, Beijing Univ. of Aeronautics and Astronautics, China; Gao, Zhentong, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 623-624; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

This paper presents a new model of rain-flow real-time counting method. It has the advantages such as counting easily, not needing the whole loading-time course, and it is also not necessary to readjust or modify the loading-time course. The field loading-time course of the model can be counted directly. The model surmounts the limitation of the previous counting model. It doesn't need the second stage counting. The above research results have been applied to the data treatment of loading-spectra for the plane engine, the fighter plane and the war tank.

Author

Counting; Real Time Operation; Models

19990027507 NASA Goddard Space Flight Center, Greenbelt, MD USA

Cloud and Radiation Mission with Active and Passive Sensing from the Space Station

Spinhirne, James D., NASA Goddard Space Flight Center, USA; 1998; 4p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A cloud and aerosol radiative forcing and physical process study involving active laser and radar profiling with a combination of passive radiometric sounders and imagers would use the space station as an observation platform. The objectives are to observe the full three dimensional cloud and aerosol structure and the associated physical parameters leading to a complete measurement of radiation forcing processes. The instruments would include specialized radar and lidar for cloud and aerosol profiling, visible, infrared and microwave imaging radiometers with comprehensive channels for cloud and aerosol observation and specialized sounders. The low altitude,. available power and servicing capability of the space station are significant advantages for the active sensors and multiple passive instruments.

Author

Aerosols; Cloud Physics; Clouds (Meteorology); Laser Applications; Low Altitude; Radiation Measurement; Cloud Cover

19990027597 Woods Hole Oceanographic Inst., MA USA

Dynamics of Forced Coastal Trapped Disturbances ***Final Report, 30 Sep. 1993 - 31 Dec. 1998***

Samelson, Roger M.; Rogerson, Audrey M.; Mar. 04, 1999; 7p; In English; Prepared in cooperation with Oregon State Univ., Corvallis, OR.

Contract(s)/Grant(s): N00014-93-1-1369

Report No.(s): AD-A360702; WHOI-131369-SP; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Numerical and analytical models have been developed and analyzed to study the dynamics of linear and nonlinear coastal-trapped disturbances (CTDs) in the marine atmospheric boundary layer, and the interaction of CTDs with coastal orography and with orographically-modified ambient winds.
DTIC
Orography; Nonlinearity; Air Water Interactions; Coasts; Marine Environments

19990027664 Department of Energy, Office of Energy Research, Washington, DC USA
Variational optimization of sub-grid scale convection parameters ***Final Report***
Zivkovic-Rothman, M., Department of Energy, USA; Nov. 25, 1997; 62p; In English
Report No.(s): DE98-007449; DOE/ER/61926-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Under the DOE CHAMMP/CLIMATE Program, a convective scheme was developed for use in climate models. The purpose of the present study was to develop an adjoint model of its tangent-linear model. the convective scheme was integrated within a single column model which provides radiative-convective equilibrium solutions applicable to climate models. The main goal of this part of the project was to develop an adjoint of the scheme to facilitate the optimization of its convective parameters. For that purpose, adjoint sensitivities were calculated with the adjoint code. Parameter optimization was based on TOGA COARE data which were also used in this study to obtain integrations of the nonlinear and tangent-linear models as well as the integrations of the adjoint model. Some inadequacies of the inner IFA data array were found, and did not permit a single numerical integration during the entire 4 months of data. However, reliable monthly radiative-convective equilibrium solutions and associated adjoint sensitivities were obtained and used to bring about the parameter optimization.
NTIS
Optimization; Climate Models; Tangents

19990027669 NASA Goddard Space Flight Center, Greenbelt, MD USA
On-Orbit Performance of the TRMM Mission Mode
Robertson, Brent, NASA Goddard Space Flight Center, USA; Placanica, Sam, NASA Goddard Space Flight Center, USA; Morgenstern, Wendy, NASA Goddard Space Flight Center, USA; Hashmall, Joseph A., Computer Sciences Corp., USA; Glickman, Jonathan, Computer Sciences Corp., USA; Natanson, Gregory, Computer Sciences Corp., USA; 1999; 9p; In English; 14th; Space Flight Dynamics, 8 Feb. - Dec. 1999, Brazil; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents an overview of the Tropical Rainfall Measuring Mission (TRMM) Attitude Control System along with detailed in-flight performance results of the TRMM Mission mode. The TRMM spacecraft is an Earth-pointed, zero momentum bias satellite launched on November 27, 1997 from Tanegashima Space Center, Japan. TRMM is a joint mission between NASA and the National Space Development Agency of Japan designed to monitor and study tropical rainfall and the associated release of energy. Prior to calibration, the spacecraft attitude showed larger Sun sensor yaw updates than expected. This was traced to not just sensor misalignment but also to a misalignment between the two heads within each Sun sensor. In order to avoid alteration of the flight software, Sun sensor transfer function coefficients were determined to minimize the error due to head misalignment. This paper describes the design, on-orbit checkout, calibration and performance of the TRMM Mission Mode with respect to the mission level requirements.
Author
Attitude Control; Calibrating; Checkout; Flight Control; Yaw; Self Tests; Trmm Satellite; Spacecraft Control; Stationkeeping

19990027916 NASA Marshall Space Flight Center, Huntsville, AL USA
Models of Plumes: Their Flow, Their Geometric Spreading, and Their Mixing with Interplume Flow
Suess, Steven T., NASA Marshall Space Flight Center, USA; Solar Plumes and Coronal Jets; Jun. 01, 1998; 9p; In English
Report No.(s): ESA-SP-421; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

There are two types of plume flow models: (1) 1D models using ad hoc spreading functions, f(r); (2) MagnetoHydroDynamics (MHD) models. 1D models can be multifluid, time dependent, and incorporate very general descriptions of the energetics. They confirm empirical results that plume flow is slow relative to requirements for high speed wind. But, no published 1 D model incorporates the rapid local spreading at the base (fl(r)) which has an important effect on mass flux. The one published MHD model is isothermal, but confirms that if b=8*pi*p/absolute value(B)2<l then the field is nearly potential below -70,000 km. Building on the MHD result, we apply a two scale approximation to calculate fl(r). We also compute the global spreading (fg(r)) out to 5.0 RSUN imposed by coronal hole geometry. Global MHD models provide a potent method of calculating fg(r). Unambiguous plume signatures have not yet been found in the solar wind. This is probably due to strong mixing of plume and interplume flows near

the Sun. We describe a physical source for strong mixing due to the observed flows being unstable to shear instabilities that lead to rapid disruption.
Author
Magnetohydrodynamics; Plumes; Solar Wind; Spreading; Coronal Holes; Kelvin-Helmholtz Instability; Stellar Structure

19990028181 Department of Energy, Office of Energy Research, Washington, DC USA
CART and GSFC Raman lidar measurements of atmospheric aerosol backscattering and extinction profiles for EOS validation and ARM radiation studies
Ferrare, R. A., Department of Energy, USA; Turner, D. D., Department of Energy, USA; Melfi, S. H., Department of Energy, USA; Evans, K. D., Department of Energy, USA; Whiteman, D. N., Department of Energy, USA; Apr. 30, 1998; 6p; In English; 19th; Laser Radar, USA
Report No.(s): DE98-052866; SAND-98-8559C; CONF-980722; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The aerosol retrieval algorithms used by the Moderate-Resolution Imaging Spectroradiometer (MODIS) and Multi-Angle Imaging SpectroRadiometer (MISR) sensors on the Earth Observing Satellite (EOS) AM-1 platform operate by comparing measured radiances with tabulated radiances that have been computed for specific aerosol models. These aerosol models are based almost entirely on surface and/or column averaged measurements and so may not accurately represent the ambient aerosol properties. Therefore, to validate these EOS algorithms and to determine the effects of aerosols on the clear-sky radiative flux, the authors have begun to evaluate the vertical variability of ambient aerosol properties using the aerosol backscattering and extinction profiles measured by the Cloud and Radiation Testbed (CART) and NASA Goddard Space Flight Center (GSFC) Raman Lidars. Using the procedures developed for the GSFC Scanning Raman Lidar (SRL), the authors have developed and have begun to implement algorithms for the CART Raman Lidar to routinely provide profiles of aerosol extinction and backscattering during both nighttime and daytime operations. Aerosol backscattering and extinction profiles are computed for both lidar systems using data acquired during the 1996 and 1997 Water Vapor Intensive Operating Periods (IOPs). by integrating these aerosol extinction profiles, they derive measurements of aerosol optical thickness and compare these with coincident sun photometer measurements. They also use these measurements to measure the aerosol extinction/backscatter ratio S(sub a) (i.e. lidar ratio). Furthermore, they use the simultaneous water vapor measurements acquired by these Raman lidars to investigate the effects of water vapor on aerosol optical properties.
NTIS
Radiometers; Optical Radar; Backscattering; Aerosols; Atmospheric Models; Imaging Techniques; Radar Measurement

19990028248 NASA Langley Research Center, Hampton, VA USA
A Study of the Vertical Structure of Tropical (20 deg S-20 deg N) Optically Thin Clouds from SAGE II Observations
Wang, Pi-Huan, Science and Technology Corp., USA; Minnis, Patrick, NASA Langley Research Center, USA; McCormick, M. Patrick, Hampton Univ., USA; Kent, Geoffrey S., NASA Langley Research Center, USA; Yue, Glenn K., NASA Langley Research Center, USA; Young, David F., NASA Langley Research Center, USA; Skeens, Kristi M., NASA Langley Research Center, USA; Atmospheric Research; 1998; ISSN 0169-8095; Vols. 47, 48, pp. 599-614; In English
Contract(s)/Grant(s): NAS1-96007; NAS1-18941; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The tropical cloud data obtained by the satellite instrument of the Stratospheric Aerosol and Gas Experiment (SAGE) II from October 1984 to May 1991 have been used to study cloud vertical distribution, including thickness and multilayer structure, and to estimate cloud optical depth. The results indicate that the SAGE-II-observed clouds are generally optically thin clouds, corresponding to a range of optical depth between approximately 8 x 10(exp -4) and 3 x 10(exp -1) with a mean of about 0.035. Two-thirds are classified as subvisual cirrus and one-third thin cirrus. Clouds between 2- to 3-km thick occur most frequently. Approximately 30% of the SAGE II cloud measurements are isolated single-layer clouds, while 65% are high clouds contiguous with an underlying opaque cloud that terminates the SAGE II profile. Thin clouds above detached opaque clouds at altitudes greater than 6.5 km occur less often. Only about 3% of the SAGE II single-layer clouds are located above the tropopause, while 58% of the cloud layers never reach the tropopause. More than one-third of the clouds appear at the tropopause. This study also shows that clouds occur more frequently and extend higher above the tropopause over the western Pacific than than over the eastern Pacific, especially during northern winter. The uncertainty of the derived results due to the SAGE II sampling constraints, data processing, and cloud characteristics is discussed.
Author
Clouds (Meteorology); Tropical Regions; Tropopause; Sage Satellite; Optical Thickness; Satellite Instruments; Vertical Distribution

19990028254 Department of Energy, Office of Energy Research, Washington, DC USA
Development of an atmospheric model based on a generalized vertical coordinate ***Final Report, 12 Sep. 1991 - 31 Aug. 1997***
Arakawa, A., Department of Energy, USA; Konor, C. S., Department of Energy, USA; Dec. 31, 1997; 5p; In English
Report No.(s): DE99-000056; DOE/ER/61214-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

There are great conceptual advantages in the use of an isentropic vertical coordinate in atmospheric models. Design of such a model, however, requires to overcome computational problems due to intersection of coordinate surfaces with the earth's surface. Under this project, the authors have completed the development of a model based on a generalized vertical coordinate, (zeta) = F((Theta), p, p(sub s)), in which an isentropic coordinate can be combined with a terrain-following (sigma)-coordinate a smooth transition between the two. One of the key issues in developing such a model is to satisfy the consistency between the predictions of pressure and potential temperature. In the model, the consistency is satisfied by the use of an equation that determines the vertical mass flux. A procedure to properly choose (zeta) = F((Theta), p, p(sub s)) is also developed, which guarantees that (zeta) is a monotonic function of height even when unstable stratification occurs. There are two versions of the model constructed in parallel: one is the middle-latitude (beta)-plane version and the other is the global version. Both of these versions include moisture prediction, relaxed large-scale condensation and relaxed moist-convective adjustment schemes. A well-mixed planetary boundary layer (PBL) is also added.
NTIS
Mathematical Models; Atmospheric Pressure; Planetary Boundary Layer; Atmospheric Models

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OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

19990026888 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Dynamic Aspects of Sea Level in the Equatorial Atlantic Ocean from Altimetry and Tide Gauge Data ***Aspectos Dinamicos do Nivel do mar do Oceano Atlantico Equatorial a Partir de Dados Altimetricos e Maregraficos***
Caltabiano, Antonio Caetano Vaz, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 116p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6967-TDI/655; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Sea-level residuals calculated from the TOPEX/POSEIDON altimetry data are used in the present work to characterize the sea-level variability in time and space and to determine wave pulse propagation in the equatorial region of the South Atlantic. These data were obtained from a deg x l deg regular grid for the period between October/1992 and January/1997 and compared with sea-level residuals generated from pressure tide gauges located in the Fernando de Noronha archipelago (Brazil) and Sao Tome island (Gulf of Guinea). Time series correlation is low for Fernando de Noronha (0.60) because they are too short, however, for the Sio Tome data correlation is significantly improved (0.88). Spectral analysis showed to be consistent with the known seasonal cycle of the region and the interpretation of the time-longitude (Equator, 5 deg S and 5 deg N) and time-latitude (30 deg W and 38 deg W) diagrams. The zonal structures showed a succession of sea-level drops and rises which is a response of the surface ocean water to the climatic forcing within the seasonal cycle variability. These zonal structures are: (1) the equatorial upwelling events in the eastern portion of the basin; and (2) the general trend of propagation of the equatorial waves eastward, their resultant reflection in the African coast and later westward propagation. The meridional structures demonstrated the seasonality of the North Equatorial Countercurrent which is in phase with the North Atlantic subtropical gyre and out of phase with the subtropical South Atlantic gyre.
Author
Sea Level; Dynamic Characteristics; Atlantic Ocean; Computation; Wave Propagation; Upwelling Water; Surface Water

19990027263 Royal Netherlands Meteorological Inst., De Bilt, Netherlands
Climatological Spin-up of the ECBILT Ocean model
Kattenberg, Arie, Royal Netherlands Meteorological Inst., Netherlands; Drijfhout, Sybren S., Royal Netherlands Meteorological Inst., Netherlands; 1997; ISSN 0169-1651; 33p; In English
Report No.(s): KNMI-SR-97-05; ISBN 90-369-2123-6; Copyright; Avail: Issuing Activity (KNMI, PO Box 201, 3730 AE De Bilt, Wilhelminalaan 10, De Bilt, The Netherlands), Hardcopy, Microfiche

In the present WR we evaluate a 4000 year spin-up of the ocean component of the KNMI ECBILT coupled climate model. The simulation was forced by monthly mean observed windstress data and by relaxation towards observed monthly mean climato-

logical SST and SSS data. Goal of the experiment was to assess the performance of the stand alone OGCM in order to have a reference for further experiments in which the OGCM is part of a coupled system. Our conclusions are that the model works properly and as intended: relevant processes such as thermohaline and wind driven circulations are operating and relevant structures such as the main global water masses and thermocline are present, all qualitatively similar to observations. Quantitatively, the climatological state of the model is somewhat less satisfactory, compared to other OGCMs of comparable costs. We hypothesize that most of the deficiencies are related to the flat bottom and simplified equation of state.
Author
Climatology; Ocean Models; Data Acquisition; Climate Models

19990027590 Woods Hole Oceanographic Inst., MA USA
Marine Jurisdictions Database ***Final Report, 1 Jan. - 31 Jan. 1998***
Goldsmith, Roger A.; Jun. 1998; 63p; In English
Contract(s)/Grant(s): N00014-98-1-0276
Report No.(s): AD-A360663; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this project was to take the data gathered for the Maritime Claims chart and create a Maritime Jurisdictions digital database suitable for use with oceanographic mission planning objectives. to accomplish this a themed data set, associated tables, prototype processing software and documentation was developed. While GIS systems readily lend themselves to this task and the eventual application of the resulting data set, this product is generated as ASCII files with positions recorded in decimal degrees. This was done so as to maximize the deployment options. Users should be able to incorporate this data set into their own applications using a variety of hardware and operating systems. In this context it should also be noted this is not a deployable navigation and display application. The operating environments of the potential user community are simply too diverse. For display applications alone there are software packages such as Matlab, gmt, Surfer/MapViewer, ArcView, Atlas GIS, AutoCAD and many others, all driving a variety of CRTs, pen plotters and laser printers. to accommodate this diversity the product was made as a simple, easy to understand database that can be incorporated into a variety of applications.
DTIC
Data Bases; Digital Simulation; Cathode Ray Tubes; Display Devices; Applications Programs (Computers); Deployment

19990027652 Norwegian Defence Research Establishment, Kjeller, Norway
Satellite Oceanography for Naval Applications: Challenges and Opportunities ***Satellittoseanografi for Sjomilitere Anvendelser: Muligheter og Utfordringer***
Olsen, Richard B., Norwegian Defence Research Establishment, Norway; Wahl, Terje, Norwegian Defence Research Establishment, Norway; Aug. 26, 1998; 30p; In Norwegian
Contract(s)/Grant(s): FFIE Proj. 721/170
Report No.(s): FFI/RAPPORT-98/04829; ISBN 82-464-0288-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Satellite oceanography is used operationally in a very limited fashion today. One of the primary limitations is adequate coverage. For Norway, a large step towards remedying this will be taken when ENVISAT is launched in 2000. This will be the first satellite to provide simultaneous observations of sea surface temperature, ocean color and radar backscatter, In combination with other satellites, the observations will enable tracking of oceanographic features over periods of several days. The Norwegian Meteorological Institute (DNMI) and other Norwegian research institutes are well recognized internationally for their work in numerical modelling and satellite image analysis for oceanographic applications. They are therefore well positioned to participate in the implementation of a national satellite oceanography service. A coordinated effort is required to reach this goal. Initial assessments indicate that such a service will provide useful information for defence purposes. Future work at NDRE should focus on further assessment of the utility of such a service to the Norwegian military, continue demonstrations of use of satellite data for defence purposes, and draw on other Norwegian research organisations to further the development of satellite data analysis algorithms for operational marine applications. This work should provide input from a military perspective to the development of a proto-type national operational satellite oceanography service.
Author
Oceanography; Satellite Imagery; Remote Sensing; Marine Technology; Image Analysis

19990027776 National Research Council of Canada, Inst. for environmental research and technology, Ottawa, Ontario Canada
NOAA National Status and Trends Program Eleventh Round Intercomparison Exercise Results for Trace Metals in Marine Sediments and Biological Tissues: National Status and Trends Program for Marine Environmental Quality
Willie, S., National Research Council of Canada, Canada; Dec. 1997; 122p; In English
Report No.(s): PB99--119430; NOAA-TM-NOS-ORCA-120; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A total of thirty-nine participants were included in the exercise, including NOAA, USEPA, state, Australian, Canadian, Mexican and Argentinean laboratories. Two samples were sent by NRC to each participant, and contaminated marine sediment from Esquimalt harbor in British Columbia and a freeze-dried oyster tissue. Laboratories were also asked to analyse two certified reference materials (CRMs) MESS-2 and CRM 2976. The elements to be determined were Al, Cr, Fe, Ni, Cu, Zn, As, Se, Ag, Cd, Sn, Hg and Pb for both matrices, plus Be, Si, Mn, Sb and Tl for the sediments. An accepted mean and confidence interval was calculated for each analyte in the two unknown samples, laboratory biases were identified and an overall rating of superior, good, fair or others were assigned to each laboratory.
NTIS
Trends; Metals; Marine Environments; Tissues (Biology); Environmental Quality; Sediments; Physical Exercise; Freeze Drying

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LIFE SCIENCES (GENERAL)

19990026763 Sternberg Astronomical Inst., Moscow, USSR
How Much Indigenous Material for Construction is Available on the Moon?
Shevchenko, Vladislav V., Sternberg Astronomical Inst., USSR; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 15; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

With the use of a remote sensing technique of assessment of surface material properties, the average content of the fine fraction and a relative content of glasses and glassy particles in the local lunar soil for a number of regions has been calculated. From the data it may be suggested that about 50% of the volume of covering material in a number of regions consists of powder-like particles (effective size of particles is about 9 pm). Sintered fine-fraction bricks and blocks could be used in construction. High-Ca lunar fine-fraction bricks could be used as cementitious material needed for the manufacture of lunar concrete. A remote-sensing maturity parameter can serve as a quantitative index of a relative content of glasses and glassy particles in the covering lunar material. The most mature soil (about 80% of agglutinates) has been discovered on about 57% of the nearside of the Moon. Lunar glass composites could be used successfully as construction materials. Concentration of fine-grained metallic Fe increases steadily with increasing maturity . The concentration amounts to about 0.8 wt% for the most mature soils. This easily-produced metallic Fe could be concentrated by magnetic concentrators and separated by melting for use as a construction material. Adopting a value of the relative H content in a rather mature soil, it is possible to determine the relationship between the dimensions of the lunar surface working site to the H mass to be produced. Combined with the assessment of surface material chemical composition, an average O mining possibility can be determined. When lunar O facilities are established, lunar water could be produced by combining lunar O with lunar H (excluding polar regions where water may be extracted from ice areas).
Author
Chemical Composition; Glass; Lunar Soil; Lunar Surface; Moon; Sintering; Water; Construction Materials

19990026877 Ohio State Univ., Research Foundation, Columbus, OH USA
Re-Evaluation of the Role of Starch in Gravitropic Sensing ***Final Report, 15 Feb. 1995 - 14 Feb. 1997***
Sack, Fred D., Ohio State Univ., USA; 1998; 6p; In English
Contract(s)/Grant(s): NAG5-3774; NAGw-4472; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Plant organs grow toward or away from gravity as a way to orient those organs for optimizing growth. Starch has long been thought to be important in sensing the direction of the g-vector in gravitropism, but that hypothesis has also evoked controversy. We have previously shown that starch-deficient mutants of Arabidopsis (TC7) and Nicotiana (NS458) are impaired in their gravitropism. While this suggests that starch is not necessary for reduced gravitropism, it also indicates that the mass of the starch contributes to sensing when present and thus is necessary for full gravitropic sensitivity. The research supported by this grant focused on three related projects, (1) the effect of light on hypocotyl gravitropism in NS458, (2) the effects of root phototropism on measurements of gravitropic sensitivity, and (3) the effects of starch overproduction on sedimentation and gravitropism. Collectively, our results provide additional strong support for the importance of starch in gravitropic sensing. First, by accounting for negative phototropism in roots of two starchless mutants of Arabidopsis we have established that these mutants are much less sensitive to gravity than previously thought. This work also demonstrates the importance of designing experimental protocols that remove the influence of root phototropism on measuring root gravitropism. Second, light apparently promotes gravitropism in starch-deficient Nicotiana hypocotyls by increasing the trace amounts of starch in the plastids, by inducing limited plastid sedimentation and thus by presumably increasing the signal provided by plastid mass. and finally, we show that excess starch in Arabidopsis seedlings has little effect on gravitropic sensitivity implying that the sensing system is already saturated. However, in light-grown stems

where this mutation results in starch accumulation and where the wild-type practically lacks starch in the sensing cells, the mutant is much more sensitive than the wild-type again showing that the loss of starch depresses gravity sensing.
Author
Gravitropism; Mutations; Phototropism; Plants (Botany); Starches

19990027040 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Enzyme catalysts for a biotechnology-based chemical industry ***Quarterly Report, 1 Apr. - 1 Jul. 1998***
Arnold, F. H., Department of Energy, USA; Jul. 08, 1998; 6p; In English
Report No.(s): DE98-007438; DOE/CH/10578-T3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The goal of this research is to engineer enzymes to be efficient and economically attractive catalysts for the chemical industry. The author is attempting to demonstrate generally-applicable approaches to enzyme improvement as well as develop specific catalysts for potential industrial application. Progress on three tasks are described: Random mutagenesis of pNB esterase-- improved activity and stability; Directed evolution of subtilisin E to enhance thermostability; and Methods for in-vitro recombination.
NTIS
Enzymes; Catalysts; Research; Bioengineering; Chemical Engineering

19990027147 Department of Energy, Office of Energy Research, Washington, DC USA
Biochemistry and genetics of autotrophy in Methanococcus ***Progress Report***
Whitman, W. B., Department of Energy, USA; Dec. 31, 1998; 14p; In English
Report No.(s): DE98-007374; DOE/ER/20158-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In the last two years of this research, the most exciting results have come from the work on the genetics of methanococci. First, the author demonstrated that the cryptic plasmid from Methanococcus maripaludis C5, pURB500, could be transformed into Methanococcus maripaludis JJ. Strain JJ is the type strain of M. maripaludis and has only about 65% DNA:DNA hybridization to strain C5. Because of the low relatedness of these strains, it was not obvious that pURB500 could be transferred between them. This goal was achieved by first transforming strain C5 with a series of suicide plasmids containing the pac cassette, which possessed the selectable puromycin resistance marker, and different cloned fragments of pURB500. From the puromycin-resistant transformants, a plasmid was isolated that transformed strain JJ. However, when this plasmid was electroporated into E. coli, only rearrangement products were obtained that contained small portions of the original pURB500. These plasmids no longer transformed Methanococcus. While these experiments did not yield a shuttle vector, they demonstrated that pURB500 could replicate in strain JJ.
NTIS
Biochemistry; Research; Genetics; Escherichia

19990027148 National Biomedical Research Foundation, Washington, DC USA
Georgetown Institute for Cognitive and Computational Sciences ***Final Report, 30 Sep. 1993 - 30 Sep. 1998***
Ledley, Robert S.; Nov. 1998; 140p; In English
Contract(s)/Grant(s): DAMD17-93-V-3018
Report No.(s): AD-A359604; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
GICCS is a multidisciplinary neuroscience research institute whose mission is to understand higher cognitive function-both under normal and pathological conditions. Its major focus areas are: higher auditory processing and language; brain injury and plasticity; computational neuroscience; and drug discovery. GICCS faculty have continued to elucidate the complex mechanisms of higher auditory processing in experimental animals, from bats to primates. Parallel research in humans, using functional brain imaging and cognitive psychology, examines how the human brain deals with complex sounds, particularly those relating to speech. These studies address not only normal language processing but also examine disorders of speech/language, including developmental and acquired dyslexias. Investigators also use tools from cellular/molecular neurobiology and from systems neuroscience to study plasticity after acute or chronic brain injury, as well as after early vision or hearing loss. This includes development of novel pharmacological strategies to limit brain damage and to enhance cognitive function after injury or neurodegeneration. Brain magnetic resonance techniques (including functional imaging) are also used. Computational methods are employed to model sensory processing based upon experimental studies. Predictions based upon mathematical modeling are evaluated in subsequent laboratory experiments.
DTIC
Cognitive Psychology; Neurology; Multidisciplinary Research; Neurophysiology; Pharmacology; Animals; Injuries

19990027545 Department of Energy, Office of Energy Research, Washington, DC USA

Why do plants have two pathways of polyamine synthesis ***Final Report***

Malmberg, R. L., Department of Energy, USA; May 15, 1998; 7p; In English

Report No.(s): DE98-006361; DOE/ER/20149-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The long term goals of this research into polyamine synthesis in plants are to understand the regulation and function of the two alternative pathways to putrescine synthesis. One pathway uses ornithine decarboxylase (ODC); the other begins with arginine decarboxylase (ADC) and continues through agmatine to putrescine. Polyamines likely contribute to a large number of cellular and developmental processes by virtue of being organic carriers of positive charges. A subset of this problem is to understand the relative functions of he ODC and ADC pathways. The author reports here that there are two ADC genes, so one must now also ask what are the relative functions of the different ADC genes. One theme for both ODC and ADC, across many taxa, is post-transcriptional regulation. The research has been directed at examining this as well. While some polyamine mutants exist, particular in single cell model systems, the pathway had not been genetically analyzed in detail in a multicellular eukaryote. The author believes the lack of such mutants has contributed to the confusion about polyamines in plants. The major goal has been to isolate mutants for regulation and function studies.

NTIS

Plants (Botany); Biosynthesis

19990027547 Department of Energy, Office of Energy Research, Washington, DC USA

Cloning and sequencing of the trpE gene from Arthrobacter globiformis ATCC 8010 and several related subsurface Arthrobacter isolates

Chernova, T., Department of Energy, USA; Viswanathan, V. K., Department of Energy, USA; Austria, N., Department of Energy, USA; Nichols, B. P., Department of Energy, USA; Dec. 31, 1998; 23p; In English

Report No.(s): DE98-006375; DOE/ER/61679-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tryptophan dependent mutants of Arthrobacter globiformis ATCC 8010 were isolated and trp genes were cloned by complementation and marker rescue of the auxotrophic strains. Rescue studies and preliminary sequence analysis reveal that at least the genes trpE, trpC, and trpB are clustered together in this organism. In addition, sequence analysis of the entire trpE gene, which encodes component I of anthranilate synthase, is described. Segments of the trpE gene from 17 subsurface isolates of Arthrobacter sp. were amplified by PCR and sequenced. The partial trpE sequences from the various strains were aligned and subjected to phylogenetic analysis. The data suggest that in addition to single base changes, recombination and genetic exchange play a major role in the evolution of the Arthrobacter genome.

NTIS

Cloning (Biology); Sequencing; Genes

19990027549 Department of Energy, Office of Energy Research, Washington, DC USA

DNA Files

Jun. 09, 1998; 7p; In English

Report No.(s): DE98-006393; DOE/ER/62549-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The DNA Files is a radio documentary which disseminates genetics information over public radio. The documentaries explore subjects which include the following: How genetics affects society. How human life began and how it evolved. Could new prenatal genetic tests hold the key to disease prevention later in life. Would a national genetic data base sacrifice individual privacy. Should genes that may lead to the cure for cancer be privately owned. This report serves as a project update for the second quarter of 1998. It includes the spring/summer 1998 newsletter, the winter 1998 newsletter, the program clock, and the latest flyer.

NTIS

Deoxyribonucleic Acid; Information Dissemination; Radio Communication

19990027550 Department of Energy, Office of Energy Research, Washington, DC USA

Genome Radio Project ***Quarterly Report***

Dec. 31, 1997; 3p; In English

Report No.(s): DE98-006395; DOE/ER/62003-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The DNA Files is now in the production phase. The managing editor, program producers, editors, technical director, research and mixing engineers are in place. All-day meetings were held November 20 through 23 between the producers and core production staff, along with several science advisors, for a combination 'each-in' discussion group and planning/formatting session. Dur-

ing this time, roles were refined and the support system provided for the producers. The meetings were organized to maximize interaction with the experts, so that producers' questions stemming from the reading they had already done could be addressed.
NTIS
Deoxyribonucleic Acid; Radio Communication

19990027551 Department of Energy, Office of Energy Research, Washington, DC USA
Genetic analysis of embryo dormancy ***Final Report***
Galau, G., Department of Energy, USA; Dec. 31, 1998; 7p; In English
Report No.(s): DE98-006404; DOE/ER/20190-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Primary dormancy is the inability of mature seed to immediately germinate until specific environmental stimuli are perceived that predict that future conditions will support plant growth and seed set. The analysis of abscisic acid deficient and insensitive mutants, in particular in Arabidopsis, suggests that embryo abscisic acid may be directly involved in the development of primary dormancy. Other studies implicate the continued accumulation of LEA proteins as inhibiting germination in dormant embryos. The results of these physiological, molecular and genetic approaches are complex and equivocal. There is a real need for approaches that test the separate nature of vivipary inhibition and primary dormancy and deliberately seed to decouple and dissect them. These approaches should be of help in understanding both late embryo development and primary dormancy. The approach taken here is to directly isolate mutants of Arabidopsis that appear to be deficient only in primary dormancy, that is fresh seed that germinate rapidly without the normally- required cold-stratification. The authors have isolated at least 8 independent, rapidly germinating RGM mutants of Arabidopsis. All others aspects of plant growth and development appear normal in these lines, suggesting that the rgm mutants are defective only in the establishment or maintenance of primary dormancy. At least one of these may be tagged with T-DNA. In addition, about 50 RGM isolates have been recovered from EMS-treated seed.
NTIS
Genetics; Embryos; Seeds; Vegetation Growth; Plants (Botany)

19990027552 Department of Energy, Office of Energy Research, Washington, DC USA
High performance computing and communications Grand Challenges program: Computational structural biology ***Final Report, 15 Aug. 1992 - 14 Jan. 1997***
Solomon, J. E., Department of Energy, USA; Oct. 02, 1997; 7p; In English
Report No.(s): DE98-006416; DOE/ER/25134-T3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Grand Challenge project consists of two elements: (1) a hierarchical methodology for 3D protein structure prediction; and (2) development of a parallel computing environment, the Protein Folding Workbench, for carrying out a variety of protein structure prediction/modeling computations. During the first three years of this project the author focused on the use of selected proteins from the Brookhaven Protein Data Base (PDB) of known structures to provide validation of the prediction algorithms and their software implementation, both serial and parallel. Two proteins in particular have been selected to provide the project with direct interaction with experimental molecular biology. A variety of site-specific mutagenesis experiments are performed on these two proteins to explore the many-to-one mapping characteristics of sequence to structure.
NTIS
Molecular Biology; Molecular Structure; Proteins

19990028177 Department of Energy, Office of Energy Research, Washington, DC USA
Partnering for functional genomics research conference: Abstracts of poster presentations
Dec. 31, 1998; 100p; In English
Report No.(s): DE98-054273; ORNL/M-6536; CONF-980479; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This reports contains abstracts of poster presentations presented at the Functional Genomics Research Conference held April 16--17, 1998 in Oak Ridge, Tennessee. Attention is focused on the following areas: mouse mutagenesis and genomics; phenotype screening; gene expression analysis; DNA analysis technology development; bioinformatics; comparative analyses of mouse, human, and yeast sequences; and pilot projects to evaluate methodologies.
NTIS
Genes; Chromosomes; Abstracts; Conferences; Deoxyribonucleic Acid; Gene Expression

52
AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

19990027390 Civil Aeromedical Inst., Oklahoma City, OK USA

Preparation of Carboxyhemoglobin Standards and Calculation of Spectrophotometric Quantitation Constants ***Final Report***

Canfield, Dennis V., Civil Aeromedical Inst., USA; Smith, Moraine D., Civil Aeromedical Inst., USA; Ritter, Roxane M., Civil Aeromedical Inst., USA; Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Aug. 1998; 14p; In English

Contract(s)/Grant(s): AM-B-96-TOX-202

Report No.(s): DOT/FAA/AM-98/21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Toxicology and Accident Research Laboratory of the Federal Aviation Administration is required to analyze specimens from all pilots involved in fatal aircraft accidents for the presence of carbon monoxide poisoning, to determine if carbon monoxide caused pilot incapacitation leading to the accident. Therefore, reliable and stable carbon monoxide controls are needed to assure the accuracy of the analysis of carbon monoxide. A method was developed for the preparation of carboxyhemoglobin standards, which were stable for more then 4 months with the prepared control remaining within acceptable limits during this time. A mathematical equation was developed to more accurately determine the constants A and B used in the equation COHB% = 100[(C-B)/(A-B)], where B 0% COHB peak ratio at 540nm and 579nm; A = 100% COHB peak ratio at 540nm and 579nm; and C the peak ratio at 540nm and 579nm for the blood being analyzed. The following equations were developed to calculate A and B: B = [P(sub avg) - (P) * [(P(sub avg - N(sub avg))/(P - N)]]; A equals B + (P(sub avg) - N(sub avg))/(P - N), P(sub avg) = average peak ratio 540/579 for the positive standard run on the spectrophotometer; P = average decimal concentration measured on the CO-OXIMETER for the positive standard; N(sub avg) = average peak ratio 540/579 for the negative standard; N = average decimal concentration measured on the CO-OXIMETER for the negative standard. The new equations provided results consistent with those obtained from a CO-OXIMETER.

Author

Blood; Carbon Monoxide; Carboxyhemoglobin; Oximetry; Spectrophotometry; Calibrating

19990027428 NASA Langley Research Center, Hampton,VA USA

Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 488

Apr. 05, 1999; 37p; In English

Report No.(s): NASA/SP-1999-7011/SUPPL488; NAS 1.21:7011/SUPPL488; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database. In its subject coverage, Aerospace Medicine and Biology concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.

Derived from text

Aerospace Medicine; Bibliographies; Data Bases; Indexes (Documentation)

19990027731 Georgetown Univ., Washington, DC USA

Akamai Network for Diagnosis, Treatment, and Management to Support Telepresence ***Annual Report, 31 Aug. 1997 - 30 Sep. 1998***

Mun, Seong K.; Oct. 1998; 253p; In English

Contract(s)/Grant(s): DAMD17-94-V-4015

Report No.(s): AD-A360022; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The expansion applications of telemedicine are being effectively employed in numerous disciplines from acute care to care of the chronically ill. Critical technological, security and clinical issues must be addressed according to each application's requirements. A pilot study has been underway to examine the impact of home telemedicine for insulin-dependant diabetic patients. Our initial results are very positive, and we plan to increase the number of patients on-line to approximately 30. Needs assessments for telemedicine is an essential incipient step, and such a methodology has been applied to the telemedicine project or the State

Department and a hospice center. We continue to lead the teleradiology applications for deployed environments. Security, a serious concern in the transfer of any electronic data, is being addressed through technological and organizational approaches. Simulation of medical procedures will have a profound impact in the future, especially if controlled remotely. We have initiated prostate biopsy, spine surgery and palpation simulation capabilities that can be remotely controlled for eventual applications of invasive telemedicine. The following manuscripts provide in depth accounts of our progress in telemedicine in 1998.
DTIC
Teleoperators; Telemedicine; Diagnosis; Medical Equipment

19990027797 San Diego State Univ., San Diego, CA USA
Improving Navy Women's Health: Preventing Smoking Relapse After Recruit Training ***Annual Report, 18 Sep. 1997 - 17 Jun. 1998***
Conway, Terry L.; Jul. 1998; 60p; In English
Contract(s)/Grant(s): DAMD17-95-1-5075
Report No.(s): AD-A359632; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Smoking is a modifiable behavior that is negatively related to women's health and physical readiness, and increases the burden on military health care systems. This behavior is of particular concern to the DoD because military women are more likely to smoke than their civilian counterparts and because women have greater difficulty quitting than do men. The present 21/2 year study, funded by the Defense Women's Health Research Program (DWHRP), is testing innovative approaches to reduce smoking among Navy women by evaluating two different relapse-prevention interventions that support maintenance of the "quit status" organizationally mandated during basic training. Women smokers (n = 3,036) were assigned to either a control group or one of two intervention groups at entry into basic training. One intervention group was encouraged to access a telephone helpline for counseling to remain a nonsmoker; the other group received a series of monthly mailings. Analyses of assessments at 3, 6, and 12 months post-graduation are being completed to evaluate the effectiveness of the interventions in maintaining the "cold turkey" smoking cessation induced during recruit training.
DTIC
Navy; Females; Health; Smoke; Prevention

19990028170 Wyle Labs., Inc., San Antonio, TX USA
Research and Development of Advanced Life Support Equipment ***Final Report, 11 Nov. 1992 - 7 Nov. 1997***
Webb, James T.; Feb. 1999; 156p; In English
Contract(s)/Grant(s): F33615-92-C-0018; AF Proj. 7184
Report No.(s): AD-A360455; AFRL-HE-BR-TR-1998-0114; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The purpose of this effort was to provide research and research support to on-going RDT&E efforts in the following areas: The effect of physical conditioning on acceleration tolerance/endurance; Female G tolerance/endurance; Effect of varied periods of acceleration layoff on acceleration tolerance/endurance; Effect of crewmember posture and position on acceleration tolerance/endurance; Use of animal models for human acceleration tolerance/endurance; Life support equipment development laboratory; Testing of life support equipment, subatmospheric research; Molecular sieve technology; Spatial disorientation (SD) countermeasures research; Sustained operations research; Biomedical laboratory operation and support; and Task order requirements. This final report provides summaries and accomplishments including citations and abstracts for the publications documenting the results of the specific efforts.
DTIC
Acceleration Tolerance; Life Support Systems; Human Tolerances; Physiological Factors; Operations Research

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

19990027083 Institute for Human Factors TNO, Soesterberg, Netherlands
Effects of Three-Dimensional and Mono Auditory Information on Flight Performance ***Final Report Het effect van drie-dimensional en mono geluidsinformatie op de vliegprestatie***
Veltman, J. A., Institute for Human Factors TNO, Netherlands; Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Oving, A. B., Institute for Human Factors TNO, Netherlands; Sep. 17, 1998; 20p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KLu/308; TNO Proj. 788.1

Report No.(s): TD98-0262; TM-98-A052; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy, Microfiche

It is possible to present auditory information in ear phones in such a manner that the spatial position of the sound source appears to remain fixed in external space, irrespective of how the listener moves his or her head. In the present experiment it was investigated whether such a virtual spatial sound presentation in a cockpit has advantages over the traditional mono sound presentation. The experiment concerned auditory presentation of directional information, related to anti collision radar (TCAS) or to mechanical failures in either one of the two engines or wings. This information was presented in addition to the standard displays on which these warnings appeared. Subjects (student pilots) had to react to the warnings while flying a civil aeroplane in a flight simulator with a wide field outside image. The experiment was carried out in two flight conditions, differing with respect to visual load. The results showed that 3D warnings, added to already present visual warning messages, yielded faster reaction times in the more visually loaded flying conditions. The effects were not as obvious in error rates, in flying performance, or in measures of subjective task load. A follow up experiment is proposed in which the flying task is made more demanding and in which the visual display on which the mechanical failure warnings are presented is placed in a more peripheral position (as is the case in actual cockpits). It is expected that in such conditions advantages of 3D audio information presentation will become more pronounced.

Author

Display Devices; Three Dimensional Models; Flight Characteristics; Failure; Ear

19990027096 Institute for Human Factors TNO, Research Inst., Soesterberg, Netherlands

Effect of Three-Dimensional and Mono Auditory Information on Performance in Cockpit Warning Tasks ***Interim Report Effecten van Drie-Dimensionaal en Mono Geluidsinformatie op de Prestatie ten Aanzien van Waarschuwingen in de Cockpit***

Oving, A. B., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Sep. 21, 1998; 27p; In English; Original contains color illustrations

Contract(s)/Grant(s): A97/KLu/307; TNO Proj. 788.1

Report No.(s): TD98-0264; TM-98-A054; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

The potential benefits of a three-dimensional (3D) auditory display in conveying directional information were investigated in a flight simulation experiment. The study was aimed at the application of 3D audio in the cockpit of civil aircraft. Participants were required to follow a specific flight path in a runway approach. Standard cockpit information was available on a set of visual displays, i.e., primary flight information, flight path and tracking information, traffic alert and collision avoidance information (TCAS) and on-board systems status information. In the experiment, additional auditory directional information was presented for TCAS-warnings or for warnings of system failures in the aircraft. In case of a TCAS-warning, participants were required to identify the specific orientation of the target aircraft with respect to the outside world. In case of a failure warning, participants had to indicate the location of the failure in the aircraft itself. Warnings were always presented both aurally and visually. There were four conditions for the presentation of directional information in the aural warnings: mono-sound with or without verbal directional statements and 3D-sound with or without verbal directional statements. The verbal directional statements in the TCAS-warning referred to a specific quadrant of the outside world in the TCAS task (e.g., lower quadrant left) and to the specific side of the aircraft for system failures (e.g., left-hand or right-hand side). The 3D auditory display used a head-track ng device to make the external position of the source invariant under head movements. In all conditions, directional information for the warnings was presented on a visual display as well. Results showed that for the TCAS task and the failure task, addition of directional information (i.e., 3D-sound or verbal directional information) resulted in significantly reduced response times. The response times were shortest when both types of directional information were combined in the TCAS-warning. For the system failure task, only the differences between the response times in the mono-without condition and the three other conditions proved to be significant.

Author

Cockpits; Three Dimensional Models; Performance Prediction; Display Devices; Research; System Failures; Failure; Warning Systems

19990027832 Naval Aerospace Medical Research Lab., Pensacola, FL USA

Probability of Success in Primary Flight Training as a Function of ASTB Scores and API Grades: An Example of the Statistical Inferencing Component of the Pilot Prediction System

Blower, David J.; Nov. 30, 1998; 19p; In English

Report No.(s): AD-A360571; NAMRL-1404; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Pilot Prediction System (PPS) is a research effort designed to provide Navy managers and other decision makers with improved access to selection and training data. Many disparate data bases, each containing partial and sometimes overlapping

information on selection data and training performance, currently exist. There has been no attempt to coordinate the bits and pieces gathered into these local databases into a coherent whole. Such data needs to be merged and the anomalies excised so that a more global picture of selection data and training performance can emerge. In addition, the targeted users of the PPS should be shielded from the low-level technicalities of the data base because such technical details are of no concern to them. For the same reason, the statistical manipulations that provide extrapolations from the data base to new cases can be hidden from view. This report documents the first efforts at constructing the statistical modeling component of the PPS as derived from Bayesian statistical decision theory. It enables the potential user of the PPS to predict success in primary flight training for flight students based on their scores on selection tests and ground school performance.
DTIC
Data Bases; Flight Training; Data Acquisition; Scoring; Management; Probability Theory; Statistical Decision Theory; Armed Forces

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

19990026743 Los Alamos National Lab., NM USA
Construction of Planetary Habitation Tunnels Using a Rock-Melt-Kerfing Tunnel-Boring Machine Powered by a Bimodal Heat Pipe Reactor
Blacic, James D., Los Alamos National Lab., USA; Houts, Mike G., Los Alamos National Lab., USA; Blacic, T. M., California Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 2-3; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Significant manned exploration and support activities over extended periods on planetary surfaces such as the Moon or Mars will require space radiation shielding of habitats and laboratories. As habitat volumes grow, it will soon become cost effective in structural mass import and extravehicular activity (EVA) time to construct habitable volumes directly underground in the form of gas-tight tunnels incorporating many meters of overburden shielding. We have previously proposed that an effective concept for constructing such tunnels is a tunnel-boring machine (TBM) design that combines conventional rotary (auger) cutters with rock-melting kerf heaters, the latter to control the tunnel gauge dimension in poorly consolidated rock and provide support for the opening. Advantages of this approach are (1) no fluids are needed to transport cuttings and (2) tunnel support in the form of a strong, impermeable glass lining is automatically formed as the TBM advances. The kerf heaters melt poorly cemented regolith rock on the tunnel boundary and consolidate the glass into a formed-in-place lining that, once cooled, is very strong and orders of magnitude less permeable; residual cooling cracks in the glass are sealed with indigenous metals using an integrated plasma spray gun. The resulting tunnel is sufficiently strong and gas-tight to allow normal pressurization for habitation, and is constructed entirely of in situ materials. A key technology needed to make the TBM design practical for space use is a robust, low-mass power supply. Recent design of a heat pipe-cooled, bimodal (thermal and electric power) fission-reactor power system (HPS) is well matched to this application. The core of the HPS is cooled by passive Li metal heat pipes that can deliver 100-1000 kW thermal power at 1800 K to the kerf-melting bodies of the TBM (recently, a Mo/Li heat pipe HPS module was fabricated and performed well in electrically heated tests to 1400 K with multiple restarts). Using one of a number of possible conversion methods, a portion of the reactor heat can also be used to generate several tens kW of electrical power for the rotary cutters and muck conveyors. Residual waste heat after electrical conversion is disposed of in the cuttings that are conveyed out of the tunnel. We project that a mostly automated, melt-kerfing TBM with this power system can produce sealed habitation tunnels, 3-5 m in diameter, in planetary regolith materials at a rate of about 8 m length per day. A 3-m diameter habitat would require a reactor generating power of about 500 kWt and 25 kWe. Additional features of the HPS are that it can be asymmetrically cooled to provide a TBM steering mechanism by asymmetric kerf heating, and it can be completely proof-tested using only resistance heaters.
Author
Boring Machines; Planetary Composition; Radiation Shielding; Mars (Planet); Mars Bases; Tunneling (Excavation); Underground Structures; Melting

19990026744 Guppy Research, Inc., Provo, UT USA

Obtaining and Utilizing Extraterrestrial Water

Buehler, David, Guppy Research, Inc., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 3-4; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

As an in situ resource, water has no rival in terms of sheer usefulness for space operations. It can be used for life support, propulsion, radiation shielding, and structure. This paper describes a low-cost system for transporting water back from water-bearing bodies such as extinct short-period comets, carbonaceous asteroids, or possibly the moons of Mars. It is likely that water will be of most benefit initially as a propellant feedstock in low Earth orbit. Several ways to use the water are discussed, including a space-based stage to assist in putting mass into orbit and a propellant ladder for lifting mass higher in the Sun's gravity well. A composite material of ice and fiberglass is discussed as a possible load-bearing structural material. A preliminary analysis of the economics of the water extraction/transportation system suggests it may be economically viable in the near-term. An initial system would require about 70 T of equipment and propellant be lifted into low Earth orbit.

Author

Ice; Life Support Systems; Propellants; Transportation; Water; Extraterrestrial Resources; Construction Materials; Spacecraft Propulsion

19990026748 Colorado State Univ., Dept. of Civil Engineering, Fort Collins, CO USA

Habitat Construction Requirements

Criswell, Marvin E., Colorado State Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 5-6; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Human-occupied habitats on either the Moon or Mars will need to make the maximum practical use of in situ resources for reasons of overall mission economy and because of transportation limitations. How the in situ resources can best be used, and to what extent they may be used, will depend on several factors, including the basic structural demands of the habitat, the maturity of the habitat and associated mission, manufacturing and construction support needed to use the material, and the degree the habitat use of such material fits with base capabilities to process such in situ material for other base and mission requirements. Habitats on either the Moon or Mars must contain, with minimum leakage and a high level of reliability, a life-supporting artificial atmosphere that allows its human occupants, along with plants and other living components of its life support and food system, to survive and thrive. In the reduced gravity environment of either site, the internal pressure of the needed atmospheric gases will dominate the structural loading of the operational habitat, even if a several meters-thick layer of mass shielding is placed atop the habitat. However, the habitat must be designed with the deployment/construction operation in mind, including the placement of mass shielding, the outfitting of the habitat, and possible planned or accidental depressurization of part or all of the habitat interior. This overview paper has the objectives of : (1) giving abroad view of the overall requirements and challenges of utilizing in situ materials in human-occupied habitats and supporting base facilities, and (2) to survey several types of uses that the author considers most practical. Planning for future habitats must include the maximum practical use of in situ materials. What uses are feasible and economical will depend upon base maturity, enabling technologies available for material processing, the resource investment needed to process in situ materials into the desired final product (imported mass of equipment, energy needs, human resources), and base mission, including any in situ products. The planning of in situ material use must consider both the development of specific applications and the overall base/habitat human, energy, and technological needs and resources.

Author

Construction; Space Habitats; Life Support Systems; Mission Planning; Lunar Bases; Mars Bases; Mars (Planet); Space Transportation

19990026751 Bechtel Corp., San Francisco, CA USA

Materials Transportation

Franklin, H. Andy, Bechtel Corp., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 7; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The movement of materials on planetary surfaces is seen to be a challenge for all stages of developing a permanent facility. The unloading of cargo spacecraft, the deployment of cargo and materials to construction sites, and the movement of large amounts of material needed for some scenarios where in situ resources are to be recovered are all situations requiring equipment development. Adaptations of many terrestrial technologies can be expected as designers meet these challenges. Large vehicles, tracked or wheeled, tractor trains, and maglev rail systems might form the basis of a mobile vehicular approach. Pipelines, cableways,

and conveyor systems are likely to be adapted for large-scale, continuous materials delivery roles. Difficulty of large-scale transportation may force a ”mobile factory” approach wherein the processing facility moves over the source fields, lifting, processing, and then depositing wastes behind its track. On the other hand, large power requirements may dictate a stationary facility and hence force delivery of material resources for long distances over rugged terrain. Even in the case of large vehicles, power is likely to be provided by onboard fuel cells or batteries. The weight of these systems will decrease the effective payload of the vehicle. This will influence the results of trade-off studies where integrated systems designs are compared. In some situations a small processing facility may be served by a series of robotic bulldozers that continuously scrape the resource material toward the fixed plant. Again, power demands and the condition of the resource material will drive the design of the transportation system. Providing simple, rugged, and reliable materials transportation systems will be the goal of designers.
Author
Construction; Industrial Plants; Payloads; Planetary Surfaces; Robotics; Tradeoffs; Transportation

19990026752 NASA Johnson Space Center, Houston, TX USA
Requirements for Planetary Outpost Life-Support Systems and the Possible Use of In Situ Resources
Gruener, John E., Hernandez Engineering, Inc., USA; Ming, D. W., NASA Johnson Space Center, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 7-8; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

If humans are ever to live and work on the Moon or Mars for extended periods of time, the operation of regenerative life-support systems at the planetary outposts will be a critical requirement. The substantial amount of materials consumed by humans and the inevitable waste products make open-loop life-support systems and resupply missions (as used in Space Shuttle and Mir operations) impractical and expensive. Natural resources found on the Moon and Mars could be used in conjunction with regenerative life support systems to further reduce the amount of material that would need to be delivered from Earth. There have been numerous studies and experiments conducted on the production of O from regolith materials on the Moon and from the atmosphere of Mars. One or several of these processes could undoubtedly be used to produce the O required by the crews at planetary outposts. Water is required in the greatest quantities, primarily for tasks such as personal hygiene and clothes washing, and it will be the most precious consumable. Again, several process have been described to produce water on the Moon using solar-wind implanted H and O, and if water ice can be found and mined at the lunar poles, another source of water may be available.
Author
Life Support Systems; Mars Atmosphere; Mars Surface; Moon; Water; Oxygen; Lunar Bases; Lunar Composition; Food Production (In Space); Thermal Protection; Radiation Protection

19990026764 University of Southern California, Dept. of Aerospace Engineering, Los Angeles, CA USA
In Situ Generation of a ”To Scale” Extraterrestrial Habitat Shell and Related Physical Infrastructure Utilizing Minimally Processed Local Resources
Thangavelu, M., University of Southern California, USA; Khalili, N., California Inst. for Earth Art and Architecture, USA; Girardey, C., Visioneering, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 15-16; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Advanced crewed lunar and Mars bases will require structurally safe and environmentally self-sustained habitats that are well protected against the vacuum or very low atmospheric pressures, very large diurnal temperature variations, harmful solar and galactic radiation, micrometeorites, and severe dust storms (on Mars). They also need to be habitable and made as safe and comfortable as possible for the crew. The architecture of such a remote base habitat entails the harmonious integration and operation of two essential and major systems: the physical structure of the enclosure and the environmental control and life-support system that will make the dwelling habitable. In Situ Resource Utilization based Stabilized Soil Technology (SST) structures that are being built here at the edge of the Mojave High Desert in Hesperia, California, promise to offer a versatile solution to these habitats and related physical infrastructure, providing highly innovative and promising solutions to critical aspects of protection, safety, and habitability issues that are paramount to the optimal long life-cycle operation of these advanced bases. From a variety of experimental structures already built, tested, and certified in Hesperia, it seems that it is quite possible to build the physical structure of the primary habitat structure itself out of local soil using special techniques that are being researched, tested, and evolved. SST habitats capable of providing thermal, micrometeoritic, and radiation protection for crew and supporting life systems with acceptable atmospheric leakage rates can be built in situ and evolved in accordance with needs as the base evolves.
Author
Environmental Control; Habitability; Life Support Systems; Lunar Bases; Mars Bases; Radiation Protection; Shelters; Lunar Shelters; Environmental Engineering

19990026767 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Ice as a Construction Material

Zuppero, Anthony, Idaho National Engineering Lab., USA; Lewis, J., Jet Propulsion Lab., California Inst. of Tech., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 18-19; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

This presentation shows how water and ice can enable exceptionally simple ways to construct structures in deep space. Practicality is underscored by applying advanced tank methods being developed for Mars missions. Water or ice is now known to be present or abundant on most objects in the solar system, starting with the planet Mercury. Thermal processes alone can be used to melt ice . The cold of space can refreeze water back into ice. The anomalous low vapor pressure of water, about 7 mm Hg, permits bladder containers. Tanks or bladders made with modern polymer fiber and film can exhibit very small (less than 0.1 %) equivalent tankage and ullage fractions and thus hold thousands of tons of water per ton bladder. Injecting water into a bladder whose shape when inflated is the desired final shape, such as a space vehicle, provides a convenient way to construct large structures. In space, structures of 1O,OOO-T mass become feasible because the bladder mass is low enough to be launched. The bladder can weigh 1OOO times less than its contents, or 10 T. The bladder would be packed like a parachute. Shaped memory materials and/or gas inflation could reestablish the desired structure shape after unpacking. The water comes from space resources. An example examines construction of torus space vehicle with 100-m nominal dimension. People would live inside the torus. A torus, like a tire on an automobile, would spin and provide synthetic gravity at its inner surface. A torus of order 100 m across would provide a gravity with gradients low enough to mitigate against vertigo.

Author

Construction; Extraterrestrial Resources; Ice; Large Space Structures; Spacecraft Structures; Tanks (Containers); Water Resources

19990027068 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA

Testing and Evaluation of the Stoeckert Shiley Multiflow Roller Pump Module, 10H Series, Model 10-10-00 ***Final Report***

Jones, Allen E.; Dec. 15, 1998; 18p; In English

Contract(s)/Grant(s): Proj-R184

Report No.(s): AD-A359614; AFRL-HE-BR-TR-1998-0080; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Stockert-Shiley, Multiflow Roller Pump is a precision peristaltic pump. It is an integral component of the Neonatal/Pediatric ECMO Transport System. The roller pump is plugged into a series bladder box, then into a modified Tripplite Isobar, then into a Topaz uninterruptible power supply (UPS), then into 115 VAC/60 Hz aircraft power. The roller pump accommodates a wide range of flow rates using different tubing diameters together with the different size tubing inserts available for the monitor. The roller pump is capable of displaying both revolutions per minute (RPM) and flow rates in liters per minute (LPM). Only LPM's should be displayed during an aeromedical evacuation ECMO Transport. The roller pump is 46.6 cm (18.3 inches) D X 18 cm (7.1 inches) W X 28.7 cm (11.3 inches) H, and weighs 25.1 Kg (55 lbs).

DTIC

Pumps; Medical Equipment; Evacuating (Transportation); Air Transportation

19990027069 Army Aeromedical Research Lab., Fort Rucker, AL USA

Helmet-Mounted Displays and Facial Injury in U.S. Army AH-64A Apache Accidents ***Final Report***

Crowley, John S.; Jan. 1999; 7p; In English

Contract(s)/Grant(s): Proj-3O162787A878

Report No.(s): AD-A359606; USAARL-99-03; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

There is concern that the helmet display unit (HDU) used by AH-64 Apache helicopter pilots might contribute to facial injury in a crash. The U.S. Army accident database was searched for HDU-related injuries in survivable Apache accidents 1985-1995. Four aviators in three crashes sustained HDU-related injury. These involved three periorbital contusions and two minor eye injuries. There were no sequalae. This equates to an incidence of 0.57 injured individuals per 100,000 flying hours or 8.0 injured aviators per 100 survivable Class A-C accidents in which the HDU was worn. Applying these data to the projected UK Army Apache flying hour programme suggests that one HDU-related injury might be encountered approximately every 10.1 years. This estimate should be interpreted with caution. Serious injury remains a possibility due to the proximity of the HDU to the eye and face.

DTIC

Helmet Mounted Displays; Accidents; Aircraft Pilots; AH-64 Helicopter; Crashes

19990027084 Institute for Human Factors TNO, Soesterberg, Netherlands

Vibrotactile Perception: A Literature Review ***Final Report***

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; Vogels, I. M. L. C., Institute for Human Factors TNO, Netherlands; Jul. 22, 1998; 40p; In English

Contract(s)/Grant(s): B97-031; TNO Proj. 788.1

Report No.(s): TD9-0252; TM-98-B011; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy, Microfiche

Operating a remotely piloted vehicle, flying a jet fighter, and other steering and control tasks are more and more supported by intelligent aids and displays. Traditionally, these displays involve the visual and auditory sense of the operator. Until recently, little attention is given to the possibilities of using tactile displays as aids in steering and control tasks, although displays for the tactile modality are successfully applied in, for example, reading aids for the visually handicapped. However, when visual and auditory information are degraded, or when systems become more complex, the surplus value of using the tactile modality may be present in orientation, and steering and control tasks as well. to be able to successfully design tactile displays for these applications, fundamental physiological and psychophysical knowledge of tactile perception is indispensable. Therefore, the present report presents a literature review on (vibro-) tactile perception, with emphasis on psychophysical parameters and phenomena such as detection and difference thresholds, summation and adaptation. This report is primarily meant to give an overview of relevant parameters and to serve as concise reference report. The report shows that, although different experimental methods and procedures may lead to different findings, the available data can be useful to formulate design considerations and identify possible problems. The transformation from fundamental knowledge into parameter choice and values (e.g. body locus, spatial resolution, and frequency) and other design considerations for tactile displays, will be described in another report (Van Erp & Van den Dobbelsteen, 1998).

Author

Information; Remotely Piloted Vehicles; Visual Perception; Display Devices

19990027094 Kopin Corp., Taunton, MA USA

Development of Advanced Technology for 2000 LPI Head-Mounted Displays ***Final Report, Jun. 1994 - Nov. 1997***

Woodard, Ollie C.; Jan. 1999; 52p; In English

Contract(s)/Grant(s): MDA972-94-C-0023

Report No.(s): AD-A359938; NATICK-TR-99/014; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Operational 2560 x 2048 active matrix liquid crystal displays (AMLCD) and operational 1280 x 1024 active matrix electroluminescent displays (AMEL) were demonstrated. Manufacturing technologies were developed for high resolution active matrix displays made in both electroluminescent and liquid crystal formats, extending the state-of-the-art from 1280 x 1024 pixel (1000 lines/in) to 2560 x 2048 pixel (2000 lines/in) displays. The 2560 x 2048 displays have 12 microns pixel pitch and a 1.5 in. screen diagonal. On-board circuits, which include video decode, row and column scanners and the pixel TFT's, contain over 5,000,000 transistors-the equivalent of a large scale integrated circuit. The program provided breakthrough display technologies, which are now used in both AMEL and AMLCD display manufacturing processes. 2000 LPI displays for Head-Mounted Display applications are in development.

DTIC

Liquid Crystals; Helmet Mounted Displays; Flat Panel Displays; Manufacturing

19990027095 Institute for Human Factors TNO, Technische Menskunde, Soesterberg, Netherlands

Evaluation of the Clothing and Equipment of the Royal Netherlands Air Force ***Final Report Evaluatie PSU Koninklijke Luchtmacht***

Kistemaker, J. A., Institute for Human Factors TNO, Netherlands; Krul, A. J., Institute for Human Factors TNO, Netherlands; Heus, R., Institute for Human Factors TNO, Netherlands; Nov. 19, 1998; 65p; In Dutch

Contract(s)/Grant(s): A97/KLu/322; TNO Proj. 789.2

Report No.(s): TD98-0273; TM-98-A061; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

The Royal Netherlands Air Force and the TNO Human Factors Research Institute developed three questionnaires to evaluate the clothing and equipment of the Royal Netherlands Air Force and to make an inventory of new clothing needs. A representative part of the wearers filled in a questionnaire on location under the supervision of the Royal Netherlands Air Force. The questionnaires were obtained from December '97 until March '98. One questionnaire dealt with the Personal Clothing & Equipment 'blauw", one questionnaire dealt with the Personal Clothing & Equipment 'woodland' and one questionnaire dealt with the functional clothing. The persons were asked to choose the questionnaire that dealt most with the clothing they usually wear. The sub-

jects had to rate usability, size and fit, functionality, quality and comfort of the clothing. The major results are: (1) the wearers showed a general positive opinion about their clothing and equipment; (2) there are several wishes that mainly refer to poor fit for women and poor comfort in the summer; (3) 7 articles show poor results and can be considered for discarding or complete redesign (f.i. underwear, hats); (4) 14 articles show poor results, but can be improved (f.i. important articles from the DT 'blauw" and the "woodland" clothing); and(5) 3 articles are reasonably good and 10 articles are good.
Author
Clothing; Evaluation; Armed Forces (Foreign); Aircraft Equipment

19990027266 Civil Aeromedical Inst., Oklahoma City, OK USA
Performance of a Portable Oxygen Breathing System at 25,000 Feet Altitude ***Final Report***
Garner, Robert P., Civil Aeromedical Inst., USA; Murphy Richard E., Civil Aeromedical Inst., USA; Hudgins, Chad B., Civil Aeromedical Inst., USA; Mandella, Joseph G., Jr., Civil Aeromedical Inst., USA; November 1998; 12p; In English
Report No.(s): DOT/FAA/AM-98/27; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A portable oxygen system utilizing open port dilution rebreathing mask technology was tested for its ability to deliver an adequate supply of oxygen at an altitude of 25,000 feet above sea level. Twenty-two subjects, 11 females and 11 males, participated in the study. Blood oxygen saturation (SaO2) baseline levels for hypoxic exposure were established for each subject. Altitude testing consisted of the subject being placed in a hypobaric chamber and it being decompressed to an altitude of 25,000 feet. Immediately after the start of the decompression, the subject was instructed to don the oxygen mask and start the flow of oxygen from the portable cylinder. Oxygen flow to the mask was continuous at 4 liters per minute. Once at altitude, the subjects pedaled a cycle ergometer at a resistance of 15 watts for five minutes. SaO2 and other physiological variables were monitored throughout the altitude exposure. SaO2 levels were maintained at ground level values for all subjects throughout the altitude exposures. At no point during the testing did oxygenation levels approach baseline levels for hypoxic exposure. The portable oxygen system tested provided protection from hypobaric hypoxia at an altitude of 25,000 feet.
Author
Breathing Apparatus; Rebreathing; Ergometers; Hypobaric Atmospheres; Oxygen Masks

19990027303 NASA Ames Research Center, Moffett Field, CA USA
Development of the Monolith Froth Reactor for Catalytic Wet Oxidation of CELSS Model Wastes ***Final Report***
Fisher, John W., NASA Ames Research Center, USA; Abraham, Martin, Toledo Univ., USA; 1993; 12p; In English
Contract(s)/Grant(s): NCC2-5151; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The aqueous phase oxidation of acetic acid, used as a model compound for the treatment of CELSS (Controlled Ecological Life Support System) waste, was carried out in the monolith froth reactor which utilizes two-phase flow in the monolith channels. The catalytic oxidation of acetic acid was carried out over a Pt/Al2O3 catalyst at temperatures and pressures below the critical point of water. The effect of externally controllable parameters (temperature, liquid flow rate, distributor plate orifice size, pitch, and catalyst distance from the distributor plate) on the rate of acetic acid oxidation was investigated. Results indicate reaction rate increased with increasing temperature and exhibited a maximum with respect to liquid flow rate. The apparent activation energy calculated from reaction rate data was 99.7 kJ/mol. This value is similar to values reported for the oxidation of acetic acid in other systems and is comparable to intrinsic values calculated for oxidation reactions. The kinetic data were modeled using simple power law kinetics. The effect of "froth" feed system characteristics was also investigated. Results indicate that the reaction rate exhibits a maximum with respect to distributor plate orifice size, pitch, and catalyst distance from the distributor plate. Fundamental results obtained were used to extrapolate where the complete removal of acetic acid would be obtained and for the design and operation of a full scale CELSS treatment system.
Author
Acetic Acid; Catalysts; Closed Ecological Systems; Life Support Systems; Oxidation; Waste Treatment

19990027735 Illinois Univ., Aviation Research Lab., Savoy, IL USA
Allocation of Attention with Head-Up Displays ***Final Report***
Wickens, C. D., Illinois Univ., USA; Ververs, P. M., Illinois Univ., USA; Nov. 1998; 22p; In English
Contract(s)/Grant(s): DTFA-95-G-049
Report No.(s): DOT/FAA/AM-98/28; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two experiments examined the effects of display location (head up vs. head down) and image intensity/clutter on flight path performance and mid-air target detection in a general aviation cruise flight environment. In Experiment 1, a low-Fidelity simulation, both near-domain and far-domain instrumentation were presented at the same optical distance. Detection of commanded flight changes and maintenance of desired flight path flight were generally better in the head-down condition, an advantage attrib-

uted to the superior image contrast ratios in that condition. In contrast, target detection was superior with the head-up display, reflecting an attentional tradeoff, Experiment 2 was performed with pilots viewing far-domain imagery (and airborne targets) on an Evans and Sutherland display positioned near optical infinity, head-up display (HUD) imagery at the same optical distance, and head-down imagery at a near distance typical of the instrument panel. The degree of clutter was also varied and image contrast ratios were equated between head-up and head-down viewing conditions. Flight performance was equivalent between the HUD and head-down locations. However, detection of both near-domain events (commanded changes) and far-domain targets was better in the HUD condition, revealing the HUD benefit of reduced scanning. Adding extra information (clutter) to the HUD inhibited detection of both events in both head-up and head-down locations. However, this clutter cost was diminished for far-domain target detection if the added information was ”low-lighted.” Flight performance was superior in clear weather, when the true horizon was available for viewing. The data provided little evidence that attention was modulated in depth (near vs. far domains), but rather suggested that attention was modulated between tasks (flight control and detection).
Author
Attention; Head-Up Displays; Target Acquisition; Flight Instruments; Human Factors Engineering; Pilot Performance

19990027759 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
A Trial of the Suitability and Practicality of a Proposed Meal Based Ration Scale
Walker, Gaylene J., Defence Science and Technology Organisation, Australia; Forbes-Ewan, Chris, Defence Science and Technology Organisation, Australia; Carins, Julia E., Defence Science and Technology Organisation, Australia; Driver, G. E., Defence Science and Technology Organisation, Australia; Sep. 1998; 56p; In English; Sponsored in part by DGFD(L)
Report No.(s): DSTO-TR-0723; DODA-AR-010-636; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report describes a trial of a proposed new means of determining food entitlements for soldiers in barracks. The aim of the trial was to determine the suitability and practicality of meal based rationing, together with a new means of determining entitlements to food. This system of feeding is known as Attendance - Based Rationing. The proposed system has been implemented by Army as a means of increasing the efficiency of Army catering.
Author
Rations; Suitability; Provisioning

19990027848 Army Soldier and Biological Chemical Command, Soldier Systems Center, Natick, MA USA
The Effects of Multilayered Military Clothing Ensembles on Body Size: A Pilot Study ***Final Report, Sep. 1991 - Jun. 1998***
Paquette, Steven P., Army Soldier and Biological Chemical Command, USA; Case, Henry W., Geo-Centers, Inc., USA; Annis, James F., Anthropology Research Project, USA; Mayfield, Teresa L., Anthropology Research Project, USA; Kristensen, Shirley, Anthropology Research Project, USA; Jan. 1999; 250p; In English
Contract(s)/Grant(s): DAAK60-91-R-2043
Report No.(s): AD-A359792; NATICK/TR-99/012; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report documents an attempt to quantify the effects of multiple clothing layers on individual body size in order to provide important information to workspace designers and clothing system developers. Over 90 measurements were taken on an anthropometrically diverse sample of five men or five women. The specific clothing ensembles examines in the study include: Ground Soldier, Aviator-Warm Weather, Aviator-Cold Weather, Combat Vehicle Crewman-Warm Weather and Combat Vehicle Crewman-Cold Weather. Semi-nude measurements served as a baseline for the body size increments documented for each successive layer of the clothing ensembles. Initial and repeat measurements of all dimensions were taken in order to assess measurement reliability. In addition, differential donning effects were assessed by measuring subjects in an initial and redress condition. Recommendations for the conduct of a full-scale clothed anthropometric survey are also provided. Finally, a companion study or range of motion under the identical clothing configurations was conducted and will be presented in a separated report.
DTIC
Clothing; Body Size (Biology); Anthropometry

19990027921 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
Alternative Control Technologies ***Technologies de Controle Non Conventionnelles***
Hudgins, Bernard, New Brunswick Univ., Canada; Leger, Alain, Sextant Avionique, France; Dauchy, Pierre, Institut de Medicine Aerospatiale Armee, France; Pastor, Dominique, Sextant Avionique, France; Pongratz, Hans, Flugmedizinisches Inst. der Luftwaffe, Germany; Rood, Graham, Defence Evaluation Research Agency, UK; South, Alan, Defence Evaluation Research Agency, UK; Carr, Karen, British Aerospace Public Ltd. Co., UK; Jarrett, Don, Defence Evaluation Research Agency, UK; McMillan, Grant, Armstrong Lab., USA; Anderson, Timothy, Armstrong Lab., USA; Borah, Joshua, Applied Science Labs., USA; December 1998; 148p; In English
Report No.(s): RTO-TR-7; AC/323(HFM)TP/3; ISBN 92-837-1009-6; Copyright Waived; Avail: CASI; A07, Hardcopy; A02, Microfiche

In January 1996, the Working Group 25 of the former AGARD Aerospace Medical Panel began to evaluate the potential of alternative (new and emerging) control technologies for future aerospace systems. The present report summarizes the findings of this group. Through different chapters, the various human factors issues related to the introduction of alternative control technologies into military cockpits are reviewed, in conjunction with more technical considerations of the state of the art of the enabling technologies. Cockpit integration issues are emphasized in regard to both human factors and engineering constraints. Several specific applications of these new technologies in the aerospace environment are considered. Challenges for further developments are identified and recommendations issued. Globally, based upon operational considerations and currently recognized limitations of the Hands on Throttle and Stick (HOTAS) concept, the conclusion is that Alternative Control Technology should now be progressively introduced into the cockpit, as a function of degree of maturity of the various techniques.
Author
Aerospace Environments; Aerospace Systems; Cockpits; Human Factors Engineering; Aircraft Instruments; Adaptive Control; Automatic Flight Control; Artificial Intelligence; Fighter Aircraft; Tracking (Position); Pilots (Personnel); Human-Computer Interface

19990027961 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Perspective Displays: A Review of Human Factors Issues
Naikar, Neelam, Defence Science and Technology Organisation, Australia; February 1998; 44p; In English
Report No.(s): AD-A360645; DSTO-TR-0630; DODA-AR-010-466; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three-dimensional displays may be a more effective way of presenting spatial information to operators than conventional two-dimensional displays because all three dimensions of space may be represented in a spatial format Of several three-dimensional computer graphics systems that are currently available, perspective displays may be the most viable option for implementation at the present time. Previous research shows that perspective displays support better performance than plan-view displays on navigation, spatial awareness, and integration tasks. However, several issues need to be carefully considered and understood before perspective displays may be safely operationalised. This report reviews these issues; monocular cues for depth perception, multiple cue interaction, frame of reference, perspective geometry, and geometric and symbolic enhancement features.
DTIC
Human Factors Engineering; Computer Graphics; Display Devices

19990028188 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA
Deformable human body model development
Wray, W. O., Department of Energy, USA; Aida, T., Department of Energy, USA; Dec. 31, 1998; 25p; In English
Report No.(s): DE99-000554; LA-UR-98-1872; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). A Deformable Human Body Model (DHBM) capable of simulating a wide variety of deformation interactions between man and his environment has been developed. The model was intended to have applications in automobile safety analysis, soldier survivability studies and assistive technology development for the disabled. To date, we have demonstrated the utility of the DHBM in automobile safety analysis and are currently engaged in discussions with the U.S. military involving two additional applications. More specifically, the DHBM has been incorporated into a Virtual Safety Lab (VSL) for automobile design under contract to General Motors Corporation. Furthermore, we have won $1.8 M in funding from the U.S. Army Medical Research and Material Command for development of a noninvasive intracranial pressure measurement system. The proposed research makes use of the detailed head model that is a component of the DHBM; the project duration is three years. In addition, we have been contacted by the Air Force Armstrong Aerospace Medical Research Laboratory concerning possible use of the DHBM in analyzing the loads and injury potential to pilots upon ejection from military aircraft. Current discussions with Arms-

trong involve possible LANL participation in a comparison between DHBM and the Air Force Articulated Total Body (ATB) model that is the current military standard.
NTIS
Computerized Simulation; Research and Development; Human Body; Models; Simulation

19990028216 Institute for Human Factors TNO, Soesterberg, Netherlands
Task Performance Under Fatigue: Effects of Public and Private Feedback ***Interim Report***
Hoeksema-vanOrden, C. Y. D., Institute for Human Factors TNO, Netherlands; Gaillard, A. W. K., Institute for Human Factors TNO, Netherlands; Langefeld, J. J., Institute for Human Factors TNO, Netherlands; May 15, 1998; 22p; In English
Contract(s)/Grant(s): A96/KL/303
Report No.(s): TNO-TM-98-A030; TD-98-0039; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy, Microfiche

This is the sixth experiment in a series of studies on the effects of fatigue and sleep deprivation on task performance. Participants worked on three different individual tasks for 20 hours without sleep, in five sessions of four hours each. In the current experiment, the main research question concerned feedback: which type of feedback motivates people the best when they have to work such long hours without sleep? Two types of feedback were tested: (1) 'private feedback', on the individual performance only; (2) 'public feedback', on all participants' performance. An interaction between feedback and fatigue was expected, in the sense that public feedback was expected to be a better motivator over time than private feedback. On one task it was indeed found that participants with public feedback performed better than those with private feedback, but this was the case right from the start. No evidence was found for an interaction between feedback and fatigue. Apparently, just the knowledge that one's performance will be made public to all other participants, motivates people to work hard, beforehand. Comparisons with previous experiments revealed some suggestions concerning the organization of continuous work during night hours: such work should preferably take place in a group setting where social control can play a role of importance. Group work should be combined with a substantial degree of individual responsibility of each group member for the outcome.
Author
Experimentation; Research; Feedback; Human Performance

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MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

19990027504 National Inst. of Standards and Technology, Information Access and User Interfaces Div., Gaithersburg, MD USA
Support Vector Machines Applied to Face Recognition
Phillips, P. Jonathon, National Inst. of Standards and Technology, USA; Nov. 1998; 16p; In English; Newal Information, 1998, USA
Report No.(s): PB99--102667; NISTIR-6241; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Face recognition is a K class problem, where K is the number of known individuals; and support vector machines (SVMs) are a binary classification method, by reformulating the face recognition problem and re-interpreting the output of the SVM classifier, the authors developed a SVM-based face recognition algorithm. The face recognition problem is formulated as a problem in difference space, which models dissimilarities between faces of the same person, and dissimilarities between faces of different people. by modifying the interpretation of the decision surface generated by SVM, the authors generated a similarity metric between faces that is learned from examples of differences between faces. The SVM-based algorithm is compared with a principal component analysis (PCA) based algorithm on a difficult set of images from the FERET database. Performance was measured for both verification and identification scenarios.
NTIS
Face (Anatomy); Pattern Recognition; Vector Processing (Computers)

19990027771 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France
KAM Theorem and Quantum Field Theory
Bricmont, Jean, Universite Catholique de Louvain, Belgium; Gawedzki, Krzysztof, Institut des Hautes Etudes Scientifiques, France; Kupiainen, A., Helsinki Univ., Finland; Aug. 1998; 38p; In English
Contract(s)/Grant(s): EC-EHRX-CT93-0411; NSF DMS-9501045
Report No.(s): PB99--122293; IHES/P/98/62; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We give a new proof of the KAM theorem for analytic Hamiltonians. The proof is inspired by a quantum field theory formulation of the problem and is based on a renormalization group argument treating the small denominators inductively scale by scale. The crucial cancellations of resonances are shown to follow from the Ward identities expressing the translation invariance of the corresponding field theory.
NTIS
Quantum Theory; Kolmogorov Theory; Field Theory (Physics)

19990027773 Rutherford Appleton Lab., Dept. for computation and information, Chilton, UK
Direct Methods
Duff, I. S., Rutherford Appleton Lab., UK; Aug. 17, 1998; ISS 1353-6254; 60p; In English
Report No.(s): PB99--120446; RAL-TR-1998-054; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche
This document reviews current methods for the direct solution of sparse linear equations. The authors discuss basic concepts such as fill-in, sparsity orderings, indirect addressing and compare general sparse codes with codes for dense systems. It examines methods for greatly increasing the efficiency when the matrix is symmetric positive definite. The authors consider frontal and multifrontal methods emphasizing how they can take advantage of vectorization, RISC architectures, and parallelism. Some comparisons are made with other techniques and the availability of software for the direct solution of sparse equations is discussed.
NTIS
Linear Equations; Matrices (Mathematics)

19990027868 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France
Poincare-Reidemeister Metric, Euler Structures, and Torsion
Farber, Michael, Institut des Hautes Etudes Scientifiques, France; Turaev, Vladimir, Institut des Hautes Etudes Scientifiques, France; May 1998; 34p; In English; Sponsored in part by Herman Minkowski Center for Geometry
Report No.(s): PB99--122269; IHES/M/98/42; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this paper the authors define a Poincare-Reidemeister scalar product on the determinant line of the cohomology of any flat vector bundle over a closed orientable odd-dimensional manifold. It is a combinatorial 'torsion-type' invariant which refines the PR-metric introduced in (Fa) and contains an additional sign or phase information. The authors compute the PR-scalar product in terms of the torsions of Euler structures, introduced in (T1), (T2). The authors show that the sign of their PR-scalar product is determined by the Stiefel-Whitney classes and the semi-characteristic of the manifold. As an application, the authors compute the Ray-Singer analytic torsion via the torsions of Euler structures. Another application: a computation of the twisted semi-characteristic in terms of the Stiefel-Whitney classes.
NTIS
Torsion; Poincare Problem

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COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing. For components see 33 Electronics and Electrical Engineering.

19990027067 Australian National Univ., Dept. of Physics, Canberra Australia
Ultrafast Optical Logic with Semiconductor Nonlinear Directional Couplers ***Final Report, 1 Jun. - 31 Dec. 1998***
Talanina, Irina; Dec. 31, 1998; 28p; In English
Contract(s)/Grant(s): F62562-98-M9148
Report No.(s): AD-A359620; AOARD-98-07; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A resonant soliton scheme to implement ultrafast optical logic gates using semiconductor, nonlinear directional couplers (NLDC) has been investigated numerically. It has been demonstrated that the resonant soliton logic gates meet fundamental requirements for digital optical logic devices: logic level restoration, cascadability, and logical completeness. The operation of AND, OR, XOR, NOT, NOR, and NAND logic gates have been demonstrated in numerical simulations using 2 X 2 device configuration for a directional coupler. 3 X 3 NLDC design has been suggested to implement logically complete gates without necessity to cascade two or more couplers. Using 3 X 3 device configuration, an inventor (NOT gate) and a NOR gate have been implemented. The opening characteristics of the resonant soliton logic gates have been investigated numerically using 100 fs input pulses with 2 (pie) pulse area. It has been shown that the operating speed of all constructed gates is 2 Tbit/s, the operation is bit-rate flexible, the signal-to-noise ratio is generally higher than 4, and the latency is on picosecond timescale. Quantitative comparison

between the operating characteristics of the resonant soliton logic gates and the corresponding parameters of NOLM gates (fiber optics) and also semiconductor electronic logic gates has been made. A conclusion has been drawn that the resonant soliton logic gates represent a novel and unique class of all-optical devices which are capable to operate at least 100 times faster than the most advanced electronic gates.
DTIC
Logic Circuits; Quantum Electronics; Digital Computers; Fiber Optics; Optical Equipment; Directional Couplers

19990027298 Department of the Navy, Washington, DC USA
Method and Apparatus for Enhancing Computer-User Selection of Computer-Displayed Objects Through Dynamic Selection Area and Constant Visual Feedback
Osga, Glenn A., Inventor; May 26, 1998; 26p; In English; Supersedes US-Patent-Appl-SN-464163
Patent Info.: Filed 5 Jun. 95,; US-Patent-Appl-SN-464,163; US-Patent-5,757,358
Report No.(s): AD-D019246; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A method and apparatus for enhancing computer-user selection of computer-displayed objects reduces required cursor travel distance to an object by increasing the effective object selection area without enlarging the displayed size of either the object symbology or cursor. This is done through the constant computation of a ”selectable” cursor target, which is the object closest to the current cursor position on a computer-display. The distance to all display symbols is computed in real-time as a cursor is moved. The system identifies the ”selectable” object by providing a visual indication to the computer-user of the closest object to the cursor before a computer-user selection action is made. A computer-user selection confirmation action, such as the depressing of a mouse switch, erases the ”selectable” object identifier and displays a visual indication that the object is a ”selected” object. Object selection speed and accuracy is improved by the application of the invention.
DTIC
Feedback; Selection; Switches; Display Devices

19990027769 ViA, Inc., Northfield, MN USA
Contractor’s Progress, Status and Management Report ***Monthly Report, 1-31 Dec. 1998***
Case, Steven; Jan. 15, 1999; 5p; In English
Contract(s)/Grant(s): N00421-97-C-1293
Report No.(s): AD-A359717; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
ViA has selected the StrongARM as the initial microprocessor for prototype development. A StrongARM evaluation board was ordered in October and was delivered in late November. The SideKick companion board, which houses the SAl101, was delivered in December. Once a functionally complete prototype is available, performance analysis will be performed to determine if the wrist device can utilize a less powerful processor. In the meantime, revised data suggests that the combination of the SAl100 and the SAl101 will exceed our original power budget for the CPU. Therefore, ViA will be studying approaches to eliminate the SAl 101 from the final system solution.
DTIC
Microprocessors; Prototypes; Contractors; Systems Management

19990028174 L-3 Communications Corp., Camden, NJ USA
Strategic/Tactical Optical Disk System (S/TODS), Deployable Optical Jukebox Evaluation ***Final Report, Apr. 1996 - Sep. 1998***
Kozak, Taras; Vaughan, William; Feb. 1999; 31p; In English
Contract(s)/Grant(s): F30602-96-C-0052; AF Proj. 3192
Report No.(s): AD-A360408; AFRL-IF-RS-TR-1999-21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The purpose of this effort is to demonstrate, test and evaluate new optical disk storage technology. An Advanced Development Model (ADM) was developed which consisted of the following subsystems: (a) ten (10), large format, rewritable optical disk media, (b) rugged optical disk drive for data recording, read-out and erasure, and (c) a robotic access mechanism for automated disk movement under computer control. The jukebox device was designed for worldwide deployments and quick assembly with minimal tools or experience. Under this effort, the storage device was demonstrated within several Air Force facilities to include: Air Force Research Laboratory (AFRL), Electronics System Center (ESC), Air Intelligence Agency (AIA), and Air Force Special Operations Command (AFSOC). Equipment demonstrations were conducted at these locations to seek user feedback needed to refine the system concept of operations and begin the transition phase.
DTIC
Optical Disks; Data Recording; Data Management; Optical Memory (Data Storage)

19990028282 Myricom, Inc., Arcadia, CA USA
A Prototype Two-Level Multicomputer Study ***Final Report, Sep. 1994 - Dec. 1996***
Seitz, Charles L.; Jan. 1999; 150p; In English
Contract(s)/Grant(s): F30602-94-C-0270; AF Proj. B861
Report No.(s): AD-A360404; AFRL-IF-RS-TR-1999-2; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The objectives of this Project were the rapid development and the evaluation of a high-performance prototype of a new type of multicomputer that promised many advantages for defense applications. This architecture is called a two-level multicomputer because each node employs a primary processor for message handling and other runtime tasks, and one or more secondary processors for performing the user computation. The specific, anticipated advantages of this node architecture include: low software overhead in message handling, because the primary processor is dedicated to packet handling and other runtime functions, so that the secondary processors can concentrate on the user's computation; high performance per unit cost, power, and size, due to the efficiency of the architecture and the level of integration in its implementation; very rapid hardware and software development of nodes that exploit the latest processor chips as the secondary processor; the ability to support heterogeneous configurations in embedded applications. Technology transition was integrated throughout this project, from the SAN chip set, to the two-level multicomputer, to its programming systems to its applications. This includes: The UC Berkeley NOW, a cluster of SPARC workstations with Myrinet and the "hotbot" (www.hotbot.com) search engine produced by Inktomi Corp, a commercial spinoff of the Berkeley NOW project, and NSWC Dahlgren for distributed computing for AEGIS ships wing actual engagement codes.
DTIC
Multiprocessing (Computers); Architecture (Computers); Computers; Chips (Electronics); Message Processing; Computer Programs; Distributed Processing

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COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

19990026875 Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA
A Geometry Based Infra-Structure for Computational Analysis and Design
Haimes, Robert, Massachusetts Inst. of Tech., USA; 1998; 81p; In English
Contract(s)/Grant(s): NAG3-2019; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The computational steps traditionally taken for most engineering analysis suites (computational fluid dynamics (CFD), structural analysis, heat transfer and etc.) are: (1) Surface Generation -- usually by employing a Computer Assisted Design (CAD) system; (2) Grid Generation -- preparing the volume for the simulation; (3) Flow Solver -- producing the results at the specified operational point; (4) Post-processing Visualization -- interactively attempting to understand the results. For structural analysis, integrated systems can be obtained from a number of commercial vendors. These vendors couple directly to a number of CAD systems and are executed from within the CAD Graphical User Interface (GUI). It should be noted that the structural analysis problem is more tractable than CFD; there are fewer mesh topologies used and the grids are not as fine (this problem space does not have the length scaling issues of fluids). For CFD, these steps have worked well in the past for simple steady-state simulations at the expense of much user interaction. The data was transmitted between phases via files. In most cases, the output from a CAD system could go to Initial Graphics Exchange Specification (IGES) or Standard Exchange Program (STEP) files. The output from Grid Generators and Solvers do not really have standards though there are a couple of file formats that can be used for a subset of the gridding (i.e. PLOT3D data formats). The user would have to patch up the data or translate from one format to another to move to the next step. Sometimes this could take days. Specifically the problems with this procedure are:(1) File based -- Information flows from one step to the next via data files with formats specified for that procedure. File standards, when they exist, are wholly inadequate. For example, geometry from CAD systems (transmitted via IGES files) is defined as disjoint surfaces and curves (as well as masses of other information of no interest for the Grid Generator). This is particularly onerous for modern CAD systems based on solid modeling. The part was a proper solid and in the translation to IGES has lost this important characteristic. STEP is another standard for CAD data that exists and supports the concept of a solid. The problem with STEP is that a solid modeling geometry kernel is required to query and manipulate the data within this type of file. (2) 'Good' Geometry. A bottleneck in getting results from a solver is the construction of proper geometry to be fed to the grid generator. With 'good' geometry a grid can be constructed in tens of minutes (even with a complex configuration) using unstructured techniques. Adroit multi-block methods are not far behind. This means that a million node steady-state solution can be computed on the order of hours (using current high performance computers) starting from this 'good' geometry. Unfortunately, the geometry usually transmitted from the CAD system is not 'good' in the grid generator sense. The grid generator needs smooth closed solid geometry. It can take a

week (or more) of interaction with the CAD output (sometimes by hand) before the process can begin. One way Communication. (3) One-way Communication -- All information travels on from one phase to the next. This makes procedures like node adaptation difficult when attempting to add or move nodes that sit on bounding surfaces (when the actual surface data has been lost after the grid generation phase). Until this process can be automated, more complex problems such as multi-disciplinary analysis or using the above procedure for design becomes prohibitive. There is also no way to easily deal with this system in a modular manner. One can only replace the grid generator, for example, if the software reads and writes the same files. Instead of the serial approach to analysis as described above, CAPRI takes a geometry centric approach. This makes the actual geometry (not a discretized version) accessible to all phases of the analysis. The connection to the geometry is made through an Application Programming Interface (API) and NOT a file system. This API isolates the top-level applications (grid generators, solvers and visualization components) from the geometry engine. Also this allows the replacement of one geometry kernel with another, without effecting these top-level applications. For example, if UniGraphics is used as the CAD package then Parasolid (UG's own geometry engine) can be used for all geometric queries so that no solid geometry information is lost in a translation. This is much better than STEP because when the data is queried, the same software is executed as used in the CAD system. Therefore, one analyzes the exact part that is in the CAD system. CAPRI uses the same idea as the commercial structural analysis codes but does not specify control. Software components of the CAD system are used, but the analysis suite, not the CAD operator, specifies the control of the software session. This also means that the license issues (may be) minimized and individuals need not have to know how to operate a CAD system in order to run the suite.

Author

Analysis (Mathematics); Computational Fluid Dynamics; Computer Aided Design; Computer Programs; Kernel Functions; Structural Analysis; User Manuals (Computer Programs); Graphical User Interface

19990026893 Department of the Navy, Washington, DC USA

Software Object for Providing a Display of a Scrolling Real-Time Graph and Which Provides for Insertion and Up-Dating of Plots of Real Time Data Into the Display

Ryll, Patrick B., Inventor; Jackson, Neil A., Inventor; Williamson, John T., Inventor; Frantz, Francis J., Inventor; Jul. 21, 1998; 7p; In English

Patent Info.: Filed 22 Jan. 96,; US-Patent-Appl-SN-693,816; US-Patent-5,784,067

Report No.(s): AD-D019202; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A software object for providing a display of a scrolling real-time graph includes a window, a fixed axis within the window, a scrolling axis within the window, axis labels within the window, a plot within the window, and facility for viewing obscured regions of the graph along the scrolling axis.

DTIC

Computer Programs; Chronology; Time Measurement

19990026954 Department of Energy, Washington, DC USA

Study of performance on SMP and distributed memory architectures using a shared memory programming model

Brooks, E. D., Department of Energy, USA; Warren, K. H., Department of Energy, USA; Aug. 08, 1997; 26p; In English; Supercomputing '97: High Performance Networking and Computing, USA

Report No.(s): DE98-050265; UCRL-JC-127449; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper we examine the use of a shared memory programming model to address the problem of portability of application codes between distributed memory and shared memory architectures. We do this with an extension of the Parallel C Preprocessor. The extension, borrowed from Split-C and AC, uses type qualifiers instead of storage class modifiers to declare variables that are shared among processors. The type qualifier declaration supports an abstract shared memory facility on distributed memory machines while making direct use of hardware support on shared memory architectures. Our benchmarking study spans a wide range of shared memory and distributed memory platforms. Benchmarks include Gaussian elimination with back substitution, a two-dimensional fast Fourier transform, and a matrix-matrix multiply. We find that the type-qualifier-based shared memory programming model is capable of efficiently spanning both distributed memory and shared memory architectures. Although the resulting shared memory programming model is portable, it does not remove the need to arrange for overlapped or blocked remote memory references on platforms that require these tuning measures in order to obtain good performance.

NTIS

Research; Distributed Memory; Architecture (Computers); Management

19990026963 Defense Technical Information Center, Fort Belvoir, VA USA
Software Tech News, Volume 2, Number 3
Jan. 1998; 22p; In English
Report No.(s): AD-A360107; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Software Tech News is the DoD source for software technology information. Articles in this issue include: Software Architecture Representation, Research Directions in Software Architecture, the Profession of Software Architecture, Call for Participation in DoD Intranet Survey, Software Architecture on WWW, DACS Patron Survey, and Commercial Off-the-Shelf Software.
DTIC
Computer Programs; Architecture (Computers); Software Engineering

19990026966 Physics and Electronics Lab. TNO, The Hague, Netherlands
The CBT Pilot SEWACO :Experiences and Evaluation ***Final Report De COO Pilot SEWACO: Ervaringen en Evaluatie***
deHoog, R., Physics and Electronics Lab. TNO, Netherlands; July 1998; 23p; In Dutch; Sponsored in party by Opschool, The Netherlands
Contract(s)/Grant(s): A97/KM/833; TNO Proj. 27429
Report No.(s): TD98-0166; FEL-98-A088; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, Microfiche

This report describes the experiences gained and lessons learned during the SEWACO pilot. The goal of the SEWACO pilot was to build ”in house” in the Opschool a computer based teaching program using Authorware as the main development tool. Based on these experiences and lessons learned a future road, as far as Computer Based Training in the Opschool is concerned, can be laid out. It captures the lessons in 8 categories: the domain chosen, the design method used, personnel and knowledge, tools used, learner evaluation, contextual factors (hardware, network, space, management, links with other systems) and consequences for instruction in the future (more advanced CBT, training ”on demand”, rethinking the curriculum, new ways of testing, changing classroom instruction).
Author
Computer Programs; Evaluation; Education

19990026991 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
Intelligent Agent Feasibility Study, Volume 1, Agent-based System Technology ***Final Report, Nov. 1997 - Feb. 1998***
Deutsch, Stephen E.; Feb. 1998; 47p; In English
Contract(s)/Grant(s): F41624-97-D-5002; AF Proj. 1710
Report No.(s): AD-A359612; BBN-8216-Vol-1; AFRL-HE-WP-TR-1998-0007-Vol-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research on software agents and agent-based systems has now been underway for more than twenty years. Within the last few years interest in agent-based systems has spread to include the active involvement of the broader commercial software community. In Volume 1 of this study we have traced these developments in the academic, commercial, and government arenas. to provide the necessary background for the study we have examined the definition of agents and the support for agent-based systems in client-server and distributed object computing environments. The focus of the study was the investigation of potential applications for agent-based technologies within the logistics areas of deployment and maintenance. An agent-based architecture was developed to support the application areas. The architecture draws on the services of the newly emerging distributed object computing environments and the combined proactive, reactive and multi-tasking agent capabilities of the Operator Model Architecture (OMAR) agent. Volume 2 provides an examination of the Mission Capable Awaiting Parts (MICAP) maintenance process as it is conducted today and outlines recommendations for employing agent-based system capabilities to improve the process.
DTIC
Software Engineering; Distributed Processing; Object-Oriented Programming

19990026992 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
Intelligent Agent Feasibility Study Volume 2:, Volume 2, Aircraft Mission Capable Parts (MICAP) Process ***Final Report, Nov. 1997 - Feb. 1998***
Vincent, Patrick J.; Tenney, Yvette J.; Feb. 1998; 36p; In English; Prepared in collaboration with Analytic Sciences Corp., Fairborn, OH. ADA359612
Contract(s)/Grant(s): F41624-97-D-5002; AF Proj. 1710
Report No.(s): AD-A359613; BBN-8216-Vol-2; AFRL-HE-WP-TR-1998-0007-Vol-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research on software agents and agent-based systems has now been underway for more than twenty years. Within the last few years interest in agents and agent-based systems has spread to include the active involvement of the broader commercial software community. In Volume 1 of this study we traced these developments in the academic, commercial, and government arenas. In this volume, Volume 2, we provide an examination of the Mission Capable Parts (MICAP) maintenance process as it is conducted today and outline recommendations for employing agent-based system capabilities to improve the process in the future.
DTIC
Software Engineering; Aircraft Maintenance; Distributed Processing; Object-Oriented Programming

19990027050 Department of Energy, Office of Energy Research, Washington, DC USA
Lilith: A software framework for the rapid development of scalable tools for distributed computing
Gentile, A. C., Department of Energy, USA; Evensky, D. A., Department of Energy, USA; Armstrong, R. C., Department of Energy, USA; Dec. 31, 1997; 16p; In English; 18th; Distributed Computing Systems, USA
Report No.(s): DE98-050982; SAND-97-8700C; CONF-980517; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Lilith is a general purpose tool that provides a highly scalable, easy distribution of user code across a heterogeneous computing platform. by handling the details of code distribution and communication, such a framework allows for the rapid development of tools for the use and management of large distributed systems. This speed-up in development not only enables the easy creation of tools as needed but also facilitates the ultimate development of more refined, hard-coded tools as well. Lilith is written in Java, providing platform independence and further facilitating rapid tool development through Object reuse and ease of development. The authors present the user-involved objects in the Lilith Distributed Object System and the Lilith User API. They present an example of tool development, illustrating the user calls, and present results demonstrating Lilith's scalability.
NTIS
Data Processing; Computers; Computer Programs; Coding

19990027087 GTE Government Systems Corp., Intelligence Systems Organization, Thousand Oaks, CA USA
Mass Storage Prototype ***Final Report, Sep. 1995 - Sep. 1998***
Riesig, Wayne J.; Fralick, Sandra; Dec. 1998; 41p; In English
Contract(s)/Grant(s): F30602-95-C-0144; AF Proj. 3192
Report No.(s): AD-A359816; Rept-1945062A; AFRL-IF-RS-TR-1998-223; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The concept of accessing multiple repositories and the ability to treat those heterogeneous repositories as a single "virtual database" is a timely and worthwhile pursuit for the intelligence community. MSP provides the ability to create a "virtual database" from many legacy intelligence systems and allows for real-time correlative queries and union views of system related information at one time. This effort has succeeded in providing a tool to query the Imagery Exploitation Support System (IESS), Modernized Integrated Data Base (MIDB), and the Image Product Archive/Image Product Library (IPA/IPL) and returning a unified set of query results of information from each of thee databases. The MSP implementation of an intuitive web interface also provides a wide range of user's access to this federated view with less training than required of a full functionality client interface. The main COTS products used for this implementation were the Virtual DB (formerly marketed as PANGEA) by Enterworks, a subsidiary of TELOS and a Netscape browser. The MSP is also capable of retrieving thumbnails and full frame imagery from the IPA/IPL. Specialized queries for geographic processing and custom queries for co-located targets are also provided.
DTIC
Data Bases; Distributed Processing; Software Engineering; Real Time Operation

19990027146 Department of Energy, Office of Energy Research, Washington, DC USA
ABAREX: A neutron spherical optical-statistical-model code: A user's manual
Smith, A. B., Department of Energy, USA; Lawson, R. D., Department of Energy, USA; Jun. 30, 1998; 120p; In English
Report No.(s): DE98-007361; ANL/NDM-145; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The contemporary version of the neutron spherical optical-statistical-model code ABAREX is summarized with the objective of providing detailed operational guidance for the user. The physical concepts involved are very briefly outlined. The code is described in some detail and a number of explicit examples are given. While the code has operated on a number of computing systems, this version is specifically tailored for the VAX/VMS work station and/or the IBM-compatible personal computer.
NTIS
User Manuals (Computer Programs); Computer Programs; Neutrons; Optical Measurement; Spheres; Statistical Analysis

19990027151 Science Applications International Corp., Albuquerque, NM USA
Air-to-Air Missile T and E Using Live Aircraft Linked to a Missile HWIL Simulation
McKee, Larry; Jan. 1998; 7p; In English
Report No.(s): AD-A359504; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Live Fly Phase (LFP) of the Systems Integration Test (SIT) was executed by the Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) and the 46th Test Wing at Eglin AFB, FL during 1997. The purpose of the SIT was to evaluate the utility of using advanced distributed simulations (ADS) to support cost-effective testing of an integrated missile weapon/launch aircraft system in an operationally realistic scenario. The SIT missions simulated a single shooter aircraft launching an air-to-air missile against a single target aircraft. In the LFP, the shooter and target were represented by live aircraft and the missile by a simulator. ADS techniques were used to link two live F-16 fighter aircraft flying over the Eglin Gulf Test Range to the Advanced Medium Range Air-to-Air Missile (AMRAAM) AIM-120 hardware-in-the-loop (HWIL) simulation facility at Eglin. This configuration had both DT and OT characteristics. There was a DT flavor because an HWIL facility was used to simulate the missile. This allowed the detailed performance of missile subsystems to be monitored, typical of a DT test. The OT characteristics of the LFP resulted from the use of aircraft performing operationally realistic engagements. Two baseline scenarios were selected from the AMRAAM FOT&E(2) live fire test series and modified for replication in the LFP trials. There were four major test objectives of the LFP: (1) Assess the validity of AMRAAM data generated in the LFP ADS configuration. (2) Assess the ability of the LFP ADS configuration to perform AMRAAM testing. (3) Assess the ability to link live aircraft to a missile HWIL simulation. (4) Evaluate the ability of the LFP ADS configuration to support distributed missile testing. This paper describes the LFP testing that was conducted during 1997, presents the results from evaluating the test objectives, and summarizes the utility of the LFP ADS configuration for air-to-air missile T&E.
DTIC
Air to Air Missiles; F-16 Aircraft; Missile Systems; Hardware-In-The-Loop Simulation

19990027157 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Modification of the Entity State PDU for Use in the End-to-End Test
Schmidt, Terry; Marchand, Gary; Jan. 1998; 7p; In English
Report No.(s): AD-A359484; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The End-to-End Test (ETE) is being conducted under the auspices of the Department of Defense Joint Advanced Distributed Simulation (JADS) Joint Test and Evaluation (JT&E). The purpose of the ETE is to investigate the utility of using advanced distributed simulation (ADS) to augment both developmental and operational testing of the Joint STARS surveillance system. The basic concept behind the ETE is to augment the Joint STARS environment with a virtual environment created by thousands of simulated entities, or targets. This virtual environment is imaged by simulations of the radar systems contained within the Joint STARS E-8C aircraft and mixed with real radar returns to provide a robust operational environment for testing of the system. The ETE Joint STARS simulation is called the Virtual Surveillance Target Attack Radar System (VSTARS). Simulated entities are transmitted to VSTARS through the use of Entity State Protocol Data Units (ESPDU). The simulation, or simulations, representing these entities transmit ESPDUs representing the status of each entity. This status is used to update data bases that are used to generate Joint STARS virtual radar images. Two modifications have been made to the ESPDU for use in the ETE. The first of these is a modification of the time field and is not mandatory, but is recommended. It records the time the ESPDU was created since the start of the simulation scenario. The second change to the ESPDU is performed internal to the Joint STARS simulation and is much more drastic. VSTARS must be capable of functioning anywhere needed, to include on board an aircraft during the conduct of a mission. This requires that the DIS network interface unit (NIU) for VSTARS exist in two parts, a ground NIU (UNIU) and an aircraft NIU (ANIU). The GNIU remains at a fixed location and receives ESPDUs from the DIS network.
DTIC
Synthetic Aperture Radar; Distributed Interactive Simulation; Radar Tracking; Moving Target Indicators; Surveillance Radar; Radar Imagery

19990027160 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Network Design and Performance of the System Integration Test, Linked Simulators Phase
Grundhoffer, Gregory; Brown, David; Ashton, Charles; Jan. 1998; 10p; In English
Report No.(s): AD-A359470; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The System Integration Test (SIT) evaluates the utility of using advance distributed simulation (ADS) to support cost effective testing of an integrated missile weapon/launch aircraft system. The Linked Simulator Phase of the test applies ADS and connects three simulators: the shooter, the target, and the missile. These simulators were located in different installations across the country. This paper discusses the network design and final network architecture. Network personnel tested performance of the network

and also came up against unexpected situations. These challenges and their solutions are examined in the paper. The goals of the Joint Advanced Distributed (JADS) Joint Test Force (JTF) and the Naval Air Warfare Center Weapons Division (NAWCWPNS) networking teams were to create a network able to satisfy the test' 5 Linked Simulator Phase (LSP) requirements and characterize the network performance. This paper discusses some of the networking issues encountered in meeting those goals.
DTIC
Computerized Simulation; Computer Networks; Distributed Interactive Simulation; Missile Systems; Systems Integration

19990027161 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
Distributed Simulation and Test Evaluation: A Midterm Report on the Utility of Advanced Distributed Simulation to Test and Evaluation
Smith, Mark E.; McKee, Larry; Jan. 1998; 16p; In English
Report No.(s): AD-A359417; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Joint Advanced Distributed Simulation Joint Test Force (JADS JTE) is chartered by the U.S. Office of the Secretary of Defense (0 SD) to determine the utility of advanced distributed simulation (ADS) for both developmental and operational test and evaluation (DT&E and OT&E). The program is at its midpoint, and this paper is designed to provide a progress report on the lessons learned to date on the use of ADS in test and evaluation (T&E). The paper opens with a brief overview of ADS technology and then a short description of the JADS Joint Test and Evaluation (JT&E) program. Third, the main portion of the paper will discuss the results and lessons learned during the ADS-enhanced testing conducted throughout the first major phases of the JADS JT&E program. Fourth, the JADS study on the linking of electronic warfare (EW) test facilities, the Threat Systems Linking Architecture (TSLA) Study, is briefly described. Finally, other considerations will be offered for the T&E professional interested in whether ADS might be a suitable test tool. The material in this paper fuses material from other JADS documents prepared by many members of the JADS JTF.
DTIC
Computerized Simulation; Electronic Warfare; Distributed Interactive Simulation

19990027214 Department of Energy, Office of Energy Research, Washington, DC USA
C++ expression templates performance issues in scientific computing
Bassetti, F., Department of Energy, USA; Davis, K., Department of Energy, USA; Quinlan, D., Department of Energy, USA; Oct. 31, 1997; 21p; In English; Parallel processing: parallel and distributed processing, USA
Report No.(s): DE98-002733; LA-UR-97-4044; CONF-980326; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Ever-increasing size and complexity of software applications and libraries in parallel scientific computing is making implementation in the programming languages traditional for this field--FORTRAN 77 and C--impractical. The major impediment to the progression to a higher-level language such as C++ is attaining FORTRAN 77 or C performance, which is considered absolutely necessary by many practitioners. The use of template metaprogramming in C++, in the form of so-called expression templates to generate custom C++ code, holds great promise for getting C performance from C++ in the context of operations on array-like objects. Several sophisticated expression template implementations of parallel array-class libraries exist, and in certain circumstances their promise of performance is realized. Unfortunately this is not uniformly the case; this paper explores the major reasons that this is so.
NTIS
Parallel Processing (Computers); C++ (Programming Language); Templates

19990027299 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Object-Oriented Design for Sparse Direct Solvers ***Final Report***
Dobrian, Florin, Old Dominion Univ., USA; Kumfert, Gary, Old Dominion Univ., USA; Pothen, Alex, Old Dominion Univ., USA; Jan. 1999; 10p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-1999-208978; NAS 1.26:208978; ICASE-99-2; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We discuss the object-oriented design of a software package for solving sparse, symmetric systems of equations (positive definite and indefinite) by direct methods. At the highest layers, we decouple data structure classes from algorithmic classes for flexibility. We describe the important structural and algorithmic classes in our design, and discuss the trade-offs we made for high

performance. The kernels at the lower layers were optimized by hand. Our results show no performance loss from our object-oriented design, while providing flexibility, case of use, and extensibility over solvers using procedural design.
Author
Object-Oriented Programming; Data Structures; Software Engineering; Applications Programs (Computers); Cholesky Factorization; Matrices

19990027329 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
MEMS design rule checking: a batch approach for remote operation
Yarberry, V. R., Department of Energy, USA; Jan. 31, 1998; 10p; In English; 5th; Smart structures and materials, USA
Report No.(s): DE98-002727; SAND-D-98-0205C; CONF-980308; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes a design rule checking (DRC) tool developed as an aid for designing microelectromechanical structures (MEMS) using AutoCAD running on a Windows NT workstation. The application suite, MEMSdrc, consists of: a graphical user interface integrated into AutoCAD to invoke DRC, translation and interface software to communicate with a commercial IC layout design checking software package, and routines to interactively display and review the results. The user interface provides the capability to select a checking window area and specific DRC rules to be applied to the design. The MEMS structures, defined as 2D AutoCAD geometry are translated first into DXF format, then to GDSII format. A remote process transfers the files to a UNIX workstation where Mentor Graphics ICverify is invoked to perform the layout design rule checks. Upon completion, the results are translated into DXF geometry and returned back to the Windows NT workstation to be overlaid onto the original design. A set of icons are provided for the user to interactively review the results inside of AutoCAD using a first/next/previous technique.
NTIS
Microelectromechanical Systems; Computer Aided Design; Applications Programs (Computers)

19990027474 Department of Energy, Washington, DC USA
Adaptation of the fuzzy k-nearest neighbor classifier for manufacturing automation
Tobin, K. W., Department of Energy, USA; Gleason, S. S., Department of Energy, USA; Karnowski, T. P., Department of Energy, USA; Jan. 31, 1998; 12p; In English; BIOS 1998: Biomedical optics, 1998, USA
Report No.(s): DE98-003174; ORNL/CP-96062; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The use of supervised pattern recognition technologies for automation in the manufacturing environment require the development of systems that are easy to train and use. In general, these systems attempt to emulate an inspection or measurement function typically performed by a manufacturing engineer or technician. This paper describes a self-optimizing classification system for automatic decision making in the manufacturing environment. This classification system identifies and labels unique distributions of product defects denoted as signatures. The technique relies on encapsulating human experience through a teaching method to emulate the human response to various manufacturing situations. This has been successfully accomplished through the adaptation and extension of a feature-based, fuzzy k-nearest neighbor (k-NN) classifier that has been implemented in a pair-wise fashion. The classifier works with pair- wise combinations of the user-defined classes so that a significant reduction in feature space and problem complexity can be achieved. This k-NN implementation makes extensive use of hold-one-out results and fuzzy ambiguity information to optimize its performance. A semiconductor manufacturing case study will be presented. The technique uses data collected from in-line optical inspection tools to interpret and rapidly identify characteristic signatures that are uniquely associated with the manufacturing process. The system then alerts engineers to probable yield-limiting conditions that require attention.
NTIS
Classifiers; Automation; Computer Aided Manufacturing; Fuzzy Systems

19990027505 Catholic Univ. of America, Dept. of Mechanical Engineering, Washington, DC USA
NIST DMIS Interpreter, Version 2
Kramer, Thomas R., Catholic Univ. of America, USA; Proctor, Frederick M., Catholic Univ. of America, USA; Rippey, William G., Catholic Univ. of America, USA; Scott, Harry A., Catholic Univ. of America, USA; Oct. 1998; 82p; In English
Contract(s)/Grant(s): NIST-70NANB7H0016
Report No.(s): PB99--105140; NISTIR-6252; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes an interpreter which reads a file of numerical control code for a coordinate measuring machine (CMM), produces calls to a set of canonical CMM functions, and writes inspection report files. The interpreter is a software system written in the C++ programming language. The function call output of the interpreter is being used to drive a coordinate measuring machine in the National Institute of Standards and Technology (NIST) Enhanced Machine Controller (EMC) control system used to control the Next-Generation Inspection Tested for System (NGIS). The canonical CMM functions were devised for use with

the interpreter and are described in the report. The interpreter includes C++ code for parsing automatically generated from a YACC grammar for DMIS written for use with the interpreter and C++ code for feature fitting provided by the NIST Algorithm Testing System. Only part of the DMIS language is implemented in the interpreter. This second version of the interpreter includes declaration and use of variables and does not require commercial software to operate, as the first version did.
NTIS
Dimensional Measurement; Inspection; Numerical Control

19990027514 British Aerospace Aircraft Group, Military Aircraft and Aerostructures, Warton, UK
FRONTIER: Open System for Collaborative Design Using Pareto Frontiers
Spicer, Dave, British Aerospace Aircraft Group, UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 6.1 - 6.10; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

FRONTIER is an ESPIRIT IV project on design optimization. It addresses problems which are both multidisciplinary and multiobjective. As industrial optimization moves from being applied to particular systems or structures towards addressing the total scope of a design, there is a need for capability to express and deal with tradeoffs of conflicting objectives which measure a design's merit in a number of business senses. There is a need for : (1) a structured set of business metrics; (2) an organization which is adapted to address shared responsibilities for design choices across disciplines and companies where necessary; and (3) design evaluation tools to address all, not just some of these metrics. This paper outlines the Frontier capability and then goes on to consider the metrics, organization and design evaluation aspects of its use in military aircraft design.
Author (revised)
Aircraft Design; Design Analysis; Systems Engineering; Computer Aided Design; Genetic Algorithms; Multidisciplinary Design Optimization

19990027516 Sheffield Univ., Dept. of Automatic Control and Systems Engineering, UK
Evolutionary Collaborative Optimisation Architectures
Khatib, Wael, Sheffield Univ., UK; Fleming, Peter J., Sheffield Univ., UK; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 8.1 - 8.12; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper deals with collaborative optimization methods for multidisciplinary problems using a novel evolutionary computing framework. The parallel nature of an evolutionary algorithm is amenable to collaborative architectures. This paper highlights the basic challenges for Multidisciplinary Optimization (MDO), and briefly discusses the main approaches for solving such problems. Collaborative optimization is presented as a powerful approach for MDO that is amenable to existing work structures in industry. An evolutionary collaborative approach is presented and is shown to exploit the strengths of both techniques. Standard evolutionary algorithms can be expensive in terms of required number of function evaluations. A new evolutionary computing approach called StudGA is presented with example applications using standard benchmark problems for optimization. This algorithm offers step gains in terms of optimisation efficiency when compared to a variety of established techniques such as genetic algorithms. A concise set of MDO problems is used to illustrate implementation issues for a typical MDO scenario. The new algorithm within a collaborative architecture appears to offer competitive performance even when the comparison is made with traditional gradient based methods. Analysis and suggestions for future work conclude this paper.
Author
Multidisciplinary Design Optimization; Algorithms; Genetic Algorithms; Architecture (Computers)

19990027518 Forschungszentrum Karlsruhe G.m.b.H., Inst. fuer Materialforschung 2, Karlsruhe, Germany
Three Dimensional Fibre Optimisation with Computer Aided Internal Optimisation (CAIO)
Reuschel, D., Forschungszentrum Karlsruhe G.m.b.H., Germany; Mattheck, C., Forschungszentrum Karlsruhe G.m.b.H., Germany; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 10.1 - 10.11; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Big efforts have been made to optimize the behavior and the properties of fiber reinforced materials. The fiber-matrix bonding, the influence of the fiber/matrix content and many other relations of several systems have been investigated intensively. Nevertheless, the arrangement of the fibers within a structure was neglected. Computer Aided Internal Optimisation (CAIO) was developed to predict the optimal arrangement of fibers for a given load and boundary conditions. The mechanism of the method has been adapted from biological structures. In nature fiber of composite structures are optimized in different ways. The fibers of a tree are optimized in a way that nearly no tension acts transverse to them and no shear in between them. The fibers in every annual ring are optimized when the annual ring is built. The inner structure of bones, the trabekel are aligned along the force flow.

In contrast to trees, they are able to optimize themselves also inside the volume and during their whole life. CAIO is based on a Commercial FE-Program. In a first step the force flow in a finite element structure is calculated by Finite Element Methods. Then the CAIO-routine changes the orientation of the Youngs Modulus to the directions of the force flow with respect to the FE-results. A new stress flow analysis leads to the reduced shear stress distribution. The optimum fiber arrangement is calculated by an automatically iterative process of alternating FE run and CAIO-calculation. The method is characterized by a rapid convergence for two and three dimensional shell-structures. The latest version of CAIO allows the calculation of the optimum fiber arrangement in three dimensional shell-structures as well as in three dimensional volume-structures.
Author
Composite Structures; Fiber Composites; Fibers; Finite Element Method; Optimization; Fiber-Matrix Interfaces; Computer Aided Design; Three Dimensional Composites

19990027519 NASA Langley Research Center, Hampton, VA USA
Multidisciplinary Design Optimization (MDO) Methods: Their Synergy with Computer Technology in Design Process
Sobieszczanski-Sobieski, Jaroslaw, NASA Langley Research Center, USA; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 11.1 - 11.14; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The paper identifies speed, agility, human interface, generation of sensitivity information, task decomposition, and data transmission (including storage) as important attributes for a computer environment to have in order to support engineering design effectively. It is argued that when examined in terms of these attributes the presently available environment can be shown to be inadequate a radical improvement is needed, and it may be achieved by combining new methods that have recently emerged from multidisciplinary design optimization (MDO) with massively parallel processing computer technology. The caveat is that, for successful use of that technology in engineering computing, new paradigms for computing will have to be developed - specifically, innovative algorithms that are intrinsically parallel so that their performance scales up linearly with the number of processors. It may be speculated that the idea of simulating a complex behavior by interaction of a large number of very simple models may be an inspiration for the above algorithms, the cellular automata are an example. Because of the long lead time needed to develop and mature new paradigms, development should be now, even though the widespread availability of massively parallel processing is still a few years away.
Author
Algorithms; Computer Systems Design; Massively Parallel Processors; Multidisciplinary Design Optimization; Parallel Processing (Computers); Computer Systems Performance; Computerized Simulation

19990027543 Department of Energy, Office of Energy Research, Washington, DC USA
characterizing the dynamics of spatio-temporal data ***Final Report***
Kostelich, E. J., Department of Energy, USA; Armbruster, H. D., Department of Energy, USA; Dec. 31, 1998; 3p; In English
Report No.(s): DE98-006352; DOE/ER/25213-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

One principal goal of the grant was to model and analyze the dynamics of spatially extended chaotic systems. One of the principal tools used in the analysis was KLTOOL, a computer package developed by the principal investigators for Karhunen-Loeve analysis. The package was used to analyze video data from a laboratory experiment on cellular flames. A second goal of the project was to analyze complex time series whose underlying dynamics may be low dimensionally chaotic. Particular emphasis was placed on systems of possible relevance to energy production and distribution. The work attempted to characterize low-dimensional aspects of the dynamics of a fluidized bed, in particular, a transition from periodic to irregular behavior. Finally, collaborators worked on aspects of targeting in chaotic dynamical systems. This work showed that it is possible to switch a moderately high-dimensional chaotic process rapidly between prespecified periodic saddle orbits embedding within the attractor. Additional work extended previously-developed algorithms for the highly accurate computation of stable manifolds of periodic saddle orbits, which is essential to the successful application of targeting algorithms.
NTIS
Dynamical Systems; Computer Programs

19990027618 NASA Lewis Research Center, Cleveland, OH USA
Development of a Multi-Disciplinary Computing Environment (MDICE)
Kingsley, Gerry, CFD Research Corp., USA; Siegel, John M., Jr., CFD Research Corp., USA; Harrand, Vincent J., CFD Research Corp., USA; Lawrence, Charles, NASA Lewis Research Center, USA; Luker, Joel J., Air Force Research Lab., USA; 1998; 12p; In English, 2-4 Sep. 1998, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-27751; RTOP 509-10-31; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The growing need for and importance of multi-component and multi-disciplinary engineering analysis has been understood for many years. For many applications, loose (or semi-implicit) coupling is optimal, and allows the use of various legacy codes without requiring major modifications. For this purpose, CFDRC and NASA LeRC have developed a computational environment to enable coupling between various flow analysis codes at several levels of fidelity. This has been referred to as the Visual Computing Environment (VCE), and is being successfully applied to the analysis of several aircraft engine components. Recently, CFDRC and AFRL/VAAC (WL) have extended the framework and scope of VCE to enable complex multi-disciplinary simulations. The chosen initial focus is on aeroelastic aircraft applications. The developed software is referred to as MDICE-AE, an extensible system suitable for integration of several engineering analysis disciplines. This paper describes the methodology, basic architecture, chosen software technologies, salient library modules, and the current status of and plans for MDICE. A fluid-structure interaction application is described in a separate companion paper.
Author
Architecture (Computers); Software Engineering; Aeroelasticity; Simulation

19990027734 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
Machine Exploitation of Language and Voice Integration (MELVIN) ***Final Report, Jun. 1996 - Oct. 1998***
Meteer, Marie; Jan. 1999; 26p; In English
Contract(s)/Grant(s): F30602-96-C-0019; AF Proj. 4594
Report No.(s): AD-A359963; AFRL-IF-RS-TR-1998-229; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report describes the development of a domain building speech interface to applications and databases. It describes how to build the domain model and the interface tools for a specific application with a SYBASE interface.
DTIC
Speech Recognition; Voice Communication; Computer Programs; Machine Oriented Languages

19990027747 Naval Surface Warfare Center, Dahlgren Div., Dahlgren, VA USA
Testing a FORTRAN 90 Compiler Using the NSWC FORTRAN 77 Mathematics Library ***Final Report***
DiDonato, Armido; Gnoffo, Russ; Feb. 1999; 64p; In English
Report No.(s): AD-A360604; NSWCDD/TR-98/75; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report describes tne analysis and associated FORTRAN program (TEST9O) that were developed to aid in establishing the validity of a new FORTRAN 90 mainframe compiler. The FORTRAN 77 Naval Surface Warfare Center (NSWC) Mathematics Library (MLIB) is used as a source of routines for checking the FORTRAN 90 compiler. At the same time, this study can be considered as an aid to determine whether MLIB can operate in a FORTRAN 90 environment The inputs for the routines were chosen so that many of the different possible paths of the routines were executed. Seventy-four directly cable routines, with 293 supporting routines, were chosen for testing. All but 17, and their supporting routines, were taken from MLIB. The ones not belonging to MLIB are double-precision versions of routines in MLIB. Thirteen hundred and twenty five numerical cases were submitted for testing. A true value for each test was obtained independently and given correctly to 35 digits by using MAPLE software. If the difference in the test output and the corresponding true value exceeds a prespecified error tolerance, an error message is printed identifying the routine and the input. Additional test cases were also prepared to check the bit and string instructions, since these do not appear in MUB. TEST90 has been used to test the latest FORTRAN 90 compilers of the CRAY EL98 and IBM PC machines. No errors were found; however, TEST90 did reveal a complex arithmetic error in an earlier version of the Cray EL98 compiler. MLIB routines ran under TEST90 without any problems on both machines. The transportability of MUB allows TEST90 to be used as an aid in testing FORTRAN 90 compilers on a variety of computers, with a single precision word length no larger than 64 bits.
DTIC
Computer Programs; Compilers; FORTRAN; Applications Programs (Computers); Central Processing Units; Fault Tolerance

19990027772 Rutherford Appleton Lab., Computing and information systems dept., Chilton, UK
AD01, FORTRAN 90 Code for Automatic Differentiation
Pryce, J. D., Royal Military Coll. of Science, UK; Reid, J. K., Rutherford Appleton Lab., UK; Sep. 11, 1998; ISSN 1358-6254; 66p; In English
Report No.(s): PB99--120453; RAL-TR-1998-057; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche
This document describes the design of a FORTRAN 90 code called AD01 for automatic differentiation. by changing the type of each independent variable and of each variable whose value depends on the independent variables and making a small number of other changes, the user can alter an existing code into one that calculates derivatives. Both the forward and backward methods

are supported. With the forward method, any derivative may be found. With the backward method. first and second derivatives are available.
NTIS
FORTRAN; Applications Programs (Computers); Differential Equations

19990027778 Oak Ridge National Lab., TN USA
Application of the NCSA Habanero Tool for Collaboration on Structural Integrity Assessments
Bass, B. R., Oak Ridge National Lab., USA; Kruse, K., Oak Ridge National Lab., USA; Dodds, R. H., Oak Ridge National Lab., USA; Malik, S. N. M., Oak Ridge National Lab., USA; Nov. 1998; 62p; In English
Report No.(s): NUREG/CR-5570; ORNL/TM-13674; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Nuclear Regulatory Commission (NRC), as a member federal agency in the World-Wide Web Federal Consortium (WWWFC), is supporting development of Internet-based software at the National Center for Supercomputing Applications (NCSA) at the University of Illinois, Urbana-Champaign (UIUC). NCSA has developed the Habanero tool as a framework for the collaborative sharing of Java applications. The Habanero tool performs distributed communication of single-user, computer software interactions to a multiuser collaborative environment. At present, Habanero is a research project intended to provide a proof of principle for a platform-independent, Java-based collaborative system. This report provides an overview of collaborative systems studied within the project, including typical software components, technical definitions and considerations, and a selected list of available commercial and research collaborative systems. The collaborative-system requirements deemed critical to engineering analyses are discussed. This is followed by a description of the installation, application, and detailed evaluation of the performance of the Habanero collaborative tool that was carried out collectively by NRC, UIUC, and ORNL as part of this project. The capabilities of the Habanero research tool are compared to those of a currently available commercial collaborative product. Finally, conclusions and some recommendations for future work in collaborative communications are included.
NTIS
Computer Programming; Applications Programs (Computers); Reactor Safety; Structural Failure; Supercomputers

19990027791 Illinois Univ., Dept. of Electrical and Computer Science, Chicago, IL USA
A Framework for the Certification and Evaluation of Real-Time Safety-Critical Intelligent Systems ***Final Report, Jul. 1995 - Oct. 1997***
Tsai, Jeffrey J.; Jan. 1999; 22p; In English
Contract(s)/Grant(s): F30692-95-1-0035; AF Proj. 5581
Report No.(s): AD-A359957; AFRL-IF-RS-TR-1998-236; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The concept of software architecture has recently emerged as a new way to improve our ability to effectively construct large scale software systems. However, there is no formal architecture specification language available to model and analyze temporal properties of complex real-time systems. In this paper, an object-oriented logic-based architecture specification language for real-time systems is discussed. Representation of the temporal properties and timing constraints, and their integration with the language to model real-time concurrent systems is given. Architecture based specification languages enable the construction of large system architectures and provide a means of testing and validation. In general, checking the timing constraints of real-time system is done by applying model checking to the constraint expressed as a formula in temporal logic. The complexity of such a formal method depends on the size of the representation of the system. It is possible that this size could increase exponentially when the system consists of several concurrently executing real-time processes. This means that the complexity of the algorithm will be exponential in the number of processes of the system and thus the size of the system becomes a limiting factor. Such a problem has been defined in the literature as the ”state explosion problem”. This paper proposes a method of incremental verification of architectural specifications for real-time systems. The method has a lower complexity in a sense that it does not work on the whole state space, but only on a subset of it that is relevant to the property to be verified.
DTIC
Software Engineering; Object-Oriented Programming; Computer Programs; Real Time Operation; Complex Systems

19990027794 Systems Engineering Associates, San Diego, CA USA
Desktop Decision Trainer User’s Manual ***Final Report, Feb. 1992 - Feb. 1997***
Rowland, Correy; Garcia, Sharon K.; Dec. 1998; 20p; In English
Contract(s)/Grant(s): F33615-91-C-0007; AF Proj. 1123
Report No.(s): AD-A360075; AL/HR-TP-1997-0023; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper represents the user's manual for use with the Desktop Decision Trainer - a computer-based training system designed to teach complex decision-making skills to Air Force Logistics Command and Control (LC2) personnel.
DTIC
Training Devices; Software Engineering; Decision Making; Computer Assisted Instruction; Command and Control; Computer Techniques

19990027798 NASA Goddard Space Flight Center, Greenbelt, MD USA
Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop
Dec. 1995; 380p; In English; 20th; Software Engineering, 29-30 Nov. 1995, Greenbelt, MD, USA; See also 19990027799 through 19990027814
Report No.(s): NASA/TM-1998-208616; SEL-95-004; NAS 1.15:208616; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

The Software Engineering Laboratory (SEL) is an organization sponsored by NASA/GSFC and created to investigate the effectiveness of software engineering technologies when applied to the development of application software. The activities, findings, and recommendations of the SEL are recorded in the Software Engineering Laboratory Series, a continuing series of reports that includes this document.
Author
Applications Programs (Computers); Computer Programming; Software Engineering; Conferences

19990027799 NASA Goddard Space Flight Center, Greenbelt, MD USA
What's Happening in the Software Engineering Laboratory?
Pajerski, Rose, NASA Goddard Space Flight Center, USA; Green, Scott, NASA Goddard Space Flight Center, USA; Smith, Donald, NASA Goddard Space Flight Center, USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 3-19; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Since 1976 the Software Engineering Laboratory (SEL) has been dedicated to understanding and improving the way in which one NASA organization the Flight Dynamics Division (FDD) at Goddard Space Flight Center, develops, maintains, and manages complex flight dynamics systems. This paper presents an overview of recent activities and studies in SEL, using as a framework the SEL's organizational goals and experience based software improvement approach. It focuses on two SEL experience areas : (1) the evolution of the measurement program and (2) an analysis of three generations of Cleanroom experiments.
Derived from text
Computer Programming; Computer Programs; Software Engineering; Software Development Tools; Checkout; Program Verification (Computers); Quality Control

19990027800 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Empirical Investigation of Perspective-Based Reading
Basili, Victor R., Maryland Univ., USA; Green, Scott, NASA Goddard Space Flight Center, USA; Laitenberger, Oliver, Kaiserslautern Univ., Germany; Shull, Forrest, Maryland Univ., USA; Sorumgard, Sivert, Trondheim Univ., Norway; Zelkowitz, Marvin V., Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 21-69; In English; See also 19990027798
Contract(s)/Grant(s): NsG-5123; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

We consider reading techniques a fundamental means of achieving high quality software. Due to lack of research in this area, we are experimenting with the application and comparison of various reading techniques. This paper deals with our experiences with Perspective Based Reading (PBR) a particular reading technique for requirement documents. The goal of PBR is to provide operation scenarios where members of a review team read a document from a particular perspective (eg., tester, developer, user). Our assumption is that the combination of different perspective provides better coverage of the document than the same number of readers using their usual technique. to test the efficacy of PBR, we conducted two runs of a controlled experiment in the environment of NASA GSFC Software Engineering Laboratory (SEL), using developers from the environment. The subjects read two types of documents, one generic in nature and the other from the NASA Domain, using two reading techniques, PBR and their usual technique. The results from these experiment as well as the experimental design, are presented and analyzed. When there

is a statistically significant distinction, PBR performs better than the subjects' usual technique. However, PBR appears to be more effective on the generic documents than on the NASA documents.
Author
Computer Programming; Experiment Design; Readers; Reading; Software Engineering; User Requirements; Computer Programs

19990027801 Computer Sciences Corp., Lanham, MD USA
Porting Experience Factory Concepts to New Environments
McGarry, Frank, Computer Sciences Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 71-92; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

As our approach to software process improvement has matured, so have the defined paradigms for characterizing the improvement steps. The experience Factory (EF) is a concept comprising both structure and activities that was first defined in 1989. The model evolved from specific experiences at NASA/ Goddard's Software engineering Laboratory, which was established in 1976 and has continued to be an operational experience factory for nearly 20 years. Other environments have also attempted to incorporate the key elements of the EF concept for the purpose of implementing a goal-driven software improvement program. This paper captured the experiences of a sample set of organizations that have attempted to apply the EF concepts. The paper addresses cost, timelines, impediments to success, and lessons learned as reported by those organizations that volunteered such information on their experiences. Approximately eight organizations had some level of information available on at least one or two key elements of their EF implementation efforts. These organizations ranged in size from those with 40 or 50 software engineers to those with over 5000 employees. This paper is a synthesis of the information provided by these groups.
Author
Computer Programming; Computer Programs; Software Engineering; Improvement; Cybernetics; Productivity

19990027802 IBM Canada Lab., North York, Ontario Canada
An Empirical Study of Software Testing and Reliability in an Industrial Setting
Slonim, Jacob, IBM Canada Lab., Canada; Bauer, Michael, University of Western Ontario, Canada; Ye, Jillian, IBM Canada Lab., Canada; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 95-128; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Today's competitive software environment requires the development of high-quality software in shorter development times. This requirement places increasing demands on software developers, their tools and processes. In particular, since much of software quality assurance still relies on testing , improved testing processes and tools to aid in efficient, cost-effective testing are required. Yet, there is still a great deal that we do not understand of the testing process and the means to assess its effectiveness. In this paper, we report on a study examining the utility of code coverage to support and improve the testing process. The study is conducted during the development of a new release of a large -scale commercial product but the data collected and analyzed to date are focused on a single line-item (product functionality) of the subjected software. We report on the information collected on the testing of this line-item during the unit and function test phases, what it reveals about testing in this environment, and the tool that was used. We conclude with some lessons learned and directions for additional data collection and analyses to better understand the utility of code coverage in improving software testing in industrial settings.
Author
Computer Programming; Program Verification (Computers); Quality Control; Software Engineering; Software Reliability; Computer Systems Performance; Programmers; Systems Analysis

19990027803 Bell Telephone Labs., Inc., Murray Hill, NJ USA
Software-Reliability-Engineered Testing
Musa, John D., Bell Telephone Labs., Inc., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 129-144; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Software-reliability-engineered testing (SRET) is testing that is designed and guided by reliability objectives and expected field usage and criticality. It generally includes feature, load and regression testing. SRET is unique in helping testers insure the necessary reliability of a system in minimum delivery time and cost. It increases tester efficiency and reduces the risk of angry customers, as compared to nonengineered testing. It is a standard proven practice. We can cost-effectively apply SRET to every software based product and to the frequently used members of component libraries. It involves activities that extend over all releases of a system and all life-cycle phases, but there is special focus on system test. We define reliability for software as the

probability of execution without failure for some specified interval, generally called the mission time. Thus we use a definition that is compatible with that used for hardware reliability, though the mechanisms of failure may be different. This is because we want to be able to work with software based systems that are composed of both software and hardware components - note that in practice there are no pure software systems. This paper presents the benefits of SRET as contrasted with nonengineered testing and it describes the practice of SRET in some detail, based on extensive experience particularly at AT&T.
Author
Computer Programs; Cost Effectiveness; Failure; Software Engineering; Software Reliability; Computer Systems Performance; Computer Program Integrity; Program Verification (Computers)

19990027804 Bell Telephone Labs., Inc., Middletown, NJ USA
Reusing Software Reliability Engineering Analysis From Legacy to Emerging Client/Server Systems
Cusick, James, Bell Telephone Labs., Inc., USA; Fine, Max, American Telephone and Telegraph Co., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 145-160; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Using Software Reliability Engineering (SRE) AT&T Teleconference Services Development controlled reliability rates, decreased testing costs by 89%, and realized a 40% increase in development productivity, over a three year period. These improvements resulted from simultaneously improving development processes and deploying new tools and technologies while reengineering a legacy distributed platform to a new client/server system that employed object-oriented technology. Software metrics were applied to measure and track reliability and productivity. This paper presents the techniques used to accomplish these results and expands on earlier findings.
Author
Client Server Systems; Object-Oriented Programming; Reliability Engineering; Software Reliability; Software Engineering; Computer Systems Design; Computer Systems Performance; Applications Programs (Computers); Low Cost

19990027805 NASA Goddard Space Flight Center, Greenbelt, MD USA
Survey Results and Award Presentations
Valett, Jon D., NASA Goddard Space Flight Center, USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 163-166; In English; See also 19990027798; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

An acknowledgement for the significant behind the scenes contributions was given to three people who had contributed to the success of the Software Engineering workshops. The rest of the presentation reports on the results of a survey sent to everyone on the workshop mailing list. The questionnaire elicited information about the state of software engineering in the respondents organization was similar to one sent 10 years before. A review of the results of the questionnaire, comparing the result to one given before is presented.
CASI
Computer Programming; Software Engineering; Surveys

19990027806 Maryland Univ., Dept. of Computer Science, College Park, MD USA
A Family of User Interface Consistency Checking Tools: Design and Development of SHERLOCK
Mahajan, Rohit, Maryland Univ., USA; Shneiderman, Ben, Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 169-188; In English; See also 19990027798; Sponsored in part by General Electric Information Services and Maryland Industrial Partnerships; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Incorporating evaluation metrics with GUI development tools will help designers create consistent interfaces in the future. Complexity in design of interfaces makes efficient evaluation infeasible by a single consistency checking evaluation tool. Our focus is on developing a family of consistency checking tools to evaluate spatial layout and terminology in user interfaces and make the evaluation process less cumbersome. We have Created a dialog box summary table to provide a compact overview of spatial and visual properties of dozens or hundreds of dialog boxes of the interface. Interface concordance tool has been developed to spot variant capitalization and abbreviations in interface terminology. As buttons are most frequent used widgets, a button concordance tool and a button layout table has been constructed. Button concordance identifies variant capitalization, distinct typefaces, distinct background colors and variant sizes in buttons. Button layout table spots any inconsistencies in height, width and relative position between a given group of buttons. A spell checking tools which detects spelling errors in interface terms has also been included in the tool set. Finally, a terminology basket tool has been created to identify unwanted synonyms of computer

related terms used in the interface. These tools are integrated together as SHERLOCK, a family of six consistency checking tools to expedite the evaluation process and provide feedback to the designers plus aid Usability Testing.
Author
Layouts; Graphical User Interface; Human-Computer Interface; Statistics; Software Development Tools; Programming Environments; Software Engineering; Computer Systems Programs

19990027807 Maryland Univ., Dept. of Computer Science, College Park, MD USA
A COTS Selection Method and Experiences of Its Use
Kontio, Jyrki, Maryland Univ., USA; Chen, Show-Fune, Hughes Information Technology Corp., USA; Limperos, Kevin, Hughes Information Technology Corp., USA; Tesoriero, Roseanne, Maryland Univ., USA; Caldiera, Gianluigi, Maryland Univ., USA; Deutsch, Mike, Hughes Information Technology Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 189-213; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents the OTSO method for reusable component selection. The Pff The Shelf Option (OTSO) method has been developed to provide a basis for evaluating and selecting reusable components for software development. The main characteristics of the OTSO method include (1) a well-defined, documented process, (2) hierarchical and detailed evaluation criteria decomposition and definition, (3) a model for making alternatives comparable in terms of cost and added value they produce, and (4) use of appropriate techniques for consolidating evaluation data. The OTSO method has been evaluated in two real-world case studies. The case studies indicated that a well-defined process allows the selection process to take place efficiently, the overhead of formal criteria definition is marginal, and the use of different data consolidation methods may influence the results.
Author
Computer Programming; Software Engineering; Software Reuse; Computer Programs; Subroutine Libraries (Computers)

19990027808 Maryland Univ., Dept. of Computer Science, College Park, MD USA
Process Enactment Within an Environment
Tesoriero, Roseanne, Maryland Univ., USA; Zelkowitz, Marvin, Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 215-244; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Environment research has often centered on either the set of tools needed to support software development or on the set of process steps followed by personnel on a project as the complete their activities. In this paper, we address the effects that the environment has on the development process steps are actually performed using a typical programming environment. We then introduce a model to measure a software engineering process in order to be able to determine the relative tradeoffs among manual process steps and automated tools. Understanding process complexity is a potential result of this model. Data f rom the Flight Dynamics Division at NASA Goddard Space Flight Center is used to understand these issues.
Author
Computer Programming; Programming Environments; Software Engineering; Software Development Tools; Computers; Software Reliability

19990027809 Naval Postgraduate School, Monterey, CA USA
Reliability and Risk Analysis of the NASA Space Shuttle Flight Software
Schneidewind, Norman F., Naval Postgraduate School, USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 247-267; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

We have used two categories of software reliability measurements and predictions in combination to assist in assuring the safety of the software of the NASA Space Shuttle Primary Avionics Software System. The two categories are: (1) measurements and predictions that are associated with residual software faults and failures, and (2) measurements and predictions that are associated with the ability of the software to survive a mission without experiencing a serious failure. In the first category are: remaining failures, total failures, fraction of remaining failures, and test time required to attain a given number or fraction of remaining failures. In the second category are: time to next failure and test time required to attain a given time to next failure. In addition, we define the risk associated with not attaining the required remaining failures and time to next failure. Lastly, we have derived a quantity from the fraction of remaining failures that we call operational quality. The benefits of predicting these quantities are: (1) they provide confidence that the software has achieved safety goals, and (2) they provide a means of rationalizing how long to test a piece of software. Having predictions of the extent that the software is not fault free (remaining failures) and its ability to survive a mission (time to next failure) are meaningful for assessing the risk of deploying safety critical software. In addition

with this type of information a program manager can determine whether more testing is warranted, or whether the software is sufficiently tested to allow its release or unrestricted use. These predictions, in combination with other methods of assurance, such as inspections, defect prevention, project control boards, process assessment, and fault tracking, provide a quantitative basis for achieving safety and reliability objectives.
Derived from text
Applications Programs (Computers); Software Reliability; Risk; Maximum Likelihood Estimates; Computer Systems Performance; Failure Analysis; Program Verification (Computers); System Failures

19990027810 Technische Hochschule, Software Engineering Group, Stuttgart, Germany
Modeling and Simulation of Software Projects
Drappa, A., Technische Hochschule, Germany; Deininger, M., Technische Hochschule, Germany; Deininger, M., Technische Hochschule, Germany; Ludewig, J., Technische Hochschule, Germany; Melchisedech, R., Technische Hochschule, Germany; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 269-281; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The lack of adequate methods and tools to support software development, and of techniques to simplify project management tasks have been identified as major factors contributing to the ”software crisis”. In reaction to this, the software engineering community has attempted to devise a number of analytical and constructive operations to both handle the complexity of software development and assure quality of the resulting products. However, despite an impressive evolution of methods and technology in the past years, neither the software development process nor overall product quality have improved significantly. Part of the reason for this appears to be a serious lack of understanding of the software development process. It is often unclear how to integrate methods and tools in the development process to achieve best results because little is known about the most important influencing factors that determine process and product quality. Our research project SESAM (Software Engineering Simulation by Animated Models) attempts to address the problems outlined above. With the SESAM project, we pursue the following two main goals: (1) Building quantitative models of software development projects to gain a better understanding of the underlying processes. (2) Simulation of software development projects, taking the models as a basis to educate future project managers.
Derived from text
Computer Programming; Project Management; Software Engineering; Software Reliability; Simulation; Systems Analysis

19990027811 Bari Univ., Dipt. di Informatica, Italy
Evaluating Empirical Models for the Detection of High-Risk Components: Some Lessons Learned
Lanubile, Filippo, Bari Univ., Italy; Visaggio, Giuseppe, Bari Univ., Italy; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 283-298; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Software complexity metrics are often used as indirect metrics of reliability since they can be obtained relatively early in the software development life cycle. Using complexity metrics to identify high-risk components, i.e. components which likely contain faults, allows software engineers to focus the verification effort on them, thus achieving a reliable product at a lower cost. Since in this study the direct metric of reliability is the class to which the software component belongs (high-risk or low-risk), the prediction problem is reduced to a classification model. Classification problems have traditionally been solved by various methods, which originate from different problem-solving paradigms such as statistical analysis, machine learning, and neural networks. I’his study compares different modeling techniques which cover all the three classification paradigms: principal component analysis, discriminant analysis, logistic regression, logical classification models, layered neural networks, and holographic networks.
Derived from text
Computer Programming; Computer Programs; Principal Components Analysis; Software Engineering; Software Reliability; Computer Program Integrity; Structured Programming; Subroutines

19990027812 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Object-Oriented Software Metrics for Predicting Reusability and Estimating Size
Sanderson, D. Peter, Southwest Missouri State Univ., USA; Tran, Tuyet-Lan, Jet Propulsion Lab., California Inst. of Tech., USA; Sherif, Josef S., Jet Propulsion Lab., California Inst. of Tech., USA; Lee, Susan S., Jet Propulsion Lab., California Inst. of Tech., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 301-316; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

As object-oriented software development methods come into more widespread use, basic questions of software quality assurance must be reconsidered. We will highlight efforts now underway at NASA’s Jet Propulsion Laboratory to both assess the quality of software systems developed using object oriented technology and develop guidelines for future development of such systems.

The current focus is on design and code reusability., and system size estimation. A number of metrics are proposed and two software systems measured and analyzed. The preliminary results reported here should be useful to software development and quality assurance personnel working in C++ implementation environment.
Author
Computer Programming; Object-Oriented Programming; Software Engineering; Software Reuse; Size Determination

19990027813 Computer Sciences Corp., Lanham, MD USA
Improving the Software Testing Process in NASA's Software Engineering Laboratory
Waligora, Sharon, Computer Sciences Corp., USA; Coon, Richard, Computer Sciences Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 317-336; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In 1992, the Software Engineering Laboratory (SEL) introduced a major change to the system testing process used to develop mission ground support systems in NASA Goddard's Flight Dynamics Division. This process change replaced two sequential functional testing phases (system testing and acceptance testing) with a single functional testing phase performed by an independent test team; functional system testing by the software developers was eliminated. to date, nine projects have been completed using the new independent testing process. The SEL recently conducted a study to determine the value of the new testing process, by assessing the impact of the testing process change on the delivered products and overall project performance. This paper reports the results of this study; it presents quantitative evidence that this streamlined independent testing approach has improved testing efficiency. This paper presents the results of a study that the authors conducted in 1995 to assess the value of a major system testing process change that was introduced in 1992 in the Flight Dynamics Division at NASA Goddard. It first presents background information to provide the context for the study. This includes information about the SEL and its project environment and highlights some key improvements that had taken place before the testing change was introduced. It then describes the testing process change and our goals and expectations for the new process. The bulk of the paper presents quantitative results that clearly show the impact of the new testing process on recent projects. These results are followed by the conclusions drawn from this study.
Derived from text
Computer Programming; Program Verification (Computers); Software Engineering; Software Reliability; Checkout; Computer Systems Performance

19990027814 Systems/Software, Inc., Washington, DC USA
How Do Formal Methods Affect Code Quality?
Pfleeger, Shari Lawrence, Systems/Software, Inc., USA; Hatton, Les, Programming Research Ltd., UK; Software Engineering Laboratory Series: Proceedings of the Twentieth Annual Software Engineering Workshop; Dec. 1995, pp. 337-351; In English; See also 19990027798; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Formal methods are advocated on many projects, in the hope that their use will improve the quality of the resulting software. However, to date there has been little quantitative evidence of their effectiveness, especially for safety-critical applications. We examined the code and development records for a large air traffic control support system to see if the use of formal methods made a measurable difference. In this case study, we show that formal specification, in concert with thorough unit testing and careful reviews, can lead to high-quality code. However, formal specification on its own may not have achieved this goal, the data show a clear, direct relationship between the number of developers and the number of faults.
Derived from text
Functional Design Specifications; Computer Systems Design; Software Engineering; Computer Programs

19990027833 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Directory of Industry and University Collaborations with a Focus on Software Engineering Education and Training, Version 7 ***Final Report***
Beckman, Kathy; Feb. 1999; 69p; In English
Report No.(s): AD-A360577; CMU/SEI-99-SR-001; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This directory describes 23 formal collaborative efforts to promote software engineering education and training activities among industry organizations (including government) and universities in the USA, Canada, and Australia. These collaborations vary in their organizational structure and types of services offered. All attempt to bridge the gap between industry needs and academic software engineering education and training offerings. Readers can use this directory to find collaborations that match their software engineering and training needs and that are located in their geographic area.
DTIC
Software Engineering; Education

19990027870 Rutherford Appleton Lab., Dept. for computation and information, Oxford, UK

Co-Array FORTRAN for Parallel Programming

Numrich, R. W., Rutherford Appleton Lab., UK; Reid, J. K., Rutherford Appleton Lab., UK; Sep. 11, 1998; ISSN 1358-6254; 40p; In English

Report No.(s): PB99--120479; RAL-TR-1998-060; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Co-Array FORTRAN, formerly known and F(--), is a small extension of FORTRAN 95 for parallel processing. A Co-Array FORTRAN program is interpreted as if it were replicated a number of times and all copies were executed asynchronously. Each copy has its own set of data objects and is termed an image. The array syntax of FORTRAN 95 is extended with additional trailing subscripts in square brackets to give a clear and straightforward representation of any access to data that is spread across images. References without square brackets are to local data, so code that can run independently is uncluttered. Only where there are square brackets, is communication between images involved. There are intrinsic procedures to synchronize images, return the number of images, and return the index of the current image.

NTIS

FORTRAN; Parallel Programming; Parallel Processing (Computers); Applications Programs (Computers); Arrays

19990027882 NASA Ames Research Center, Moffett Field, CA USA

Applications of Digital Image Processing 11

Cho, Y. -C., NASA Ames Research Center, USA; 1988, pp. 266-277; In English; 11th, 15-17 Aug. 1988, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new technique, digital image velocimetry, is proposed for the measurement of instantaneous velocity fields of time dependent flows. A time sequence of single-exposure images of seed particles are captured with a high-speed camera, and a finite number of the single-exposure images are sampled within a prescribed period in time. The sampled images are then digitized on an image processor, enhanced, and superimposed to construct an image which is equivalent to a multiple exposure image used in both laser speckle velocimetry and particle image velocimetry. The superimposed image and a single-exposure Image are digitally Fourier transformed for extraction of information on the velocity field. A great enhancement of the dynamic range of the velocity measurement is accomplished through the new technique by manipulating the Fourier transform of both the single-exposure image and the superimposed image. Also the direction of the velocity vector is unequivocally determined. With the use of a high-speed video camera, the whole process from image acquisition to velocity determination can be carried out electronically; thus this technique can be developed into a real-time capability.

Author

Particle Image Velocimetry; Time Dependence; Velocity Measurement; High Speed Cameras; Velocity Distribution

19990027964 Joint Advanced Distributed Simulation Joint Test Force, Joint Test and Evaluation, Albuquerque, NM USA

JADS Joint Test and Evaluation: High Level Architecture Runtime Infrastructure Test Report, *1 Feb. - 31 Jul. 1998*

Wright, Darrell L., Joint Advanced Distributed Simulation Joint Test Force, USA; Harris, Clyde J., Joint Advanced Distributed Simulation Joint Test Force, USA; Black, Jerry W., Joint Advanced Distributed Simulation Joint Test Force, USA; August 1998; 50p; In English

Report No.(s): AD-A360656; JADS/JTE-TR-98-006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Joint Advanced Distributed Simulation Joint Test and Evaluation is an Office of the Secretary of Defense-sponsored joint test force chartered to determine the utility of advanced distributed simulation (ADS) technologies for test and evaluation (T&E). The JADS Electronic Warfare (EW) Test will use high level architecture (HLA) federates to replicate all elements of an actual open air range (OAR) test environment and the selected EW system under test. To determine the utility of ADS technology for EW T&E, JADS will use and evaluate the HLA in a three-phase test program. During the ADS test phases, each OAR test run will be recreated using HLA-compliant federates. This report addresses performance of a key HLA component developed by the Defense Modeling and Simulation Organization (DMSO) called the runtime infrastructure (RTI). Use of the RTI is required to be HLA compliant. Since the RTI provides a new means for dissimilar simulators and facilities to communicate, an additional source of latency is imposed on a test architecture which must be measured, optimized, and controlled for accurate real-time measurement of test events. This work was performed for the JADS EW Test and is the subject of this report.

DTIC

Electronic Warfare; Real Time Operation; Simulation

19990027966 Defence Science and Technology Organisation, Information Technology Div., Salisbury Australia
Attribute Cafe: A Java/COBRA Technology Experiment
Toh, T. H., Defence Science and Technology Organisation, Australia; Phillips, Matthew P., Defence Science and Technology Organisation, Australia; Vernik, Rudi J., Defence Science and Technology Organisation, Australia; October 1998; 31p; In English
Report No.(s): AD-A360676; DSTO-TR-0722; DODA-AR-010-635; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes an experiment which was undertaken to consider a range of software engineering issues associated with the development of component-based distributed applications. The experiment focused on the use of Java and Common Object Request Broker (CORBA) technologies as used in the development of a software visualization demonstrator application (the Attribute Cafe) which extracts, integrates and presents software-related information. This experiment has raised a number of issues that need to be considered if Java and CORBA are to provide basis for application development. These include architectural considerations, support for component-based development, technology selection issues, design approaches and the need for effective tool support.
DTIC
Software Engineering; Computer Programming; Object-Oriented Programming; Java (Programming Language)

19990027968 Florida Univ., Dept. of Computer and Information Sciences, Gainesville, FL USA
Distributed Events in Sentinel: Design and Implementation of a Global Event Detector ***Final Report, Aug. 1996 - Oct. 1998***
Chakravarthy, S., Florida Univ., USA; Liao, H., Florida Univ., USA; Kim, H., Florida Univ., USA; January 1999; 53p; In English
Contract(s)/Grant(s): F30602-96-1-0275; AF Proj. R427
Report No.(s): AD-A360712; AFRL-IF-RS-TR-1999-6; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In conventional database management systems, data are created, updated, retrieved and deleted in a passive way; that is, only in response to operations performed by users or application programs. Active database management systems (ADBMSs) enhance the functionality of conventional database systems by issuing operations on their own in response to event occurrences or satisfied conditions. ECA (event-condition-action) rules are used to capture this activity capability: when an event is detected, a condition is checked and an action is executed if the condition is satisfied. Many computing applications are distributed in nature and hence require support for distributed computing. Many of the active OODBMS developed recently do not address event specification outside of their address space. Rules cannot be specified on events that occur in one or more applications. That is, none of them addresses processing ECA rules in a distributed environment. This report extends the earlier work on Sentinel and APBMS, by supporting global event specification and detection. Global events definitions are extended to Snoop, and a global event detector (GED) is implemented to detect events that span multiple applications.
DTIC
Data Bases; Software Engineering; Knowledge Based Systems; Data Base Management Systems

19990027983 Department of Energy, Washington, DC USA
Optimization strategies for complex engineering applications
Eldred, M. S., Department of Energy, USA; Feb. 28, 1998; 103p; In English
Report No.(s): DE98-002890; SAND-98-0340; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

LDRD research activities have focused on increasing the robustness and efficiency of optimization studies for computationally complex engineering problems. Engineering applications can be characterized by extreme computational expense, lack of gradient information, discrete parameters, non- converging simulations, and nonsmooth, multimodal, and discontinuous response variations. Guided by these challenges, the LDRD research activities have developed application-specific techniques, fundamental optimization algorithms, multilevel hybrid and sequential approximate optimization strategies, parallel processing approaches, and automatic differentiation and adjoint augmentation methods. This report surveys these activities and summarizes the key findings and recommendations.
NTIS
Optimization; Augmentation; Parallel Processing (Computers); Robustness (Mathematics); Computer Aided Design

19990028001 Newcastle Polytechnic, Dept. of Computing Science, Newcastle-upon-Tyne, UK
CO-OPN/2 Specification of the DSGamma System Designed Using Coordinated Atomic Actions
DiMarzo Serugendo, G., Eidgenoessische Technische Hochschule, Switzerland; Guelfi, N., Eidgenoessische Technische Hochschule, Switzerland; Romanovsky, A., Newcastle Polytechnic, UK; Zorzo, A., Newcastle Polytechnic, UK; Jun. 1998; 32p; In English
Report No.(s): PB99--121790; TRS-641; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives of this paper are twofold. On the one hand, it aims to show the advantage of Co-ordinated Atomic actions (CA actions) as a design concept for dependable distributed system development, and on the other hand, it explains how the formal language CO-OPN/2 can be used to express the semantics of CA actions design. A fault-tolerant distributed applications is developed according to a simple development life cycle. informal requirements, specification, design, implementation. The design phase is built according to the CA action concept. The CO-OPN/2 language is used to formally express the design phase. The implementation is made in Java based on a library of generic classes implementing the CA action concept. The paper is to serve as a basis for a more general approach aimed at defining CA action semantics.
NTIS
Atoms; Systems Engineering; Design Analysis

19990028002 Newcastle Polytechnic, Dept. of Computing Science, Newcastle-upon-Tyne, UK
ERT Model of Fault-Tolerant Computing and Its Application to a Formalization of Coordinated Atomic Actions, No. 636
Koutny, M., Newcastle Polytechnic, UK; Pappalardo, G., Newcastle Polytechnic, UK; May 1998; 46p; In English
Report No.(s): PB99--121808; TRS-636; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Co-ordinated Atomic (CA) action concept is an approach to structuring complex concurrent activities in a distributed environment, aimed at supporting fault tolerance in the design of object-oriented systems. In this paper the authors investigate the issues involved in the formalization of systems based on CA actions. For this investigation the authors have chosen a compositional model of system behavior which enables one to relate the behavior of (simple) base processes and their (complex) implementations, and state the correctness of the latter in terms of the former. The base processes can be thought of as specifications, or ideal processes operating in an error-free environment, while the implementations model their actual realization which can exploit CA actions, possibly combined with a variety of fault-tolerant techniques to deliver reliable results.
NTIS
Fault Tolerance; Atoms

19990028019 Boeing Co., Seattle, WA USA
Algorithmic Research and Software Development for an Industrial Strength Sparse Matrix Library for Parallel Computers *Final Report, Sep. 1995 - Jan. 1999*
Grimes, Roger G.; Feb. 1999; 10p; In English
Contract(s)/Grant(s): DABT63-95-C-0122
Report No.(s): AD-A360441; D6-82405; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This final report describes the status of work performed during the months of Sept. 1995 through Jan. 1999 on the Algorithmic Research and Software Development For An Industrial Strength Sparse Matrix Library For Parallel Computers. The objective of this effort was to: 1. research and demonstrate new algorithms for the solution of systems of linear equations in parallel; and 2. research and demonstrate a new parallel approach for the real symmetric sparse generalized eigenvalue problem.
DTIC
Algorithms; Software Engineering; Parallel Computers; Computer Programming; Subroutine Libraries (Computers)

19990028169 Secure Computing Technology Corp., Roseville, MN USA
Hypervisors for Security and Robustness *Final Report, Aug. 1996 - Mar. 1998*
Mitchum, Terrence; Larson, Kent; Lu, Raymond; Loe, Brian; OBrien, Dick; Feb. 1999; 52p; In English
Contract(s)/Grant(s): F30602-96-C-0338; DARPA Order E186; AF Proj. E017
Report No.(s): AD-A360460; AFRL-IF-RS-TR-1999-23; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This is the final report for the Hypervisors for Security and Robustness (Kernel Hypervisors) program. It contains a description of the kernel hypervisor approach that was developed on the program for selectively controlling COTS components to provide robustness and security. Using the concept of a loadable module, kernel hypervisors were implemented on a Linux kernel. These kernel hypervisors provide unbypassable security wrappers for application specific security requirements and can also be used to provide replication services. Kernel hypervisors have a number of potential applications, including protecting user systems from malicious active content downloaded via a Web browser and wrapping servers and firewall services for limiting possible compromises. This report also includes a summary of the results of the performance testing and composability analysis that was done on the program. It concludes with a discussion of lessons learned and open issues.
DTIC
Computer Programs; Computer Information Security

19990028184 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
An Object-Oriented Collection of Minimum Degree Algorithms: Design, Implementation, and Experiences ***Final Report***
Kumfert, Gary, Old Dominion Univ., USA; Pothen, Alex, Old Dominion Univ., USA; Jan. 1999; 14p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-1999-208977; NAS 1.26:208977; ICASE-99-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The multiple minimum degree (MMD) algorithm and its variants have enjoyed 20+ years of research and progress in generating fill-reducing orderings for sparse, symmetric positive definite matrices. Although conceptually simple, efficient implementations of these algorithms are deceptively complex and highly specialized. In this case study, we present an object-oriented library that implements several recent minimum degree-like algorithms. We discuss how object-oriented design forces us to decompose these algorithms in a different manner than earlier codes and demonstrate how this impacts the flexibility and efficiency of our C++ implementation. We compare the performance of our code against other implementations in C or FORTRAN.
Author
Object-Oriented Programming; C (Programming Language); Matrices (Mathematics)

19990028229 Department of Defense, Washington, DC USA
Some theoretical issues on computer simulations
Barrett, C. L., Department of Defense, USA; Reidys, C. M., Department of Defense, USA; Feb. 28, 1998; 9p; In English; Artificial life and robotics, USA
Report No.(s): DE98-003360; LA-UR-97-4775; CONF-980133; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The subject of this paper is the development of mathematical foundations for a theory of simulation. Sequentially updated cellular automata (sCA) over arbitrary graphs are employed as a paradigmatic framework. In the development of the theory, the authors focus on the properties of causal dependencies among local mappings in a simulation. The main object of and study is the mapping between a graph representing the dependencies among entities of a simulation and a representing the equivalence classes of systems obtained by all possible updates.
NTIS
Computerized Simulation; Mapping; Applications of Mathematics

62
COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990026958 Naval Postgraduate School, Monterey, CA USA
Utilizing Hardware Features for Secure Thread Management
Isa, Haruna R.; Dec. 1998; 157p; In English
Report No.(s): AD-A360097; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Transaction processing (TP) applications are of use when solving a wide variety of data processing problems. Current commercial TP systems do not possess the ability to manage information at multiple security levels with high assurance. Department of Defense and Department of Navy Command, Control, Communication, Computers and Intelligence (C4I) applications handle information over a wide variety of classifications and compartments. The existence of TP applications that can securely process information of different classifications (with assurance) would save the DoD the need to create separate single level systems to process all necessary information. A trusted computing base (TCB) and security kernel architecture for supporting multi-threaded, queue-driven transaction processing applications in a multilevel secure environment has been designed. Intel's Pentium CPU architecture provides hardware with two distinct descriptor tables. One is used in the usual way for process isolation while the other is used for thread isolation. This allocation, together with an appropriately designed scheduling policy, permits us to avoid the full cost of process creation when only switching between threads of different security classes in the same process. where large numbers of transactions are encountered on transaction queues, this approach has benefits over traditional multilevel systems.
DTIC
Command and Control; Data Processing; Computer Information Security; Management Information Systems

19990026987 Battelle Memorial Inst., Dayton, OH USA

Information Gathering for the Initial Tools Study for the Integrated Requirements Support System (IRSS) ***Final Report, Jun. 1995 - Jun. 1997***

Moulder, Roger; Apr. 1998; 56p; In English

Contract(s)/Grant(s): F33657-92-D-2055; AF Proj. 1710

Report No.(s): AD-A359591; AFRL-HE-WP-TR-1998-0061; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We describe a group of related approaches to quantitative evaluations and prioritization of system requirements and proposals. In formulating requirements for new systems, analysts face difficult tasks of selecting between alternative requirement decompositions, identifying questionable or low-priority requirements, eliminating requirements that add unnecessary costs, projecting cost impact of the requirements and then evaluating alternative system design proposals against the stated requirements. We seek approaches that require modest investments of time and can be applied even at the early stages of the requirements formulation process. We show that the Analytical Hierarchy Process can be applied to provide such evaluation mechanisms and illustrate our approach with a detailed example.

DTIC

Systems Engineering; Software Engineering; Management Information Systems

19990027101 Department of Energy, Washington, DC USA

Tecolote: An Object-Oriented Framework for Hydrodynamics Physics

Holian, K. S., Department of Energy, USA; Ankeny, L. A., Department of Energy, USA; Clancy, S. P., Department of Energy, USA; Hall, J. H., Department of Energy, USA; Marshall, J. C., Department of Energy, USA; Sep. 30, 1997; 9p; In English; New models and numerical codes for shock wave processes in condensed media

Report No.(s): DE98-002662; LA-UR-97-4263; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tecolote is an object-oriented framework for both developing and accessing a variety of hydrodynamics models. It is written in C++, and is in turn built on another framework -Parallel Object-Oriented Methods and Applications (POOMA) . The Tecolote framework is meant to provide modules (or building blocks) to put together hydrodynamics applications that can encompass a wide variety of physics models, numerical solution options, and underlying data storage schemes, although with only those modules activated at runtime that are necessary. Tecolote has been designed to separate physics from computer science, as much as humanly possible. The POOMA framework provides fields in C++ to Tecolote that are analogous to FORTRAN-9O-like arrays in the way that they are used, but that, in addition, have underlying load balancing, message passing, and a special scheme for compact data storage. The POOMA fields can also have unique meshes associated with them that can allow more options than just the normal regularly-spaced Cartesian mesh. They also permit one-, two, and three- dimensions to be immediately accessible to the code developer and code user.

NTIS

Object-Oriented Programming; Hydrodynamics

19990027240 Rutherford Appleton Lab., Chilton, UK

Elements of a Framework to Increase Usability of Systems Linked to the Web

Guedj, R. A., Rutherford Appleton Lab., UK; Dec. 10, 1998; ISSN 1358-6254; 9p; In English

Report No.(s): RAL-TR-1998-077; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

Information Systems of the future will have a Web front-end and will be strongly influenced by Web architecture, constraints and environment. The lack of a self-evident conceptual framework, together with the paradoxical situation of having to design an information system for a community of users whose needs and abilities are mostly unknown, forces us to look for preliminary steps towards a framework. Those steps include looking for regularities in specific situations of human consumable data types and the fundamental media to represent information and transforming the results into Metadata, exploiting theories that seem pertinent in analogous situations such as conversation theory, identifying what constitutes a style of design for the Web and deriving guidelines for styles of design from guidelines for styles of writing, in particular the Classic Style. It is expected that a pertinent conceptual framework might emerge by following this course.

Author

Frames; Data Management; Reuse; Systems Compatibility

19990027297 Department of the Navy, Washington, DC USA

Shielded Computer Network Switch

Bouthillier, Stephen W., Inventor; Jul. 07, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-687102

Patent Info.: Filed 22 Jul. 96,; US-Patent-Appl-SN-687,102; US-Patent-5,777,400.

Report No.(s): AD-D019245; No Copyright; Avail: US Patent and Trademark Office, Microfiche

This report describes a secure computer network switch, wherein a network switch is enclosed in a material which not only reflects electromagentic waves but also absorbs them. this arrangement keeps all network signals confined to the switch enclosure and prevents electromagnetic radiation from the network cable connections. this allows a single computer to have access to multiple networks without vulnerability to theft or unauthorized disclosure of data between the networks.

DTIC

Computer Networks; Switches; Confinement

19990027443 Naval Postgraduate School, Monterey, CA USA

Transition to Asynchronous Transfer Mode (ATM) an Implementation Model for NPS Software Metrics Lab

Carney, Cameron P.; Ellis, Tony L.; Mar. 1999; 78p; In English

Report No.(s): AD-A359905; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

With Asynchronous Transfer Mode (ATM), we are experiencing the emergence of a network technology that has the potential of satisfying the requirement for a worldwide standard to allow interoperability of information, regardless of the hosts or type of information. Historically ATM has been advertised as a Wide Area Network (WAN) technology. Recently, we have seen ATM take on more applications in the local area environment competing with the standard LAN technology, Ethernet. With its ability to accommodate the simultaneous transmission of data, voice. and video. ATM could potentially create a seamless network based on one standard. As a switched-based technology, some of the benefits provided by ATM are dedicated bandwidth per connection, higher aggregate bandwidth, flexible access speeds, reduced network bandwidth cost. reduced network access costs, reduced equipment cost and commitment, and improved management and flexibility. We provide a discussion of the ATM standard an evaluation of the SML's LAN architecture, and propose three ATM implementation models using the SML that NPS could employ to provide ITM students with practical experience and exposure to this technology. Each model outlines the specifications (i.e. hardware and software) required for implementation.

DTIC

Asynchronous Transfer Mode; Computer Networks; Computer Programs; Communication Networks

19990027445 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

How to Develop an Interactive Electronic Technical Manual: An Industry Perspective

Karabulut, Ali N.; Oz, Hilmi; Dec. 1998; 139p; In English

Report No.(s): AD-A359936; AFIT/GLM/LAL/98S-9; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Improvements in technology, especially in computer science, in the last two decades have made it possible, and preferable to develop digital technical manuals. A digital manual, which is called an Interactive Electronic Technical Manual (IETM), is a package of information required for the diagnosis and maintenance of a weapon systems, optimally arranged and formatted for interactive screen presentation to the end-user. Being the largest organization in the U.S., the Department of Defense has pioneered in the development of IETM concept as well as in the establishment of its standards. There have been many researches done about different IETM applications and their effectiveness in DoD environment. However, little research has been done in the area of how an IETM is developed in a civilian environment. This thesis identifies what it takes to develop an IETM in a civilian environment and investigates differentiating factors of commercial industry. In addition to the identification of IETM development steps in a case study, IETM standards, IETM development specifications in industry as well as in military, problems areas in today's IETM development environment, and DoD classification of IETMs are also discussed.

DTIC

Data Management; Computer Programs; Manuals; Weapon Systems

19990027749 Synectics Corp., Rome, NY USA

Real-Time Network Management *Final Report*

Riolo, Joseph R.; Jul. 1998; 32p; In English

Contract(s)/Grant(s): DAAH01-98-C-R040

Report No.(s): AD-A360617; WH97JR00-A002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of our effort was to develop methods for diagnosing network performance problems in real time for DARPA. According to our Phase I research, it is possible to collect data on the network and morph it into queuing models to produce infor-

mation about the network and physical layers of nodes on a network. The program consisted of three tasks. In the first task Synectics assembled a set of metrics that formed an accurate network traffic model, identified mechanisms for hooking well-researched mathematical performance models into software artifacts to allow the definition of expected behavior, and identified deviations from such behavior. Secondly, Synectics described the logical architecture of the proposed performance monitoring system as an object model. Finally, Synectics developed the prototype using Java, with support from JMAPI(Java Management Application Programmer's Interface) and JDBC(Java Database Connectivity), and the object model designed in the second task.
DTIC
Local Area Networks; Data Bases; Applications Programs (Computers); Performance Prediction

19990027767 Florida Univ., Dept. of Electrical and Computer Engineering, Gainesville, FL USA
Parallel and Distributed Computing Architectures and Algorithms for Fault-Tolerant Sonar Arrays ***Annual Report, 1 Jan. - 31 Dec. 1998***
George, Alan D.; Jan. 29, 1999; 72p; In English
Contract(s)/Grant(s): N00014-98-1-0188
Report No.(s): AD-A359698; HCS-TR-99-1; AR-3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report summarizes the progress and results of the third year of a three-year study whose goal is the use of fault-tolerant distributed and parallel processing techniques to decrease the cost and improve the performance and reliability of large, battery-powered, autonomous sonar arrays. In FY98, work has been completed for single-aperture conventional parallel beamforming (CBF), recently completed for split-aperture parallel beamforming (SA-CBF), and initiated for more advanced adaptive or optimal processing algorithms. A comprehensive set of performance experiments has been conducted with the new CBF and SA-CBF parallel algorithms on both clustered workstation testbeds and simulated array architectures, and the results have illuminated the strengths and weaknesses of the algorithms. Several of the new CBF and SA-CBF parallel algorithms developed in this project have been shown to have promising performance and scalability characteristics in terms of processing and memory capacity. In addition, to support sensitivity studies for the mapping of parallel algorithms to array architectures, a new rapid virtual prototyping tool for the design and analysis of distributed parallel sonar arrays has been completed and demonstrated. Finally, an 8-node distributed parallel array prototype has been designed, developed, fabricated, and tested, and promising preliminary results have been attained.
DTIC
Parallel Processing (Computers); Architecture (Computers); Algorithms; Sonar; Arrays; Distributed Processing; Fault Tolerance

19990027784 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
Performance Characteristics of a Java Object Request Broker
Miron, David, Defence Science and Technology Organisation, Australia; Taylor, Samuel, Australian National Univ., Australia; Jun. 1998; 17p; In English
Report No.(s): DSTO-TR-0696; DODA-AR-010-589; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, South Australia 5108), Hardcopy, Microfiche

The efficiency of the Common Object Request Broker Architecture (CORBA) for the transfer of large files over a network is of particular interest to the Imagery Management and Dissemination Group (IMAD). The IMAD group will be using Java and CORBA for such transfers. This report studies the performance of a Java Object Request Broker (ORB) for the transfer of large files over such networks. This performance analysis is done using the Visigenics ORB Visibroker and involves the measurement of throughput and latency. These measurements are then compared with the results obtained when using socket to socket connections. The results show that the throughput of an ORB for large file transfer approaches that of sockets on low bandwidth networks. However on high bandwidth networks the throughput using the ORB is significantly less than that using sockets. It is also shown that the latency incurred by the ORB is much greater than that incurred using sockets.
Author
Performance Prediction; Reliability Analysis; Data Transfer (Computers)

19990027962 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
A Serial Communication Interface for Data Acquisition Instrumentation in a Wind Tunnel
Spataro, M., Defence Science and Technology Organisation, Australia; Kent, S., Defence Science and Technology Organisation, Australia; November 1998; 33p; In English
Report No.(s): AD-A360647; DSTO-TR-0740; DODA-AR-010-669; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Low Speed Wind Tunnel (LSWT) at the Aeronautical and Maritime Research Laboratory (AMRL) has used a proprietary Bidirectional Parallel Interface (BPI) bus for data collection from instrumentation since 1989. As part of the ongoing development of the LSWT data acquisition system it was decided that a more reliable and faster communication scheme was required. This report describes the unique system of hardware and software developed to enable the VMEbus-based instrumentation modules to communicate with a Host computer over an ethernet network.
DTIC
Interfaces; Data Acquisition; Low Speed Wind Tunnels; Instruments

19990028020 Mei Technology Corp., San Antonio, TX USA
Interactive Multimedia Distance Learning (IMDL) ***Final Report, Apr. 1994 - Oct. 1997***
Christinaz, Daniel U.; Walsh, William J.; Filipski, Gary; Escobar, Susan; Jan. 1999; 76p; In English
Contract(s)/Grant(s): F41624-94-C-5003; AF Proj. 1123
Report No.(s): AD-A360439; AFRL-HE-BR-TR-1999-0004; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

As a result of shrinking training budgets, the Air Force is looking for ways to stretch its training dollars. One avenue of investigation has been to evaluate emerging computer and network technologies to determine if training can be delivered at a distance more efficiently than traditional classroom training. This effort focused on developing and demonstrating a PC-based distance learning system that was fully interactive and multimedia capable. Bandwidth between the instructor and distance class was provided by a dedicated T-1 landline. The class was comprised of 12 student workstations with individual cameras networked together. The network provided two-way video, audio and data as well as a link into the internet. The instructor's image or presentation materials could be delivered to large screen monitors/speakers at the front of the class or to the student's individual computer screens. The demonstration phase consisted of delivering an Air Force counseling course which is required training for Air Education and Training Command (AETC) instructors. The course was taught successfully in terms of students performance on the final exam; however, some issues were identified that need to be addressed if such a system were to be deployed.
DTIC
Multimedia; Education; Learning

19990028179 Department of Energy, Office of Energy Research, Washington, DC USA
Use of software agents and distributed objects to integrate enterprises: Compatible or competing technologies
Pancerella, C. M., Department of Energy, USA; Apr. 30, 1998; 18p; In English; 5th; Agents Theories and Languages (ATAL '98), 1998, USA
Report No.(s): DE98-052869; SAND-98-8542C; CONF-980726; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Distributed object and software agent technologies are two integration methods for connecting enterprises. The two technologies have overlapping goals- -interoperability and architectural support for integrating software components- -though to date little or no integration of the two technologies has been made at the enterprise level. The primary difference between these two technologies is that distributed object technologies focus on the problems inherent in connecting distributed heterogeneous systems whereas software agent technologies focus on the problems involved with coordination and knowledge exchange across domain boundaries. This paper addresses the integration of these technologies in support of enterprise integration across organizational and geographic boundaries. The authors discuss enterprise integration issues, review their experiences with both technologies, and make recommendations for future work. Neither technology is a panacea. Good software engineering techniques must be applied to integrate an enterprise because scalability and a distributed software development team are realities.
NTIS
Computer Networks; Data Processing; Technology Assessment; Computer Programming; Computer Systems Programs; Information Transfer; Software Engineering

19990028239 Odyssey Research Associates, Inc., Ithaca, NY USA
Policy Specification Language Design ***Final Report, Jun. 1996 - Oct. 1997***
Rosenthal, David; Stillerman, Matt; Thomas, Roshan; Jan. 1999; 66p; In English
Contract(s)/Grant(s): F30602-96-C-0213; AF Proj. 1069
Report No.(s): AD-A360505; ORA-TM-97-0029; AFRL-IF-RS-TR-1998-235; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this investigation was to aid developers of groupware applications, such as applications using Lotus Notes, in choosing appropriate security controls. Products such as Lotus Notes have security controls (e.g., access control lists, encrypted sections, and digital signatures) for building applications that meet complex security policies. It may be difficult for the application

developer to select the right combination of controls to meet the desired security policy. This report describes a security policy language that can express general policy constraints on users and data, as well as constraints that directly map to Lotus Notes security controls. It can capture both the type of protection desired as well as some aspects of the assurance level.
DTIC
Computer Information Security; Software Engineering; Access Control; Data Processing

63
CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/System Technology and Life Support.

19990026814 Department of Energy, Assistant Secretary for Fossil Energy, Washington, DC USA
Surface blemish detection from passive imagery using learned fuzzy set concepts
Gurbuz, S., Department of Energy, USA; Carver, A., Department of Energy, USA; Schalkoff, R., Department of Energy, USA; Dec. 31, 1997; 7p; In English
Report No.(s): DE98-051220; DOE/FETC/C-98/7304; CONF-9704176; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An image analysis method for real-time surface blemish detection using passive imagery and fuzzy set concepts is described. The method develops an internal knowledge representation for surface blemish characteristics on the basis of experience, thus facilitating autonomous learning based upon positive and negative exemplars. The method incorporates fuzzy set concepts in the learning subsystem and image segmentation algorithms, thereby mimicking human visual perception. This enables a generic solution for color image segmentation. This method has been applied in the development of ARIES (Autonomous Robotic Inspection Experimental System), designed to inspect DOE warehouse waste storage drums for rust. In this project, the ARIES vision system is used to acquire drum surface images under controlled conditions and subsequently perform visual inspection leading to the classification of the drum as acceptable or suspect.
NTIS
Images; Image Analysis; Imagery; Inspection; Real Time Operation; Defects; Fuzzy Sets

19990027255 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Intelligence Control Based on Self-Correcting Fuzzy-Neural Networks for Brushless DC Motor Drive
Fan, Zhengqiao, Beijing Univ. of Aeronautics and Astronautics, China; Li, Chengjun, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 529-532; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The report presents a self-correcting fuzzy-neural network controller (SCFNNC) to realize the requirement of the start, regulating the speed, resisting disturbance and the brake for a brushless DC motor. The SCFNNC implements good controlling rules by the method of regulating self-correcting gain parameters for the system. The paper emphatically develops the design method of self-correcting gain parameters, the design of the fuzzy controller and the method to realize the rules of fuzzy control by artificial neural networks, etc. The self-correcting gain parameters depend on expected values of the overshoot, steady-state error and dynamic velocity-drop for the system. According to systematic requirements, the fuzzy controller is designed and a suitable rule table of fuzzy control is also determined, which is used to train neural networks. In order to reach optimal performances, complex control of combining self-correcting fuzzy-neural networks with Bang-Bang and proportional control is applied. It is shown by digital simulation that the system with SCFNNC has excellent dynamic and static performances, good robustness and the ability for resisting disturbance.
Author
Control Systems Design; Electric Motors; Fuzzy Systems; Neural Nets; Controllers; Off-On Control

19990027406 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Research on Dynamic Optimization Control of Redundant Manipulators
Chen, Weihai, Beijing Univ. of Aeronautics and Astronautics, China; Zhang, Qixian, Beijing Univ. of Aeronautics and Astronautics, China; Yang, Zongxu, Beijing Univ. of Aeronautics and Astronautics, China; Li, Jian, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24,

No. 5, pp. 607-610; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

Stability and end state self-motion are important and difficult points. To solve these difficulties that exist in dynamic optimization of redundant manipulators, this paper deeply researched the inner relation and contradictory conflict between dynamic optimization and joint velocities. A new idea to raise the general quality of dynamic optimization by means of optimizing joint velocities is presented. A scheme resulted from adjusting joint velocity homogeneous items in real-time is developed to effectively improve stability and joint velocities at the end of motion to be near zero. Computer simulations verified the proposed approach to be very useful and efficient.

Author

Dynamic Control; Manipulators; Optimization; Redundancy; Robotics

19990027462 NASA Lewis Research Center, Cleveland, OH USA

The Application of Dedicated Controllers to Parallel/Serial Exhauster Trains

Sadhukhan, Debashis, NASA Lewis Research Center, USA; Dever, Therese M., NASA Lewis Research Center, USA; 1998; In English; ISA Expo '98, 1998, Houston, TX, USA; Sponsored by Instrument Society of America, USA

Contract(s)/Grant(s): RTOP 022-00-00; Proj. 7535; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Twenty new dedicated controllers were interfaced to the Distributed Control System (DCS) at NASA Lewis Research Center. Better surge avoidance, improved energy savings, interface intricacies, and plant complexities are the subjects of this paper. Problems with the existing Programmable Logic Controller (PLC) control logic are described as well as the solutions implemented with the new controllers. The complexity of the new communication network between the dedicated controllers, Multipurpose Micro-Processor (MMPs), and the operator workstations are illustrated. The complicated nature of the plant and methods of controlling the associated processes are also discussed.

Author

Distributed Parameter Systems; Controllers; Active Control; Control Systems Design; Energy Conservation

19990027568 Department of Energy, Office of Energy Research, Washington, DC USA

Adaptive heterogeneous multi-robot teams

Parker, L. E., Department of Energy, USA; Dec. 31, 1998; 8p; In English; 4th; Neural Networks and their Applications, USA

Report No.(s): DE98-004975; ORNL/CP-97305; CONF-980367; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This research addresses the problem of achieving fault tolerant cooperation within small- to medium-sized teams of heterogeneous mobile robots. The author describes a novel behavior-based, fully distributed architecture, called ALLIANCE, that utilizes adaptive action selection to achieve fault tolerant cooperative control in robot missions involving loosely coupled, largely independent tasks. The robots in this architecture possess a variety of high- level functions that they can perform during a mission, and must at all times select an appropriate action based on the requirements of the mission, the activities of other robots, the current environmental conditions, and their own internal states. Since such cooperative teams often work in dynamic and unpredictable environments, the software architecture allows the team members to respond robustly and reliably to unexpected environmental changes and modifications in the robot team that may occur due to mechanical failure, the learning of new skills, or the addition or removal of robots from the team by human intervention. After presenting ALLIANCE, the author describes in detail the experimental results of an implementation of this architecture on a team of physical mobile robots performing a cooperative box pushing demonstration. These experiments illustrate the ability of ALLIANCE to achieve adaptive, fault- tolerant cooperative control amidst dynamic changes in the capabilities of the robot team.

NTIS

Robots; Research; Fault Tolerance; Heterogeneity

19990027653 Norwegian Defence Research Establishment, Kjeller, Norway

Artificial Intelligence Techniques with Potential for Use in Two Person Zero Sum Games ***Kunstig Intelligens Teknikker Med Potensiale for Bruk I Tomanns Nullsum-Spill***

Norodd, Hagenson, Norwegian Defence Research Establishment, Norway; Oct. 19, 1998; 31p; In English

Contract(s)/Grant(s): FFISYS Proj. 722/161.3

Report No.(s): FFI/RAPPORT-97/05291; ISBN 82-464-0300-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report gives an overview of established theory and recent results in artificial intelligence fields which are relevant to two person zero sum games. The following fields are surveyed, game theory, game applications, search, belief networks and other

ways of handling uncertainty, fuzzy logic, fuzzy sets, neural networks, knowledge representation, expert systems, genetic algorithms and hybrid approaches.
Author
Game Theory; Artificial Intelligence; Genetic Algorithms; Fuzzy Systems; Zero Sum Games; Expert Systems

19990027733 Clarkson Univ., Div. of Research, Potsdam, NY USA
Neural Networks for High Speed Communication Switching ***Final Report, Feb. 1994 - May 1995***
Meyer, Robert; Perreault, David; Jan. 1999; 35p; In English; Prepared in cooperation with Boston University (College of Engeering), Boston, Mass.
Contract(s)/Grant(s): F30602-94-C-0023; AF Proj. 4519
Report No.(s): AD-A359959; AFRL-IF-RS-TR-1998-237; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Neural networks and fuzzy systems have been studied to develop effective means to control highly dynamic high-speed networks in a cost efficient manner. Using the results from a study of robust transfiguring protocols which were designed to recognize changes in assumed network state and adapt to these changing network conditions, a fuzzy control algorithm was implemented.
DTIC
Neural Nets; Switching; Fuzzy Systems

19990027989 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Computations of entropy bounds: Multidimensional geometric methods
Makaruk, H. E., Department of Energy, USA; Feb. 28, 1998; 10p; In English; EIS '97: Engineering of Intelligent Systems, 1997, USA
Report No.(s): DE98-002919; LA-UR-97-4413; CONF-980216; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The entropy bounds for constructive upper bound on the needed number-of- bits for solving a dichotomy is represented by the quotient of two multidimensional solid volumes. For minimization of this upper bound exact calculation of the volume of this quotient is needed. Three methods for exact computing of the volume of a given nD volume are presented: (1) general method for calculation any nD volume by slicing it into volumes of decreasing dimension is presented; (2) a method applying appropriate curvilinear coordinate system is described for volume bounded by symmetrical curvilinear hypersurfaces (spheres, cones, hyperboloids, ellipsoids, cylinders, etc.); and (3) an algorithm for dividing any nD complex into simplices and computing of the volume of the simplices is presented, supplemented by a general formula for calculation of volume of an nD simplex. These mathematical methods enable exact calculation of volume of any complicated multidimensional solids. The methods allow for the calculation of the minimal volume and lead to tighter bounds on the needed number-of-bits.
NTIS
Learning; Integrated Circuits; Computation; Entropy; Neural Nets; Optimization

19990028249 NASA Lewis Research Center, Cleveland, OH USA
On the Generation and Use of TCP Acknowledgments
Allman, Mark, NASA Lewis Research Center, USA; ACM Computer Communication Review; 1998, pp. 1-18; In English
Contract(s)/Grant(s): NAS3-27121; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents a simulation study of various TCP acknowledgment generation and utilization techniques. We investigate the standard version of TCP and the two standard acknowledgment strategies employed by receivers: those that acknowledge each incoming segment and those that implement delayed acknowledgments. We show the delayed acknowledgment mechanism hurts TCP performance, especially during slow start. Next we examine three alternate mechanisms for generating and using acknowledgments designed to mitigate the negative impact of delayed acknowledgments. The first method is to generate delayed ACKs only when the sender is not using the slow start algorithm. The second mechanism, called byte counting, allows TCP senders to increase the amount of data being injected into the network based on the amount of data acknowledged rather than on the number of acknowledgments received. The last mechanism is a limited form of byte counting. Each of these mechanisms is evaluated in a simulated network with no competing traffic, as well as a dynamic environment with a varying amount of competing traffic. We study the costs and benefits of the alternate mechanisms when compared to the standard algorithm with delayed ACKs.
Author
Transmitters; Receivers; Counting; Costs

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990026848 Naval Research Lab., Washington, DC USA
An Improved Limiter for Multidimensional Flux-Corrected Transport
DeVore, C. R.; Dec. 31, 1998; 22p; In English
Report No.(s): AD-A360122; NRL/MR/6440--98-8330; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An improved prescription is given for limiting ('correcting') the high-order fluxes in multidimensional, flux-corrected transport (FCT) algorithms. These fluxes are designed to reduce the numerical error in positive-definite, monotone solutions to the hydrodynamics equations. The role of the limiter is to ensure that the desirable positivity and monotonicity properties of the low-order solutions are not lost in the quest to minimize the numerical error. It is shown that Zalesak's (1979) formulation of a limiter for multidimensional FCT preserves positivity but not monotonicity. The introduction of a prelimiting step into his prescription, based on the original positive and monotone limiter of Boris and Book (1973), is proposed and is shown to improve significantly the performance of multidimensional ECT algorithms.
DTIC
Algorithms; Hydrodynamics; Correction; Transport Theory

19990027093 San Jose State Univ., School of Engineering, CA USA
Convolution Methods for Mathematical Problems in Biometrics
Frenzen, Christopher L.; Jan. 15, 1999; 10p; In English
Report No.(s): AD-A359925; NPS-MA-99-001; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Estimation of the impostor probability density function from the inter-template and template-sample probability density functions involves a multi-dimensional convolution of the latter density functions. We assume isotropy of the probability distribution functions and use the Fourier transform to express the convolution as a one-dimensional integral with a kernel given by a spherical Bessel function.
DTIC
Biometrics; Convolution Integrals; Integral Transformations; Probability Density Functions

19990027203 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Small fan-in is beautiful
Beiu, V., Department of Energy, USA; Makaruk, H. E., Department of Energy, USA; Sep. 30, 1997; 9p; In English; Computational intelligence; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-000277; LA-UR-97-3493; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The starting points of this paper are two size-optimal solutions: (1) one for implementing arbitrary Boolean functions; and (2) another one for implementing certain subclasses of Boolean functions. Because VLSI implementations do not cope well with highly interconnected nets -- the area of a chip grows with the cube of the fan-in -- this paper will analyze the influence of limited fan-in on the size optimality for the two solutions mentioned. First, the authors will extend a result from Horne and Hush valid for fan-in (Delta) = 2 to arbitrary fan-in. Second, they will prove that size-optimal solutions are obtained for small constant fan-ins for both constructions, while relative minimum size solutions can be obtained for fan-ins strictly lower that linear. These results are in agreement with similar ones proving that for small constant fan-ins ((Delta) = 6...9) there exist VLSI- optimal (i.e., minimizing AT(exp 2)) solutions, while there are similar small constants relating to the capacity of processing information.
NTIS
Boolean Functions; Optimization

19990027241 Rutherford Appleton Lab., Chilton, UK
Matrix Methods
Duff, Iain S., Rutherford Appleton Lab., UK; Nov. 24, 1998; ISSN 1358-6254; 26p; In English; Supercomputing, Collision Processes and Applications, 14-16 Sep. 1998, Belfast, UK
Report No.(s): RAL-TR-1998-076; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

We consider techniques for the solution of linear systems and eigenvalue problems. We are concerned with large-scale applications where the matrix will be large and sparse. We discuss both direct and iterative techniques for the solution of sparse

equations, contrasting their strengths and weaknesses and emphasizing that combinations of both are necessary in the arsenal of the applications scientist. We briefly review matrix diagonalization techniques for large-scale problems.
Author
Matrix Methods; Linear Systems; Eigenvalues

19990027325 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Recasting risk analysis methods in terms of object-oriented modeling techniques
Wyss, G. D., Department of Energy, USA; Craft, R. L., Department of Energy, USA; Vandewart, R. L., Department of Energy, USA; Funkhouser, D. R., Department of Energy, USA; Dec. 31, 1998; 10p; In English; 16th; System Safety, USA
Report No.(s): DE98-007099; SAND-98-1752C; CONF-980910; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

For more than two decades, risk analysts have relied on powerful logic-based models to perform their analyses. However, the applicability of these models has been limited because they can be complex and expensive to develop. Analysts must frequently start from scratch when analyzing a new (but similar) system because the understanding of how the system works exists only in the mind of the analyst and is only incompletely instantiated in the actual logic model. This paper introduces the notion of using explicit object-oriented system models, such as those embodied in computer-aided software engineering (CASE) tools, to document the analyst's understanding of the system and appropriately capture how the system works. It also shows that from these models, standard assessment products, such as fault trees and event trees, can be automatically derived.
NTIS
Object-Oriented Programming; Risk

19990027398 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Comparing Two Regression Methods Based on Different Principal Components
Wang, Huiwen, Beijing Univ. of Aeronautics and Astronautics, China; Yang, Xianghong, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 575-578; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

This paper deals with comparing two regression methods based on different principal components. The principal components acquired by principal component analysis are the best summary of the information in the independent variables' system, but generally are short of explaining the dependent variable. However, the components acquired by using PLS regression can not only summarize the independent variables well, but also they have the best explanation to the dependent variable. Moreover, the interference rom invalid information is eliminated at the same time.
Author
Principal Components Analysis; Regression Analysis

19990027400 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Traveling Waves of the Cahn-Hilliard Equation
Liu, Shenquan, Beijing Univ. of Aeronautics and Astronautics, China; Lu, Qishao, Beijing Univ. of Aeronautics and Astronautics, China; Qi, Wang, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 584-587; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The asymptotic perturbation method is used to deal with the Cahn-Hilliard equation and obtain the inner and outer solutions of traveling waves. The two solutions are matched into one solution of the equation. The feature of the method not only matches the inner and outer solutions of the higher order partial differential equation, but also satisfies the boundary condition and initial condition. After a long time evolution, the solutions of the Cahn-Hilliard equation have the structures of traveling waves as the limit states. The result in this paper can explain the theoretic and numerical simulation results of the Cahn-Hilliard equation. The properties of the model fit well with that of the equation.
Author
Asymptotic Methods; Perturbation Theory; Traveling Waves; Partial Differential Equations

19990027401 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Algorithm of Movie Transit Intersection Survey Via the Least Square Estimation

Yan, Shoufeng, Beijing Univ. of Aeronautics and Astronautics, China; Liu, Zhongkan, Beijing Univ. of Aeronautics and Astronautics, China; Lu, Fenghai; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 588-591; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

A method based on the least square estimation for movie transit rendezvous survey is proposed. In the conventional direct algorithm, it is not easy to control the switching time of two equations. This new method is an iterative algorithm, it can obtain the moving object's spatial location at anytime using the redundant data of three transits and avoid the question of two equation switch. Theoretical analyses and numeric simulations in the new choice of stations have shown that this method possesses the advantages in computation and fast convergence rate, compared with the conventional direct method. It can improve the measure precision of radar etc..

Author

Least Squares Method; Position (Location); Algorithms; Iterative Solution

19990027405 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Closed-Form Displacement Analysis of a Planar Fifth Class Group with Lower Pairs

Lin, Han, Beijing Univ. of Aeronautics and Astronautics, China; Liang, Chonggao, Beijing Univ. of Posts and Telecommunications, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 603-606; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The closed-form displacement analysis of one kind of planar fifth-class groups with 8 links and 12 lower pairs is solved by the method of combining vectors with complex numbers. First, the vector equations are established according to different loops. Then the equations are changed into the form of complex numbers. The problem is reduced to a single unknown equation after algebraic elimination. The input-output equation, which is proved to be a 42nd degree polynomial equation, is obtained. It shows that this construction of fifth-class groups has 42 structures. Lastly, a numerical example is studied. Four real roots are listed. The symbolic computation is carried out by the computer algebra system Mathematica.

Author

Group Theory; Complex Numbers; Polynomials; Kinematics

19990027450 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

Uncertainty Analysis Applied to Least Squares Curve and Surface Fits ***Final Report***

Hess, David E.; Smith, William E.; Dec. 1998; 37p; In English

Report No.(s): AD-A360063; NSWCCD-50-TR-1998/012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The application of uncertainty analysis to curve and surface fits obtained by the method of Least Squares is described. The primary obstacle to the routine implementation of the uncertainty analysis procedure: the derivation of the sensitivity derivatives, has been removed. Analytic expressions for the derivatives applicable to fits of arbitrary order have been derived, and a step-by-step procedure for their incorporation within a computer program provided. A review of the techniques for the construction of curve and surface fits of arbitrary order is included. The use of uncertainty analysis as an aid to the assessment of the suitability of a particular fit is demonstrated by the application of these procedures to a series of examples employing a generic data set typical of experimentally derived data. Some results include: quantification of the penalty for using a higher-order fit when it is not appropriate, and the fact that reduction of uncertainty in the data to be fitted is more effective at reducing the uncertainty in fit coefficients and fitted values than simply increasing the amount of data used to construct the fit. A computer program implementing these procedures is available from the authors.

DTIC

Least Squares Method; Computer Programs

19990027615 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Gas Evolution Dynamics in Godunov-Type Schemes and Analysis of Numerical Shock Instability ***Final Report***

Xu, Kun, Institute for Computer Applications in Science and Engineering, USA; January 1999; 20p; In English; Sponsored in part by the Hong Kong Research Grant Council

Contract(s)/Grant(s): NAS1-97046; RGC97/98.HKUST6166.97P; RTOP 505-90-52-01

Report No.(s): NASA/CR-1999-208985; NAS 1.26:208985; ICASE-99-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper we are going to study the gas evolution dynamics of the exact and approximate Riemann solvers, e.g., the Flux Vector Splitting (FVS) and the Flux Difference Splitting (FDS) schemes. Since the FVS scheme and the Kinetic Flux Vector Splitting (KFVS) scheme have the same physical mechanism and similar flux function, based on the analysis of the discretized KFVS scheme the weakness and advantage of the FVS scheme are closely observed. The subtle dissipative mechanism of the Godunov method in the 2D case is also analyzed, and the physical reason for shock instability, i.e., carbuncle phenomena and odd-even decoupling, is presented.
Author
Flux Vector Splitting; Flux Difference Splitting; Gas Evolution; Functional Analysis

19990027616 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Entropy Analysis of Kinetic Flux Vector Splitting Schemes for the Compressible Euler Equations ***Final Report***
Shiuhong, Lui, Hong Kong Univ. of Science and Technology, Hong Kong; Xu, Jun, Institute for Computer Applications in Science and Engineering, USA; January 1999; 16p; In English; Sponsored in part by the Hong Kong Research Grant Council
Contract(s)/Grant(s): NAS1-97046; RGC-HKUST6166/97P; RGC-HKUST726/96E; RTOP 505-90-52-01
Report No.(s): NASA/CR-1999-208981; NAS 1.26:208981; ICASE-99-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flux Vector Splitting (FVS) scheme is one group of approximate Riemann solvers for the compressible Euler equations. In this paper, the discretized entropy condition of the Kinetic Flux Vector Splitting (KFVS) scheme based on the gas-kinetic theory is proved. The proof of the entropy condition involves the entropy definition difference between the distinguishable and indistinguishable particles.
Author
Kinetic Theory; Differential Equations; Flux Vector Splitting; Euler Equations of Motion

19990027955 Department of Energy, Washington, DC USA
Investigation into the accuracy, stability and parallel performance of a highly stable explicit technique for stiff reaction-transport PDEs
Franz, A., Department of Energy, USA; Feb. 17, 1998; 90p; In English, USA
Report No.(s): DE98-058825; UCRL-LR-130400; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The numerical simulation of chemically reacting flows is a topic, that has attracted a great deal of current research. At the heart of numerical reactive flow simulations are large sets of coupled, nonlinear Partial Differential Equations (PDES). Due to the stiffness that is usually present, explicit time differencing schemes are not used despite their inherent simplicity and efficiency on parallel and vector machines, since these schemes require prohibitively small numerical stepsizes. Implicit time differencing schemes, although possessing good stability characteristics, introduce a great deal of computational overhead necessary to solve the simultaneous algebraic system at each timestep. This thesis examines an algorithm based on a preconditioned time differencing scheme. The algorithm is explicit and permits a large stable time step. An investigation of the algorithm's accuracy, stability and performance on a parallel architecture is presented.
NTIS
Accuracy; Stability; Parallel Processing (Computers); Stiffness; Partial Differential Equations

19990028240 North Carolina State Univ., Center for Research in Scientific Computation, Raleigh, NC USA
Computational Methods for Control in Partial Differential Equations ***Final Report, 1 Jun. 1995 - 31 May 1998***
Banks, H. T.; Jul. 13, 1998; 7p; In English
Contract(s)/Grant(s): F49620-95-1-0375; F49620-95-1-0236
Report No.(s): AD-A360519; AFRL-SR-BL-TR-99-0067; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Research efforts and achievements in the area of modeling and computational methods in distributed parameter physical systems are summarized. Significant progress is reported on projects involving: (1) modeling of hepatic uptake and elimination of dioxin, (2) modeling and parameter estimation in electromagnetic field/solid interactions, and (3) radio frequency bonding of adhesives.
DTIC
Mathematical Models; Partial Differential Equations; Distributed Parameter Systems

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing: Monte Carlo method; and stochastic processes.

19990028202 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Evaluating uncertainty in stochastic simulation models
McKay, M. D., Department of Energy, USA; Feb. 28, 1998; 6p; In English; 2nd; Sensitivity analysis of model output, USA
Report No.(s): DE98-003354; LA-UR-97-4503; CONF-980424; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper discusses fundamental concepts of uncertainty analysis relevant to both stochastic simulation models and deterministic models. A stochastic simulation model, called a simulation model, is a stochastic mathematical model that incorporates random numbers in the calculation of the model prediction. Queuing models are familiar simulation models in which random numbers are used for sampling interarrival and service times. Another example of simulation models is found in probabilistic risk assessments where atmospheric dispersion submodels are used to calculate movement of material. For these models, randomness comes not from the sampling of times but from the sampling of weather conditions, which are described by a frequency distribution of atmospheric variables like wind speed and direction as a function of height above ground. A common characteristic of simulation models is that single predictions, based on one interarrival time or one weather condition, for example, are not nearly as informative as the probability distribution of possible predictions induced by sampling the simulation variables like time and weather condition. The language of model analysis is often general and vague, with terms having mostly intuitive meaning. The definition and motivations for some of the commonly used terms and phrases offered in this paper lead to an analysis procedure based on prediction variance. In the following mathematical abstraction the authors present a setting for model analysis, relate practical objectives to mathematical terms, and show how two reasonable premises lead to a viable analysis strategy.
NTIS
Stochastic Processes; Probability Theory

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990027442 Naval Research Lab., Washington, DC USA
Mechanical Verification of Timed Automata: A Case Study
Archer, Myla; Heitmeyer, Constance; Dec. 31, 1998; 78p; In English
Report No.(s): AD-A359891; NRL/MR/5540--98-8180; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes the results of a case study on the feasibility of developing and applying mechanical methods, based on the proof system PVS, to prove propositions about real-time systems specified in the Lynch-Vaandrager timed automata model. In using automated provers to prove propositions about systems described by a specific mathematical model, both the proofs and the proof process can be simplified by exploiting the special properties of the mathematical model. Because both specifications and methods of reasoning about them tend to be repetitive, the use of a standard template for specifications, accompanied by repetitive, the use of a standard template for specifications, accompanied by standard shared theories and standard proof strategies or tactics, if often feasible. Presented are the PVS specification of three theories that underlie the timed automata model, a template for specifying timed automata models in PVS, and an example of its instantiation. Both hand proofs and the corresponding PVS proofs of two propositions are provided to illustrate how these can be made parallel at different degrees of granularity. Our experience in applying PVS to specify and reason about real-time systems modeled as timed automata is also discussed. The methods for reasoning about timed automata in PVS developed in the study have evolved into a system called TAME (Timed Automata Modeling Environment). A summary of recent developments regarding TAME is provided. A shorter version of the report was presented at the 1997 Real-Time Applications Symposium.
DTIC
Automata Theory; Real Time Operation; Mathematical Models

19990027562 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
The Air Operations Simulation Centre Audio System
Worl, Reg, Defence Science and Technology Organisation, Australia; Apr. 1998; 37p; In English
Report No.(s): DSTO-GS-0172; DODA-AR-010-512; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The Air Operations Division at the Aeronautical and Maritime Research Laboratory has established the Air Operations Simulation Centre for conduct of manned aircraft flight simulations. An audio system has been developed to deliver sound effects during simulations and to provide audio communications between manned stations. This report describes the hardware and software components of the audio system.
Author
Flight Simulation; Stations; Audio Equipment

19990027846 Ministry of Univ. and Scientific and Technological Research, Instituto Nazionale de Ottica, Italy
Control of Chaos: New Perspectives in Experimental and Theoretical Science, Part 2
Arecchi, F. T.; Boccalettt, S.; Ciofini, M.; Grebogi, ZG.; Meucci, R.; Sep. 1998; 118p; In English, 16-18 May 1997, USA
Contract(s)/Grant(s): F61708-97-W-0108
Report No.(s): AD-A359775; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Final Proceedings for Control of Chaos: New Perspectives In Experimental and Theoretical Science. 16 May 1997 - 18 May 1997 nonlinear. adaptive and robust control; synchronization of chaotic processes; and applications of control of chaos in science and technology. The discipline of chaos has created a universal paradigm, a scientific parlance, and a mathematical tool for grappling with collinear phenomena. In every field of the applied sciences (astronomy, atmospheric sciences, biology, chemistry, economics, geophysics, life and medical sciences, physics, social sciences, zoology, etc.) and engineering (aerospace, chemical, civil, computer, information, mechanical, software, telecommunication, etc.) the local and global manifestations of Chaos and Bifurcation have burst forth in an unprecedented universality, linking scientists heretofore unfamiliar with one another's fields, and offering an opportunity to reshape our grasp of reality. The primary objective of this journal is to provide a single forum for this multidisciplinary discipline - a forum specifically designed for an interdisciplinary audience, a forum accessible and affordable to all. Real-world problems and applications will be emphasized. Our goal is to bring together, in one periodical, papers of the highest quality and greatest importance on every aspect of nonlinear dynamics, phenomena, modeling, and complexity, thereby providing a focus and catalyst for the timely dissemination and cross-fertilization of new ideas, principles, and techniques across a broad interdisciplinary front.
DTIC
Chaos; Conferences; Adaptive Control; Synchronism

67
THEORETICAL MATHEMATICS

Includes topology and number theory.

19990027740 Geophysical Observatory, Helsinki, Finland
Differential Fields and Complex Differential Equations
Rieppo, Jarkko, Joensuu Univ., Finland; Lehto, Olli, Editor, Helsinki Univ., Finland; 1998; ISSN 1239-6303; 37p; In English
Report No.(s): Rept-118; ISBN 951-41-0853-1; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper is a study on differential fields and complex differential equations. This study does not require any deep results of the differential field theory. In addition to Nevanlinna theory and the complex differential equations, only the fundamental concepts related to differential fields are needed.
CASI
Field Theory (Algebra); Differential Equations

19990027741 Geophysical Observatory, Helsinki, Finland
On Nonhomogeneous Quasilinear Elliptic Equations
Zhong, Xiao, Jyvaskyla Univ., Finland; Lehto, Olli, Editor, Helsinki Univ., Finland; 1998; 46p; In English
Report No.(s): Rept-117; ISBN 951-41-0852-3; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this work, we first study the existence and uniqueness of solution to the quasilinear elliptical equation. We construct a Lipschitz continuous test-function by using a pointwise inequality for Sobolev functions in terms of the maximal function. We also study the continuity of solutions of these equations in terms of their integration domains.
Derived from text
Elliptic Functions; Lipschitz Condition; Nonlinearity; Inhomogeneity

19990027742 Geophysical Observatory, Helsinki, Finland
On Some Classes of Meromorphic Functions
Wulan, Hasi, Joensuu Univ., Finland; Lehto, Olli, Editor, Helsinki Univ., Finland; 1998; ISSN 1239-6303; 56p; In English
Report No.(s): Rept-116; ISBN 951-41-0848-5; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper is a study of certain classes of meromorphic functions corresponding to several important spaces of analytic functions. Sections of this paper includes: Carleson type measures; Spherical Besov classes; and The meromophic classes N(sup alpha).
CASI
Meromorphic Functions; Analytic Functions; Banach Space

19990027919 Geophysical Observatory, Helsinki, Finland
Numerical Approximation of Bicanonical Embedding
Smolander, Pekka, Joensuu Univ., Finland; Lehto, Olli, Editor, Helsinki Univ., Finland; 1998; ISSN 1239-6303; 50p; In English; Sponsored in part by the Finnish Cultural Foundation
Report No.(s): Rept-119; ISBN 951-41-0854-X; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we study the approximation of the bicanonical embedding in detail. Our method involves an approximation of a basis for holomorphic quadratic differentials. The approximation is based on the construction of S. Wolpert, which gives a basis of holomorphic quadratic differentials in terms of relative Poincare series, called the Petersson series. We also generalize the method given for symmetric Riemann surfaces, given by Fuchsian groups of the second kind, and derive error estimates for the approximations.
Derived from text
Approximation; Analytic Functions; Embedding

70
PHYSICS (GENERAL)

For precision time and time interval (PTTI) see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

19990027402 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Modal Bifurcations and Stability Analysis of a Nonconservative Nonlinear Coupled System
Gan, Chunbiao, Beijing Univ. of Aeronautics and Astronautics, China; Lu, Qishao, Beijing Univ. of Aeronautics and Astronautics, China; Huang, Kelei, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 592-595; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

This paper deals with a coupled nonlinear Van der Pol oscillator system with linear coupled elastic terms. The dissimilar modes and their bifurcations have been discussed by modal analysis. Moreover, the stabilities and the superposition of the dissimilar modes have also been analyzed theoretically and numerically. It is shown that the modal superposition can effectively simulate the system's attenuation effects. The theoretical results are compared with the numerical results and it is found that very small errors exist between them. However, when the parameter of the system passes through some value, the Hopf bifurcation takes place and a stable limit cycle arises in the modal equation of the system, and as a result, the modal superposition loses its efficacy, especially in their phase positions.
Author
Nonlinear Systems; Modal Response; Systems Stability

19990027421 Virginia Univ., Dept. of Physics, Charlottesville, VA USA

Dipole-Dipole Interactions in a Frozen Rydberg Gas

Lowell, John R.; May 1998; 142p; In English

Report No.(s): AD-A359916; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

We investigate here the characteristics of energy resonant dipole-dipole interactions between Rydberg atoms in Magneto-Optical Trap. These resonant processes occur in a kinetic energy regime in which the atoms may be considered stationary over the time scale of the experiment. Coupled with the long range of the interactions considered, this leads to multi-atom interactions becoming non-negligible. A simple model is outlined to provide insight into the effects of these multi-atom interactions which lead to some interesting behaviors. Experiments which examine the broadening of the dipole-dipole resonances and observe the time dependence of the interaction signal are discussed. Examination of adiabatic character of population transfer caused by slewing across the resonance is discussed in another experiment, as is the scaling behavior of the resonance linewidths and on-resonant signal growth rates. We end by discussing an experiment which takes advantage of some of the characteristics of these interactions to measure the tensor polarizability of Rydberg states of Rb.

DTIC

Dipoles; Gases; Atoms; Magneto-Optics; Quantum Theory; Rydberg Series; Atomic Interactions

19990027595 Mississippi Univ., Dept. of Electrical Engineering, University, MS USA

Applied Computational Electromagnetics Society Journal and Newsletter, Volume 14 No. 1

Mar. 1999; 87p; In English

Report No.(s): AD-A360697; ISSN 1054-4887; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Applied Computational Electromagnetics Society Journal hereinafter known as the ACES Journal is devoted to the exchange of information in computational electromagnetics, to the advancement of the state-of-the-art, and to the promotion of related technical activities. A primary objective of the information exchange is the elimination of the need to ”re-invent the wheel” to solve a previously-solved computational problem in electrical engineering, physics, or related fields of study. The technical activities promoted by this publication include code validation performance analysis, and input/output standardization; code or technique optimization and error minimization; innovations in solution technique or in data input/output; identification of new applications for electromagnetics modeling codes and techniques; integration of computational electromagnetics techniques with new computer architectures; and correlation of computational parameters with physical mechanisms.

DTIC

Computational Electromagnetics; Electrical Engineering; Electromagnetism; Reliability Analysis

19990027758 Rutherford Appleton Lab., Chilton, UK

Bounds on Anomalous Gauge Couplings from Past and Near Future Experiments: The Role of the Different Measurements

Beccaria, M., Lecce Univ., Italy; Renard, F. M., Montpellier-2 Univ., France; Spagnolo, S., Rutherford Appleton Lab., UK; Verzegnassi, C., Lecce Univ., Italy; Oct. 21, 1998; ISSN 1358-6254; 14p; In English

Contract(s)/Grant(s): CHRX-CT94-0579

Report No.(s): RAL-TR-1998-068; PM/98-19; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Diccot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

We analyze the bounds on the set of four ”non-blind” anomalous gauge couplings that will be derived, in absence of deviations from the Standard Model predictions, from near future measurements at LEP2 and at the TEVATRON. The bounds are obtained by combining these negative results with those already available from LEP1 and from atomic parity violation experiments. In this process, the information coming from LEP2 is treated using a recently proposed (”Z-peak subtracted”) theoretical approach. This makes it easier to identify the specific role that the different experiments play in this determination, in the spirit of a recent previous investigation for the set of three ”blind” couplings.

Author

Couplings; Gauge Theory; Research

19990027793 California Univ., Center for High Frequency Electronics, Los Angeles, CA USA
Joint Services Electronics Program on Millimeter Wave Electronics ***Final Report***
Itoh, Tatsuo; Jan. 04, 1999; 104p; In English
Contract(s)/Grant(s): F49620-98-1-0088
Report No.(s): AD-A360035; AFRL-SR-BL-TR-99-0042; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This technical report summarizes activities of five (5) research units of UCLA JSEP during 1998 and serves as the Final Technical Report. The short length of the present research program is mainly dedicated to successful "close down" of the JSEP effort. by its nature, we have done the following: (1) We have tried to complete the technical project with graduate students completing their degree requirements. (2) Substantial effort has been expended to find out the method to transition the technical projects to industry and government agencies. (3) Extrapolation of the research effort has been used to initiate newly funded research projects. For instance, some of the JSEP findings are extended and included in some of the MURI programs at UCLA.
DTIC
Electrical Engineering; Solid State Devices; Millimeter Waves

19990027866 Department of Energy, Office of Energy Research, Washington, DC USA
Shared research equipment at Oak Ridge National Laboratory
Evans, N. D., Department of Energy, USA; Kenik, E. A., Department of Energy, USA; Miller, M. K., Department of Energy, USA; Feb. 28, 1998; 4p; In English; Microscopy and Microanalysis 1998, 1998, USA
Report No.(s): DE98-005022; ORNL/CP-96512; CONF-980713; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Shared Research Equipment (SHaRE) User Facility and Program at Oak Ridge National Laboratory (ORNL) provides microanalytical facilities for studies within the materials sciences. Available instrumentation includes advanced analytical electron microscopes, atom probe field ion microscopes, and nanoindentation facilities. Through SHaRE, researchers from US universities, industries, and government laboratories may collaborate with Facility scientists to perform research not possible at their home institutions. International collaborations are also possible. Most SHaRE projects seek correlations at the microscopic or atomic scale between structure and properties in a wide range of metallic, ceramic, and other structural materials. Typical research projects include studies of magnetic materials, advanced alloys, catalysts, semiconductor device materials, high Tc superconductors, and surface-modified polymers. Projects usually involve one or more external researchers visiting the SHaRE Facility for up to three weeks during the fiscal year (October 1--September 30). Project approval is based upon the scientific excellence and relevance of proposed collaborative research. Operating time is available without charge to researchers who intend to publish their results in the open literature. Additionally, proprietary research can be accomplished on either a full cost-recovery basis or by Cooperative Research and Development Agreements (CRADAs). Analytical services (service microscopy) which can be purchased from commercial laboratories are not offered by SHaRE. Detailed information regarding the SHaRE User Facility, available instrumentation, travel support, faculty fellowships, and how users access these is available at http://www.ornl.gov/share.
NTIS
Electron Microscopes; High Temperature Superconductors; Ion Microscopes; Microanalysis; Research Facilities; Materials Science

19990028201 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Equilibrium free energies from nonequilibrium processes
Jarzynski, C., Department of Energy, USA; Oct. 29, 1997; 21p; In English; Statistical Physics, USA
Report No.(s): DE98-003355; LA-UR-97-4506; CONF-9709212; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A recent result, relating the (irreversible) work performed on a system during a non quasistatic process, to the Helmholtz free energy difference between two equilibrium states of the system, is discussed. A proof of this result is given for the special case when the evolution of the system in question is modeled by a Langevin equation in configuration space.
NTIS
Free Energy; Nonequilibrium Conditions

71
ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see 45 Environmental Pollution.

19990027060 Institute TNO of Applied Physics, Delft, Netherlands
Statistical Energy Analysis Applied to Ship-Like Structures, Part 1, Air-Borne Noise Radiation
Termeer, M. K., Institute TNO of Applied Physics, Netherlands; deJong, C. A. F., Institute TNO of Applied Physics, Netherlands; Jul. 07, 1998; 62p; In English; Original contains color illustrations
A97/KM/132; TNO Proj. 827.215
Report No.(s): TD98-0116; HAG-RPT-980080; Copyright; Avail: Issuing Activity (TNO Inst. of Applied Physics, Stieltjesweg 1, P.O. Box 155, 2600 AD Delft, The Netherlands), Hardcopy, Microfiche

This report investigates the applicability of Statistical Energy Analysis (SEA) as a prediction tool for the underwater noise radiation of ships due to structure-borne sound from machinery. A brief introduction to the theory of SEA is given and the SEA-modelling approach is discussed. SEA-predictions are compared to measurements of a single and triple section ANTEASR model. Topics of investigation are input mobilities, energy distribution and the sound radiation to air. In future research sound radiation to water will be investigated.
Author
Statistical Analysis; Energy; Research; Sound Waves; Underwater Acoustics

19990027238 Institute for Human Factors TNO, Soesterberg, Netherlands
A Review of Research on the Annoyance Caused by Shooting Sounds *Final Report Een overzicht van onderzoek naar de hinder van schietgeluid*
Vos, J., Institute for Human Factors TNO, Netherlands; Sep. 16, 1998; 82p; In Dutch
Contract(s)/Grant(s): A97/RIM/303; TNO Proj. 786.3
Report No.(s): TD98-0260; TM-98-A050; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, PO Box 23, 3769 DE Soesterberg, The Netherlands), Hardcopy, Microfiche

Under contract with the Ministry of Defence, the present study reviews the existing knowledge about the annoyance caused by shooting sounds. Results from many new field and laboratory studies published in the last decade, and, especially for the sounds produced by medium-large and large firearms, new insights into the annoyance caused by single events, necessitated an update of a previous review [Vos, IZF-report 1985-24; see also Proceedings Internoise '85, Vol. 2, pp. 1029-1032]. For the community response to artillery sounds, six new field surveys were studied. The availability of the raw data from three of these surveys enabled the performance of necessary re-analyses. The previously reviewed information about the noise annoyance caused by small fire-arms was supplemented with the data from now field and laboratory studies as well. The new insights into the subjective effects of shooting sounds were based on new laboratory study results, including those obtained in extensive studies designed at our own institute. From the present review the following conclusions could be drawn: (l) for the prediction of the annoyance, the dose of single impulses is sufficiently characterized by its sound exposure level ISEL); (2) if, for shooting sounds with relatively little energy in the low frequency bands (produced mainly by pistols and rifles), only the A-weighted sound exposure level (ASEL) is available, the rating sound level L, might be approximated rather well by the A-weighted yearly average sound level to which a correction of 12 dB is added; (3) if, for shooting sounds with relatively much energy in the low frequency bands, such as those produced by medium-large (e.g., 25 mm cannons and large firearms (e.g., mortars and howitzers), only C-weighted sound expo-sure level (CSEL) is available, L might only to a limited extent be approximated by the C- weighted yearly average sound level; moreover, a correction of 5 dB should be added to this level. If a considerable portion of shooting takes place in the night-time, a correction greater than 5 dB might be needed; (4) for all shooting sounds, L, should preferably be based on ASEL and CSEL, where the predictability of the expected annoyance on the basis of ASEL can be considerably increased by adding not only a constant of about 12 dB, but also adding the weighted product (CSEL-ASEL)ASEL. For a single impulsive event L = L(sub AE) + beta(L(sub CE) - L(sub AE)(L(sub AE)-alpha) + 12 dB; and (5) especially one of the new field surveys on the community response to artillery shooting sounds was considered being appropriate for the validation of the latter procedure.
Author
Research; Dosage; Low Frequencies; Sound Intensity; Sound Propagation; Conferences; Acoustic Velocity

19990027304 Institute of Sound and Vibration Research, Fluid Dynamics and Acoustics Group, Southampton, UK

Estimation of Acoustic Source Strength by Inverse Methods, Part 2, Methods for Choosing Regularisation Parameters

Yoon, S. H., Institute of Sound and Vibration Research, UK; Nelson, P. A., Institute of Sound and Vibration Research, UK; October 1998; In English

Report No.(s): ISVR-TR-279; Copyright; Avail: Issuing Activity (Institute of Sound and Vibration Research, University of Southampton, Southampton SO17 1BJ, UK), Hardcopy, Microfiche

Two regularization methods, Tikhonov regularization and singular value discarding, are used to improve the accuracy of reconstruction of acoustic source strength by inverse techniques. In this report, some methods are investigated for choosing the Tikhonov regularization parameter and the singular values to be discarded. of these, we concentrate on the use of ordinary cross-validation and generalised cross-validation. These methods can provide an appropriate regularization parameter without prior knowledge of either the acoustic source strength or the contaminating measurement noise. Some computer simulation results obtained using a model of a randomly vibrating simply supported plate mounted in an infinite baffle are presented to illustrate the performance of the methods for choosing the regularization parameters.

Author

Estimating; Acoustic Emission; Noise (Sound); Acoustic Measurement; Thermal Stresses

19990027424 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

The Arccos and Lommel Diffraction Formulations: An Approximate Fourier Transform Pair Leading to A Unified Theory of Spatially Averaged Diffraction Corrections for Ultrasonic Piston Transducers Operating in Pulsed Mode

Daly, Charles J.; Jan. 1998; 174p; In English

Report No.(s): AD-A359928; AFIT-FY99-44; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This work has three goals. The first is to derive closed-form spatially averaged two-way diffraction corrections for focused piston transducers operating in pulsed mode. The goal is attained by: (1) establishing that the arccos and Lommel diffraction formulations form an approximate Fourier transform pair and (2) exploiting this newly established Fourier equivalence in rigorous and original derivations of spatially averaged diffraction corrections for one-way and two-way diffraction. In addition to the first goal, this research has two larger goals. The first is to develop a unified theory of spatially averaged diffraction corrections for piston transducers. The second is to advance the scientific community's understanding of diffraction from a circular aperture, a ubiquitous and fundamental physical problem. When viewed in its entirety, this research attains these larger goals by presenting rigorous derivations and original analyses that unify and extend existing theory with generalized results and fresh insights. Finally, an aspect of the unified theory is tested in a practical application. Specifically, two-way diffraction corrections are applied to ultrasonic data obtained from laboratory experiments. The diffraction corrections are implemented as time-varying filters using a short-time Fourier technique known as the weighted overlap-add method. Raw and diffraction-corrected RF data are quantitatively compared via spectral centroids, and B-mode images are reconstructed from diffraction-corrected data.

DTIC

Ultrasonics; Diffraction; Pistons; Ultrasonic Wave Transducers; Ultrasonic Radiation; Surface Acoustic Wave Devices

19990027524 Italian Aerospace Research Center, C.I.R.A. S.c.p.A., Capua, Italy

Number and Placement Optimisation of Active Devices in a Noise Active Control System

Concilio, A., Italian Aerospace Research Center, Italy; DeVivo, L., Italian Aerospace Research Center, Italy; Multidisciplinary Design and Optimisaton: Proceedings; 1998, pp. 17.1 - 17.12; In English; See also 19990027508; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Active sound control systems have been recently used, aimed at noise suppression inside turboprop aircraft. The final aim is to substitute or integrate the classical passive methods, inside a novel design philosophy able to consider the problems related to noise aspects, especially the design to noise approach. Recent studies have demonstrated the non-direct correlation between the vibration and the sound field. As a consequence a system referring to sound figures and structural actuators, should be implemented according to the well-known Acoustostructural active control strategy (ASAC). Acoustic fields may be taken into account as suggested by the Control of sound by vibration suppression (CONVIS) approach. Whatever is the method, the performance of the active control arrangement is strictly related to the placement of the selected actuators and sensors. The work presented deals with a multi-tonal attenuation problem in a typical bare propeller aircraft fuselage: three different frequencies, corresponding to the Blade Passage Frequencies and its first two harmonics; a two-dimensional Finite Element representation of the fuselage section has been investigated. A standard feed forward non-adaptive algorithm is used. Piezoceramic actuators and microphones are implemented as active devices. The best placement of both the actuators and the sensors is derived by means of GENALG a numerical code, genetic algorithm based program. Its peculiarities and ability in solving the optimization problem for a very high number

of discrete possible solutions, leads to the possibility of performing a parametric analysis aimed at pointing out the best number of both actuators and sensors.
Author
Acoustics; Active Control; Finite Element Method; Genetic Algorithms; Noise Reduction; Propellers; Turboprop Aircraft; Aerodynamic Noise; Computer Aided Design; Optimization

19990027748 Washington Univ., Applied Physics Lab., Seattle, WA USA
Ray Tracing for Ocean Acoustic Tomography
Dushaw, Brian D.; Colosi, John A.; Dec. 1998; 39p; In English; Sponsored in part by Grant MDA972-93-1-003
Contract(s)/Grant(s): N00014-97-1-0259
Report No.(s): AD-A360612; APL-UW-TM-3-98; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes a new, flexible computer code in the FORTRAN computer language to make ray calculations for ocean acoustic tomography. The Numerical Recipes software package provided the basis for much of this computer code. The ray equations are reviewed, and ray equations that include the effects of ocean current are derived. Methods are derived for rapidly integrating those equations to obtain time front and eigenray information for long-range, deep-water acoustic transmissions. These methods include a look-up table for sound speed, sound speed gradient, second derivative of sound speed, and range-dependent information. Cubic spline methods are used to interpolate sound speed with depth and to obtain the derivatives of sound speed. The choice of the step size increments used to integrate the equations is a critical aspect of the integration, affecting both the accuracy of the prediction and the speed of computation. A predetermined, user-specified step size appears to allow more efficient calculations than"adaptive step" methods. "Adaptive step" methods adjust the step size automatically to maintain a given accuracy in the integration of the ray equations, while user-specified step sizes allow one to use prior knowledge of the integration problem to achieve the desired accuracy with much less computational overhead. Several integration methods were explored, but the classical 4th order Runge-Kutta method appears to be the most efficient and best method for this integration problem. Appendices describe detailed aspects of the computer code, as well as the methods used for deriving eigenray information and for parallelizing the ray calculations. The computer code is designed to be unstable so that the user can easily modify it to his or her own purposes.
DTIC
Ray Tracing; Underwater Acoustics; Acoustic Velocity; Applications Programs (Computers); Computer Programs

19990027856 Naval Postgraduate School, Monterey, CA USA
Acoustic-Induced Drag on a Bubble
Chan, Eugene J.; Mar. 1999; 40p; In English
Report No.(s): AD-A360380; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This work reports experiments that show that the drag on a bubble can be modified by the presence of isotropic, homogeneous broadband acoustic noise, when the band overlaps the bubble's resonance width. This constitutes an acoustic analog to the Einstein-Hopf drag on an electromagnetic dipole oscillator in the presence of isotropic and homogeneous electromagnetic fluctuations. In contrast with the electromagnetic Einstein-Hopf drag, band-limited acoustic noise can reduce the drag when the lower frequency of the spectrum coincides with the resonant frequency of the bubble. The modification of the drag experienced by a bubble in the presence of acoustic noise suggests possible applications to bubble migration and to heat transfer in a two-phase fluid. Depending on its size (i.e., resonant frequency), a bubble will experience less or more drag when the fluid is insonified with broadband noise, thereby modifying and possibly controlling bubble migration and heat transfer.
DTIC
Bubbles; Drag Reduction; Experimentation; Ultrasonic Radiation; Resonant Frequencies; Noise (Sound); Induced Drag; Acoustic Properties

19990027857 Washington Univ., Applied Physics Lab., Seattle, WA USA
Final Report on Analysis and Modeling of ASREX Results
Thorsos, Eric I.; Oct. 12, 1998; 37p; In English
Report No.(s): AD-A360400; N00014-96-1-0063; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research was conducted on analysis and modeling of low frequency sea surface scattering data obtained during the Acoustic Surface Reverberation Experiment (ASREX) conducted between December 1993 and March 1994 in the North Atlantic. This research contributed to the development of more accurate scattering models for the mean scattering level as a function of environmental conditions. A second result was to understand the statistical distribution of the backscattered intensity.
DTIC
Backscattering; Acoustic Scattering; Research; Data Acquisition; Low Frequencies; Ocean Surface

19990028192 Institute of Sound and Vibration Research, Fluid Dynamics and Acoustics Group, Southampton, UK

Estimation of Acoustic Source Strength by Inverse Methods, Part 3, Experiments

Yoon, S. H., Institute of Sound and Vibration Research, UK; Nelson, P. A., Institute of Sound and Vibration Research, UK; October 1998; 56p; In English

Report No.(s): ISVR-TR-280; Copyright; Avail: Issuing Activity (Institute of Sound and Vibration Research, University of Southampton, Southampton SO17 1BJ, UK), Hardcopy, Microfiche

Experiments on the reconstruction of acoustic source strengths by inverse methods are conducted by using a randomly vibrating simply supported plate mounted in a finite baffle. The acoustic source strength distribution is constructed by using measurements of the radiated pressure field and assumed transfer functions between the elements of the vibrating plate and the acoustic pressure at the measurement positions. The least squares method is used for both well- and ill-conditioned experimental models. Regularization methods such as Tikhonov regularization and singular value discarding are employed to enhance the accuracy of reconstruction for the ill-conditioned experimental models. The Tikhonov regularization parameter and the singular values to be discarded are determined by using the generalised cross-validation technique. These methods are found to enhance considerably the accuracy of source strength reconstruction when the problem is ill-conditioned.

Author

Acoustic Emission; Estimating; Experimentation

19990028193 Southampton Univ., Fluid Dynamics and Acoustics Group, UK

A Method for the Efficient Construction of Acoustic Pressure Cross-Spectral Matrices

Yoon, S. H., Southampton Univ., UK; Nelson, P. A., Southampton Univ., UK; October 1998; In English

Report No.(s): ISVR-TR-281; Copyright; Avail: Issuing Activity (Inst. of Sound and Vibration Research, Univ. of Southampton, Southampton SO17 1BJ, England), Hardcopy, Microfiche

A method is presented for constructing, with the minimum number of physical measurements, the full cross-spectral matrix of acoustic pressures associated with a number of measurement positions. It is necessary to evaluate the elements of the matrix in question when using inverse methods for the reconstruction of acoustic source strength spectra. The method presented uses the concept of ”reference microphones”. The relation between the rank of the cross-spectral matrix of acoustic pressures and the number of uncorrelated acoustic sources is discussed and used to determine the required number of reference microphones. A method is proposed for selecting this number in the inverse problem in which information regarding acoustic sources is unknown. The results of computer simulations are presented which explore the main features of the technique under various conditions. Experimental results are also presented which validate the technique.

Author

Computerized Simulation; Procedures; Sound Pressure; Construction

19990028237 Institute of Sound and Vibration Research, Fluid Dynamics and Acoustics Group, Southampton, UK

Estimation of Acoustic Source Strength by Inverse Methods, Part 1, Conditioning of the Inverse problem

Nelson, P. A., Institute of Sound and Vibration Research, UK; Yoon, S. H., Institute of Sound and Vibration Research, UK; October 1998; In English

Report No.(s): ISVR-TR-278; Copyright; Avail: Issuing Activity (Institute of Sound and Vibration Research, University of Southampton, Southampton SO17 1BJ, UK), Hardcopy, Microfiche

This report deals with the discrete inverse problem in acoustics. It is assumed that a number of acoustic sources are located at known spatial positions and that the acoustic pressure is measured at a number of spatial positions in the radiated field. The transfer functions relating the strengths of the acoustic sources to the radiated pressures are also assumed known. In principle, the strengths of the acoustic sources can be deduced from the measured acoustic pressures by inversion of this matrix of transfer functions. The accuracy of source strength reconstruction (in the presence of noise which contaminates the measured pressures) is crucially dependent on the conditioning of the matrix to be inverted. This report examines the conditioning of this inverse problem, particularly with regard to the geometry and number of sources and measurement positions and the non-dimensional frequency. A preliminary investigation is also presented of methods such as Tikhonov regularization and singular value discarding which can improve the accuracy of source strength reconstruction in poorly conditioned cases. Results are also presented which enable the solution of the inverse problem when the time histories of the acoustic sources are time-stationary random processes and the spectra and cross-spectra are measured at a number of positions in the radiated field. The report illustrates the possibilities and limitations of the use of inverse methods in the deduction of acoustic source strength from radiated field measurements.

Author

Estimating; Acoustics; Transfer Functions; Random Processes; Inversions

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990026828 Department of Energy, Office of Energy Research, Washington, DC USA
Search for new particles in multijet final states at the Tevatron
Dorigo, T., Department of Energy, USA; Aug. 31, 1997; 11p; In English; 12th; Hadrons in Collisions
Report No.(s): DE97-054155; FNAL/C-97/281-E; CONF-9706103-2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We present the latest results of the searches for new particles in hadronic final states performed in p(anti p) collisions at (radical)s = 1.8 TeV. The large data samples collected with the Collider Detector at Fermilab (CDF) and D0 detectors at the Tevatron collider between 1992 and 1995 allow searches for low cross section phenomena in dijet and multijet events, despite the hindrance of the high background from normal Quantum Chromodynamics (QCD) processes. However no signal for new physics is found, and the data show good agreement with QCD. Limits on the mass and on the cross section of the searched states can thus be set. NTIS
Particles; Hadrons

19990026850 Department of Energy, Office of Energy Research, Washington, DC USA
Measurement of color transparency by C(p,2p) reactions at large momentum transfer
Carroll, A. S., Department of Energy, USA; Dec. 31, 1997; 6p; In English; 7th; Hadron Spectroscopy, USA
Report No.(s): DE98-004428; BNL-65030; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The subject of color transparency, the enhancement of the ability of hadrons to penetrate nuclear matter by kinematic selection, is both interesting and controversial. The description of the collision of hadrons with nucleons inside nuclei, and the connection with initial and final state interactions involve fundamental questions of quantum mechanics, and nuclear and particle physics. Interest in color transparency was greatly increased by AGS Experiment 834 which observed dramatic changes with incident momentum for a variety of nuclei. A new experiment, E850, has studied the (p,2p) quasi-elastic reaction near 90 deg.cm for momenta between 5.9 and 9 GeV/c. The quasi-elastic reaction was compared to the elastic reaction on free protons to determine the transparency. With limited statistics, but with better kinematic definition in a new detector, the authors have confirmed the rise in Carbon transparency ratio seen in Expt 834. The Tr(D/H) for deuterium is consistent with no energy dependence. Unlike the free d(sigma)/dt for hydrogen, the d(sigma)/dt from protons in a nucleus is consistent with the exact s(sup -10) scaling. This suggests two components to the pp scattering amplitude; one small and perturbative, the other spatially large and varying, but filtered away by the nuclear matter in the Carbon nucleus. The plan is to complete the repairs of the superconducting solenoid early this fall, reassemble the detector, and collect data starting next spring.
NTIS
Protons; Hadrons; Elementary Particle Interactions; Color; Nuclear Particles

19990026863 Department of Energy, Office of Energy Research, Washington, DC USA
Evidence of K(+) yields pi(+)nu(anti nu): The BNL E787 1995 result (How did we get here)
Chiang, I. H., Department of Energy, USA; Feb. 28, 1998; 15p; In English; Kaon, Muon and Neutrino Physics and the Future at High Energy Accelerator Research Organization (KEK), USA
Report No.(s): DE98-004472; BNL-65258; CONF-9710190; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The kaon was studied very thoroughly since its discovery some 50 years ago. In the study of charged kaon branching ratios, it was noticed that K(+) yields pi(0)e(+)nu(e) is allowed while K(+) yields pi(+)nu(anti nu) is not. The latter was then empirically classified as a forbidden decay, leading to the so called strangeness changing current rule. The decay K(+) yields pi(0)e(+)nu(e) is mediated by the strangeness changing charged current and its branching ratio is 4.8%. by contrast K(+) yields pi(+)nu(anti nu) is a strangeness changing neutral current, which is forbidden. In 1970, the GIM model was introduced to explain this effect and in 1974, Gaillard and Lee calculated the K(+) yields pi(+)nu(anti nu) branching ratio to be on the order of 10(sup -10). In the current theory, the K(+) yields pi(+)nu(anti nu) is mediated by a Flavor Changing Neutral Current (FCNC) in which the cancellation of the three quark generations should be complete down to second order except for the difference in the quark masses. The top quark is much heavier than the charm and up quarks, so that the cancellation is not complete. In other words, this decay is more dependent on the top sector. The measurement of K(+) yields pi(+)nu(anti nu) branching ratio measures the modulus of the V(sub td) element

of the CKM Matrix. The 1995 results of E787 were published in 1997. This report is focused on how the author achieved the goal of detecting events with such as small branching ratio.
NTIS
Kaons; Quarks; Elementary Particle Interactions; Strangeness; Particle Decay; Pions

19990026865 Department of Energy, Office of Energy Research, Washington, DC USA
Ultrarelativistic cascades and strangeness production
Kahana, D. E., Department of Energy, USA; Kahana, S. H., Department of Energy, USA; Feb. 28, 1998; 12p; In English; Hypernuclear and Strange Particle Physics, USA
Report No.(s): DE98-004470; BNL-65248; CONF-9710193; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A two phase cascade, LUCIFER II, developed for the treatment of ultra high energy Ion-Ion collisions is applied to the production of strangeness at SPS energies. This simulation is able to simultaneously describe both hard processes such as Drell-Yan and slower, soft processes such as the production of light mesons by separating the dynamics into two steps, a fast cascade involving only the nucleons in the original colliding relativistic ions followed, after an appropriate delay, by a normal multiscattering of the resulting excited baryons and mesons produced virtually in the first step. No energy loss can take place in the short time interval over which the first cascade takes place. The chief result is a reconciliation of the important Drell-Yan measurements with the apparent success of standard cascades to describe the nucleon stopping and meson production in heavy ion experiments at the CERN SPS.
NTIS
Ionic Collisions; Elementary Particle Interactions; Particle Production; Strangeness; Baryons; Mesons

19990027017 Department of Energy, Office of Energy Research, Washington, DC USA
CP violation in K and B decays
Buchalla, G., Department of Energy, USA; Aug. 31, 1997; 16p; In English; 6th; Intersection of Particle and Nuclear Physics, Unknown
Report No.(s): DE98-059119; SLAC-PUB-7613; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The author reviews basic aspects of the phenomenology of CP violation in the decays of K and B mesons. In particular he discusses the commonly used classification of CP violation--CP violation in the mass matrix, in the interference of mixing with decay, and in the decay amplitude itself--and the related notions of direct and indirect CP violation. These concepts are illustrated with explicit examples. The author also emphasizes the highlights of this field including the clean observables B(K(L) yields pi(0) nu(anti nu)) and A(CP) (B yields J/Psi K(S)). The latter quantity serves to demonstrate the general features of large, mixing induced CP violation in B decays.
NTIS
Particle Decay; Kaons; Mesons; Elementary Particle Interactions

19990027053 Department of Energy, Washington, DC USA
High-field penning-malmberg trap: confinement properties and use in positron accumulation
Hartley, J. H., Department of Energy, USA; Sep. 01, 1997; 189p; In English
Report No.(s): DE98-051072; UCRL-LR-128703; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This dissertation reports on the development of the 60 kG cryogenic positron trap at Lawrence Livermore National Laboratory, and compares the trap's confinement properties with other nonneutral plasma devices. The device is designed for the accumulation of up to 2 x 10(exp 9) positrons from a linear-accelerator source. This positron plasma could then be used in Bhabha scattering experiments. Initial efforts at time-of-flight accumulation of positrons from the accelerator show rapid ((approximately)100 ms) deconfinement, inconsistent with the long electron lifetimes. Several possible deconfinement mechanisms have been explored, including annihilation on residual gas, injection heating, rf noise from the accelerator, magnet field curvature, and stray fields. Detailed studies of electron confinement demonstrate that the empirical scaling law used to design the trap cannot be extrapolated into the parameter regime of this device. Several possible methods for overcoming these limitations are presented.
NTIS
Cryogenics; Fabrication; Traps; Plasmas (Physics); Scattering

19990027163 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Molecular Modelling Studies on Sulphur-Containing Oligopeptides as Scavengers for Organoarsenicals ***Final Report***

Rumley-vanGurp, R. A., Prins Maurits Lab. TNO, Netherlands; November 1998; 24p; In English

Contract(s)/Grant(s): A94/M/445; TNO Proj. 213497650

Report No.(s): TD98-0051; PML-1998-A11; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., P.O. Box 45, 2280 AA Rijswijk, The Netherlands), Hardcopy, Microfiche

Lewisite (2-chloorethenyidichloorarsine) is a classical vesicant chemical agent which is stockpiled in large quantities. Adequate and effective medical countermeasures are still lacking, while the most commonly used antidote, British Anti-Lewisite, (i.e., 2,3-dimercaptopropan- 1 -ol) suffers from a number of drawbacks. We investigated the reactivity of small peptides containing two cysteine residues in view of their prospective use as specific antidotes against organoarsenical poisoning, using molecular modelling techniques. The predominant driving force of the adduct formation reaction is the ring size of the cyclic adduct, with an expected optimum at five-or six-membered rings. A secondary optimum was found for Cys-Res-Cys (with Res is an arbitrary amino acid residue) sequences rather than Cys-Cys, a result which was confirmed by two independent modelling methods. It was also found that the influence of neighbouring residues upon the reactivity of the two cysteines is negligible. Preliminary experiments indicate that lewisite is indeed bound by such peptides.

Author

Molecular Dynamics; Research; Reactivity; Peptides; Antidotes; Amino Acids; Models

19990027179 Department of Energy, Office of Energy Research, Washington, DC USA

Shell-model Monte Carlo studies of nuclei far from stability

Dean, D. J., Department of Energy, USA; Dec. 31, 1997; 13p; In English; Fission and properties of neutron-rich nuclei, USA

Report No.(s): DE98-003160; ORNL/CP-96142; CONF-9711113; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The shell model Monte Carlo technique (SMMC) transforms the traditional nuclear shell model problem into a path-integral over auxiliary fields. Applications of the method to studies of various properties of fp-shell nuclei, including Gamow-Teller strengths and distributions, are reviewed. Part of the future of nuclear structure physics uses in the study of nuclei far from beta-stability. The author discusses preliminary work on proton deficient Xe isotopes, and on neutron rich nuclei in the sd-pf shells.

NTIS

Monte Carlo Method; Stability; Nuclear Models; Nuclear Structure

19990027181 Department of Energy, Office of Energy Research, Washington, DC USA

Computational nuclear structure: Challenges, rewards, and prospects

Dean, D. J., Department of Energy, USA; Dec. 31, 1997; 12p; In English; 17th; Innovative computational methods in nuclear many-body problems, USA

Report No.(s): DE98-003163; ORNL/CP-96154; CONF-9711114; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The shell model Monte Carlo technique (SMMC) transforms the traditional nuclear shell model problem into a path-integral over auxiliary fields. Applications of the method to studies of various properties of fp-shell nuclei, including Gamow-Teller strengths and distributions, are reviewed. Part of the future of nuclear structure physics lies in the study of nuclei far from beta-stability. The author discusses preliminary work on proton deficient Xe isotopes, and on neutron rich nuclei in the sd-JP shells.

NTIS

Nuclear Structure; Neutrons; Nuclear Models

19990027184 Nuclear Regulatory Commission, Washington, DC USA

SCALE radiation shielding V and V package

Emmett, M. B., Nuclear Regulatory Commission, USA; Bowman, S. M., Nuclear Regulatory Commission, USA; Broadhead, B. L., Nuclear Regulatory Commission, USA; Dec. 31, 1997; 10p; In English; Radiation protection and shielding: technologies for the new century, USA

Report No.(s): DE98-003168; ORNL/CP-95950; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Verification and validation (V and V) are essential elements of software quality assurance (QA) for computer codes that are used for scientific calculations. The sponsors of the SCALE code system have required a QA plan and a V and V plan. For purposes of validating and verifying the SCALE shielding codes, a set of problems has been assembled and tested.

NTIS

Computer Programs; Quality Control; Proving

19990027198 Department of Energy, Washington, DC USA

Impossibility of unconditional stability and robustness of diffusive acceleration schemes

Azmy, Y. Y., Department of Energy, USA; Jan. 31, 1998; 11p; In English; Radiation protection and shielding topical: technologies for the new century, USA

Report No.(s): DE98-004061; ORNL/CP-96473; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors construct a problem for which exists no preconditioner with a cell-centered diffusion coupling stencil that is unconditionally stable and robust. In particular they consider an asymptotic limit of the Periodic Horizontal Interface (PHI) configuration wherein the cell height in both layers approaches zero like (sigma)(exp 2) while the total cross section varies like a in one layer and like 1/(sigma) in the other layer. In such case they show that the conditions for stability and robustness of the flat eigenmodes of the iteration residual imply instability of the modes flat in the y-dimension and rapidly varying in the x-dimension. This paper is important for radiation transport studies.

NTIS

Diffusivity; Stability; Robustness (Mathematics); Acceleration; Radiation Transport

19990027335 Department of Energy, Office of Energy Research, Washington, DC USA

Design aspects of a compact, single-frequency, permanent magnet ECR ion source with a large uniformly distributed resonant plasma volume

Liu, Y., Department of Energy, USA; Alton, G. D., Department of Energy, USA; Mills, G. D., Department of Energy, USA; Reed, C. A., Department of Energy, USA; Haynes, D. L., Department of Energy, USA; Sep. 30, 1997; 17p; In English; 7th; Ion sources

Report No.(s): DE98-000591; ORNL/CP-94794; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A compact, all-permanent-magnet single-frequency ECR ion source with a large uniformly distributed ECR plasma volume has been designed and is presently under construction at the Oak Ridge National Laboratory (ORNL). The central region of the field is designed to achieve a flat-field (constant mod-B) which extends over the length of the central field region along the axis of symmetry and radially outward to form a uniformly distributed ECR plasma volume. The magnetic field design strongly contrasts with those used in conventional ECR ion sources where the central field regions are approximately parabolic and the consequent ECR zones are surfaces. The plasma confinement magnetic field mirror has a mirror ratio B(sub max)/B(sub ECR) of slightly greater than two. The source is designed to operate at a nominal RF frequency of 6 GHz. The central flat magnetic field region can be easily adjusted by mechanical means to tune the source to the resonant conditions within the limits of 5.5 to 6.8 GHz. The RF injection system is broadband to ensure excitation of transverse electric (TE) modes so that the RF power is largely concentrated in the resonant plasma volume which lies along and surrounds the axis of symmetry of the source. Because of the much larger ECR zone, the probability for absorption of microwave power is dramatically increased thereby increasing the probability for acceleration of electrons, the electron temperature of the plasma and, consequently, the hot electron population within the plasma volume of the source. The creation of an ECR volume rather than a surface is commensurate with higher charge states and higher beam intensities within a particular charge state.

NTIS

Ion Sources; Plasmas (Physics); Permanent Magnets; Design Analysis; Electron Cyclotron Resonance

19990027475 Department of Energy, Office of Energy Research, Washington, DC USA

ORLANDO -- Oak Ridge Large Neutrino Detector

Bugg, W., Department of Energy, USA; Cohn, H., Department of Energy, USA; Efremenko, Y., Department of Energy, USA; Gabriel, T., Department of Energy, USA; Kamyshkov, Y., Department of Energy, USA; Dec. 31, 1997; 5p; In English; 5th; Topics in astroparticle and underground physics, USA

Report No.(s): DE98-003177; ORNL/CP-96153; CONF-9709190; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors discuss a proposal for construction of an Oak Ridge LArge Neutrino Detector (ORLANDO) to search for neutrino oscillations at the Spallation Neutron Source (SNS). A 4 MW SNS is proposed to be built at the Oak Ridge National Laboratory with the first stage to be operative around 2006. It will have two target stations, which makes it possible with a single detector to perform a neutrino oscillation search at two different distances. Initial plans for the placement of the detector and the discovery potential of such a detector are discussed.

NTIS

Neutrinos; Detection; Construction; Oscillations

19990027479 Department of Energy, Office of Energy Research, Washington, DC USA

LSND neutrino oscillation results and implications

Louis, W. C., Department of Energy, USA; Mar. 31, 1998; 18p; In English; 19th; Course of the Erice school on nuclear physics: neutrinos in astro, particle and nuclear physics, USA

Report No.(s): DE98-003362; LA-UR-97-4430; CONF-9709213; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The LSND experiment at Los Alamos has conducted searches for (anti(nu))(sub (mu)) (r-arrow) (anti(nu))(sub e) oscillations using (anti(nu))(sub (mu)) from (mu)(sup +) decay at rest and for (nu)(sub (mu)) (r-arrow) (nu)(sub e) oscillations using (nu)(sub (mu)) from (pi)(sup +) decay in flight. For the (anti (nu))(sub (mu)) (r-arrow) (anti(nu))(sub e) search, a total excess of 51.8(sub -16.9)(sup +18.7) +/-8.0 events is observed with e(sup +) energy between 20 and 60 MeV, while for the (nu)(sub mu) (r-arrow) (nu)(sub e) search, a total excess of 18.1 +/-6.6 +/-4.0 events is observed with e(sup -) energy between 60 and 200 MeV. If attributed to neutrino oscillations, these excesses correspond to oscillation probabilities (averaged over the experimental energies and spatial acceptances) of (0.31 +/-0.12 +/-0.05)% and (0.26 +/-0.10 +/-0.05)%, respectively. For the future, the Boone experiment at Fermilab could prove that neutrino oscillations occur and make precision measurements of (Delta)m(exp 2) and sin(exp 2)2(theta).

NTIS

Neutrinos; Oscillations

19990027546 Department of Energy, Office of Energy Research, Washington, DC USA

Lattice gauge theory on a massively parallel computing facility ***Final Report***

Sugar, R., Department of Energy, USA; Aug. 07, 1998; 2p; In English

Report No.(s): DE98-006365; DOE/ER/25186-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This grant provided access to the massively parallel computing facilities at Oak Ridge National Laboratory for the study of lattice gauge theory. The major project was a calculation of the weak decay constants of pseudoscalar mesons with one light and one heavy quark. A number of these constants have not yet been measured, so the calculations constituted a set of predictions which will be tested by future experiments. More importantly, f(sub B) and f(sub B(sub s)), the decay constants of the B and B(sub s) mesons, are crucial inputs for extracting information regarding the CKM matrix element V(sub td) from experimental measurements of B-(anti B) mixing, and future measurements of B(sub s)-(anti B)(sub s) mixing planned for the B-factory currently under construction at the Stanford Linear Accelerator Center. V(sub td) is one of the least well determined parameters of the Standard Model of High Energy Physics. It does not appear likely that F(sub B) and f(sub B(sub s)) will be measured experimentally in the near future, so lattice calculations such as this will play a crucial role in extracting information about the Standard Model from the B-factory experiments. The author has carried out the most accurate calculations of the heavy-light decay constants to date within the quenched approximation, that is ignoring the effects of sea quarks. Furthermore, his was the only group to have estimated the errors in the decay constants associated with the quenched approximation.

NTIS

Parallel Processing (Computers); Gauge Theory; Massively Parallel Processors

19990027567 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Space charge limited degradation of bipolar oxides at low electric-fields

Witczak, S. C., Department of Energy, USA; Lacoe, R. C., Department of Energy, USA; Mayer, D. C., Department of Energy, USA; Fleetwood, D. M., Department of Energy, USA; Schrimpf, R. D., Department of Energy, USA; Mar. 31, 1998; 6p; In English; Nuclear and Space Radiation Effects, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE98-005033; SAND-98-0709C; CONF-980705; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Radiation-induced degradation of many types of bipolar transistors and circuits is more severe following low dose rate exposure than following high dose rate exposure. Since microelectronic devices in space are generally subjected to low dose rate irradiation, this complicates the hardness assurance testing of linear circuits and can lead to an overestimation of device lifetime in space. Previous work examining the physical mechanisms responsible for this dose rate effect has focused primarily on oxide trapped charge. Reduced net positive oxide trapped charge densities at high dose rates and zero bias have been attributed to space charge effects from slowly transporting holes trapped metastably at O vacancy complexes. Decreasing the dose rate or increasing the irradiation temperature leads to an increase in net positive oxide trapped charge near the Si-SiO(sub 2) interface by reducing these space charge effects. In this work, concentrations of hydrogen transport through two types of bipolar oxides are estimated from dopant passivation measurements in MOS capacitors. For unbiased irradiations, hydrogen passivation of substrate acceptors is greatly reduced at high dose rates compared to that at low dose rates or elevated temperatures. Consistent with other widely

accepted models, it is argued that fewer interface traps are formed by high dose rate irradiation under zero bias, because fewer H(sup +) ions can drift to the Si-SiO(sub 2) interface and react with trap precursors. Similar to hole transport in these oxides, drift of the H(sup +) ions is inhibited at high dose rates by space charge accumulated in the oxide bulk.
NTIS
Semiconductor Devices; Radiation Effects; Degradation; Irradiation; Transistors

19990027649 National Inst. for Fusion Science, Toki, Japan
Some Problems Inside a Mass Analyzer for Pions Extracted from a H2 Gas Discharge
Uramoto, Johsin, National Inst. for Fusion Science, Japan; Mar. 1998; ISSN 0915-633X; 34p; In English
Report No.(s): NIFS-543; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When positive or negative pions are extracted with (H(+), H2(+), H3(+)) ions or H(-) ions and enter a magnetic mass analyzer MA of 90 deg deflection type, some problems occur, which are very different from mass analyses of classical charged particles. Because the pions can penetrate indirectly metal plates (which include a beam collector itself of MA) while mu-neutrino nu(sub mu) and anti-mu-neutrino (bar)nu(sub mu) beams generate. This phenomenon becomes serious when (H(+), H2(+), H3(+)) ions or H(-) ions are reflected by a back metal lid plate of MA and are supplied around the beam collector.
Author
Hydrogen; Charged Particles; Pions; Neutrinos; Ions

19990027661 Department of Energy, Office of Energy Research, Washington, DC USA
Resonance enhanced multiphoton and single-photon ionization of molecules and molecular fragments ***Final Report, May 1993 - Apr. 1997***
McKoy, V., Department of Energy, USA; Dec. 31, 1998; 31p; In English
Report No.(s): DE98-006433; DOE/ER/60513-T7; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Resonance enhanced multiphoton ionization (REMPI) utilizes pulsed laser radiation to prepare a molecule in an excited state via absorption of one or more photons and to subsequently ionize that level before it decays. A remarkable feature of REMPI is that the very narrow bandwidth of laser radiation makes it possible to select a specific rotational level in the initial (ground) state and to prepare the excited state of interest in a single rotational level. Thus, by suitable choice of the excitation step, it is possible to selectively ionize a species that may be present. The key objective of the effort is to carry out quantitative studies of REMPI of molecules and molecular fragments, as well as of single-photon ionization of these species by coherent VUV radiation, in order to provide a robust description of significant spectral features of interest in related experiments and needed insight into the underlying dynamics of these spectra. A major focus of the effort is joint theoretical and experimental studies of these ion rotational distributions which are being widely studied by the zero-kinetic-energy (ZEKE) technique. This technique, which is based on the detection of photoelectrons resulting from pulsed-field ionization of very high Rydberg states lying just below an ion threshold, makes it possible to obtain cation distributions with subwave number resolution. The unprecedented resolution of this ZEKE technique is opening up entirely new vistas in studies of photoionization dynamics, ion spectroscopy, and state-selected ion-molecule reactions. Emerging applications built on the ultra-high resolution of this technique include its use for accurate determination of thermochemically important ionization energies, for characterization of ion rovibrational level structure of large organic molecules, of elemental clusters, and of weakly bound molecular complexes, for probing reactive fragments, and for pump-probe photoelectron studies of wavepacket dynamics. This surge of experimental activity in ultra-high resolution studies of molecular photoelectron spectra continues to raise new theoretical challenges and has provided the stimulus for several of the collaborations with experimental groups in North America and Europe.
NTIS
Photons; Molecules; Ionization; Resonance; Fragments

19990027918 Rutherford Appleton Lab., Chilton, UK
The Dualized Standard Model and its Applications
Hong-Mo, Chan, Rutherford Appleton Lab., UK; Bordes, Jose, Valencia Univ., Spain; Tsou, Sheung Tsun, Oxford Univ., UK; Oct. 14, 1998; ISSN 1358-6254; 5p; In English
Report No.(s): RAL-TR-1998-071; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

The Dualized Standard Model offers a natural explanation for Higgs fields and 3 generations of fermions plus a perturbative method for calculating SM(Standard Model) parameters. by adjusting only 3 parameters, 14 quark and lepton masses and mixing

parameters (including nu oscillations) are calculated with general good success. Further predictions are obtained in post-GZK air showers and FCNC decays.
Author
Higgs Bosons; Perturbation; Standard Model (Particle Physics); Fermions

19990027957 Department of Energy, Office of Energy Research, Washington, DC USA
Three electroweak results from lattice QCD
Kronfeld, A. S., Department of Energy, USA; Aug. 31, 1998; 8p; In English; 33rd; Rencontres de moriond, QCD and high energy hadronic interactions, USA
Report No.(s): DE98-058732; FNAL/C-98/242-T; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Quantum chromodynamics is needed to understand quarks and, hence, to determine the quarks' Yukawa couplings from experimental measurements. As a short illustration, the results of three lattice calculations are given.
NTIS
Quantum Chromodynamics; Electroweak Interactions (Field Theory)

19990027995 Department of Energy, Washington, DC USA
Importance of ion energy on SEU in CMOS SRAMs
Dodd, P. E., Department of Energy, USA; Shaneyfelt, M. R., Department of Energy, USA; Sexton, F. W., Department of Energy, USA; Hash, G. L., Department of Energy, USA; Winokur, P. S., Department of Energy, USA; Mar. 31, 1998; 6p; In English; Nuclear and Space Radiation Effects, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE98-005028; SAND-98-0626C; CONF-980705; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The single-event upset (SEU) responses of 16 Kbit to 1 Mbit SRAMs irradiated with low and high-energy heavy ions are reported. Standard low- energy heavy ion tests appear to be sufficiently conservative for technologies down to 0.5 micron.
NTIS
Single Event Upsets; CMOS; Random Access Memory; Radiation Effects; Ion Irradiation

19990028203 Department of Defense, Washington, DC USA
Evolution on folding landscapes in combinatorial structures
Fraser, S. M., Department of Defense, USA; Reidys, C. M., Department of Defense, USA; Nov. 30, 1997; 8p; In English; Artificial life and robotics, USA
Report No.(s): DE98-003353; LA-UR-97-4454; CONF-980133; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In this paper the authors investigate the evolution of molecular structures by random point mutations. They will consider two types of molecular structures: (a) (RNA) secondary structures, and (b) random structures. In both cases structure consists of: (1) a contact graph, and (2) a family of relations imposed on its adjacent vertices. The vertex set of the contact graph is simply the set of all indices of a sequence, and its edges are the bonds. The corresponding relations associated with the edges are viewed as secondary base pairing rules and tertiary interaction rules respectively. Mapping of sequences into secondary and random structures are modeled and analyzed. Here, the set of all sequences that map into a particular structure is modeled as a random graph in the sequence space, the so called neutral network and they study how neutral networks are embedded in sequence space. A basic replication of deletion experiment reveals how effective secondary and random structures can be searched by random point mutations and to what extent the structure effects the dynamics of this optimization process. In particular the authors can report a nonlinear relation between the fraction of tertiary interactions in random structures, and the times taken for a population of sequences to find a high fitness target random structure.
NTIS
Folding Structures; Combinatorial Analysis; Molecular Structure; Evolution (Development)

19990028228 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Towards even and odd squeezed number states
Nieto, M. M., Department of Energy, USA; Mar. 31, 1998; 6p; In English; 5th; Wigner, USA
Report No.(s): DE98-003361; LA-UR-97-4398; CONF-9708155; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The time evolution of even and odd squeezed states, as well as that of squeezed number states, has been given in simple, analytic form. This follows experimental work on trapped ions which has demonstrated even and odd coherent states, number states,

and squeezed (but not displaced) ground states. The authors review this situation and consider the extension to even and odd squeezed number states. Questions of uncertainty relations are also discussed.
NTIS
Squeezed States (Quantum Theory); Ground State

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NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory. For space radiation see 93 Space Radiation.

19990026753 Los Alamos National Lab., NM USA
Fission Power Systems for Surface Outposts
Houts, Mike G., Los Alamos National Lab., USA; Poston, D. I., Los Alamos National Lab., USA; Berte, M. V., Massachusetts Inst. of Tech., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 8-9; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Space-fission power systems can potentially enhance or enable ambitious lunar and martian surface missions. Research into space fission power systems has been ongoing (at various levels) since the 1950s, but to date the U.S. has flown only one space-fission system (SNAP-1OA in 1965). Cost and development time have been significant reasons that space-fission systems have not been used by the U.S. High cost and long development time are not inherent to the use of space-fission power. However, high cost and long development time are inherent to any program that tries to do too much at one time. Nearly all U .S . space-fission power programs have attempted to field systems capable of high power, even though more modest systems had not yet been flown. All of these programs have failed to fly a space-fission system.
Author
Costs; Fission; Spacecraft Power Supplies; Safety; Nuclear Fuels

19990026827 Department of Energy, Office of Energy Research, Washington, DC USA
Present searches for Higgs signatures at the Tevatron
Groer, L., Department of Energy, USA; Aug. 31, 1997; 12p; In English; 12th; Hadrons in Collisions
Report No.(s): DE97-054156; FNAL/C-97/213-E; CONF-9706103-3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We present results for various searches for signatures of standard and non- standard model Higgs boson decays conducted at the collider detectors Collider Detector at Fermilab (CDF) and D0 using approximately 100/pb of integrated luminosity each from the Tevatron collider Run 1 (1992-96) at (radical)s = 1.8 TeV. No evidence for a Higgs boson decay is found and various limits are set.
NTIS
Higgs Bosons; Signatures; Particle Decay

19990026849 Department of Energy, Office of Energy Research, Washington, DC USA
Lasers and future high energy colliders
Parsa, Z., Department of Energy, USA; Feb. 28, 1998; 11p; In English; Lasers and Applications, USA
Report No.(s): DE98-004430; BNL-65251; CAP-203-MISC-98C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Future high energy colliders, directions for particle physics and relationship to new technology such as lasers are discussed. Experimental approaches to explore New Physics with emphasis on the utility of high energy colliders are also discussed.
NTIS
Lasers; Storage Rings (Particle Accelerators); High Energy Interactions

19990026853 Department of Energy, Office of Energy Research, Washington, DC USA
Two-component multistep direct reactions: A microscopic approach
Koning, A. J., Department of Energy, USA; Chadwick, M. B., Department of Energy, USA; Mar. 31, 1998; 8p; In English; Nuclear Data for Science and Technology Trieste 1997, 1997, USA
Report No.(s): DE98-004360; LA-UR-97-5016; CONF-9705133; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present two principal advances in multistep direct theory: (1) A two-component formulation of multistep direct reactions, where neutron and proton excitations are explicitly accounted for in the evolution of the reaction, for all orders of scattering. While this may at first seem to be a formidable task, especially for multistep processes where the many possible reaction pathways becomes large in a two-component formalism, the authors show that this is not so -- a rather simple generalization of the FKK convolution expression 1 automatically generates these pathways. Such considerations are particularly relevant when simultaneously analyzing both neutron and proton emission spectra, which is always important since these processes represent competing decay channels. (2) A new, and fully microscopic, method for calculating MSD cross sections which does not make use of particle-hole state densities but instead directly calculates cross sections for all possible particle-hole excitations (again including an exact book-keeping of the neutron/proton type of the particle and hole at all stages of the reaction) determined from a simple non-interacting shell model. This is in contrast to all previous numerical approaches which sample only a small number of such states to estimate the DWBA strength, and utilize simple analytical formulae for the partial state density, based on the equidistant spacing model. The new approach has been applied, along with theories for multistep compound, compound, and collective reactions, to analyze experimental emission spectra for a range of targets and energies. The authors show that the theory correctly accounts for double-differential nucleon spectra.
NTIS
Neutron Emission; Neutrons; Nucleons; Protons; Excitation

19990026854 Department of Energy, Office of Energy Research, Washington, DC USA
Extended direct-semidirect mechanism and the role of multistep processes in fast-nucleon radiative capture
Dietrich, F. S., Department of Energy, USA; Chadwick, M. B., Department of Energy, USA; Kerman, A. K., Department of Energy, USA; Mar. 31, 1998; 5p; In English; Nuclear Data for Science and Technology Trieste 1997, 1997, USA
Report No.(s): DE98-004359; LA-UR-97-5017; CONF-9705133; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have recently developed an extension of the direct semidirect (DSD) radiative capture model to unstable final stages and have confirmed its utility in explaining the spectrum of gamma rays from capture of polarized 19.6 MeV protons on Y-89. It was found that the extended DSD model, supplemented by a Hauser Feshbach contribution, successfully explains the observed gamma spectra, angular distributions, and analyzing powers, without requiring additional mechanisms, such as precompound or multistep emission, or nucleon-nucleon bremsstrahlung. In this contribution they show that the model also successfully explains data at higher energies (34 MeV incident protons), and that there is no need for additional contributions other than Hauser-Feshbach at this energy as well.
NTIS
Nucleon-Nucleon Interactions; Protons; Nuclear Radiation; Gamma Ray Spectra; Gamma Rays

19990026862 Department of Energy, Office of Energy Research, Washington, DC USA
Resonant Higgs enhancement at the First Muon Collider
Kamal, B., Department of Energy, USA; Marciano, W. J., Department of Energy, USA; Parsa, Z., Department of Energy, USA; Mar. 31, 1998; 9p; In English
Report No.(s): DE98-004474; BNL-65301; CAP-207-MUON-98C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The effect of beam polarization on Higgs resonance signals and backgrounds (b(anti b)), tau(anti tau), (c(anti c)) at the First Muon Collider is studied. Angular distributions (forward-backward charge asymmetries) are examined. The resulting effective enhancement of the Higgs signal relative to the background is investigated as is the reduction in scan time required for Higgs discovery.
NTIS
Higgs Bosons; Elementary Particle Interactions; Muons; Polarized Light; Quarks

19990026864 Department of Energy, Office of Energy Research, Washington, DC USA
Parton cascade description of heavy ion collisions at CERN
Geiger, K., Department of Energy, USA; Feb. 28, 1998; 6p; In English; Quark matter '97, 1997, USA
Report No.(s): DE98-004471; BNL-65252; CONF-971231; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

There seems to be a general consensus now that a first glimpse of a QGP-like effect has become visible in the beautiful NA50 data on J/psi production and the anomalous suppression phenomenon. On the other hand, it is still widely believed that the dynamics of heavy-ion collisions at CERN SPS energy is predominantly governed by soft, non-perturbative physics. This is ironic: after

all, it is unlikely that a QGP could be formed if the underlying dynamics were essentially soft, rather than that it requires intense quark-gluon production with sufficient cascade-like reinteractions which drive the matter to large density and equilibrium. Therefore, the author advocates in this contribution that for ultra-relativistic nucleus-nucleus collisions a description based on the pQCD interactions and cascade evolution of involved partons can and should be used, owing to the claim that short-range parton interactions play an important role at sufficiently high beam energies, including CERN energy radical-s approx-equal to 20 A GeV. Here mini-jet production which liberates of quarks and gluons cannot be considered as an isolated rare phenomenon, but can processes.
NTIS
Nuclear Interactions; Ionic Collisions; Particle Production; Partons

19990027055 Department of Energy, Office of Energy Research, Washington, DC USA
Determination of the b-quark production cross section in p(anti p) collisions at 630 GeV
Abbott, B., Department of Energy, USA; Oct. 31, 1997; 14p; In English; 18th; 18th; Lepton Photon Interactions, USA, USA
Report No.(s): DE98-051107; FNAL/C-97/366-E; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We present a preliminary measurement of the b-quark production cross section in p(anti p) collisions at (radical)s = 630 GeV. The analysis is based on 340/nb of data collected with the D0 detector at the Fermilab Tevatron Collider. We determine the ratio of the b-quark production cross sections at 630 GeV to 1800 GeV and compare our results with the CDF and UA1 measurements, and with the next-to- leading order QCD predictions.
NTIS
Quantum Chromodynamics; Electromagnetic Measurement; Quarks; Data Management

19990027197 Department of Energy, Office of Energy Research, Washington, DC USA
Prompt muon-induced fission: A probe for nuclear friction in large-amplitude collective motion
Oberacker, V. E., Department of Energy, USA; Umar, A. S., Department of Energy, USA; Wells, J. C., Department of Energy, USA; Strayer, M. R., Department of Energy, USA; Maruhn, J. A., Department of Energy, USA; Jan. 31, 1998; 12p; In English; Fission and properties of neutron-rich nuclei, USA
Report No.(s): DE98-004059; ORNL/CP-96416; CONF-9711113; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Excited muonic atoms in the actinide region may induce prompt fission by inverse internal conversion, i.e. the excitation energy of the muonic atom is transferred to the nucleus. The authors solve the time dependent Dirac equation for the muonic spinor wave function in the Coulomb field of the fissioning nucleus on a 3-dimensional lattice and demonstrate that the muon attachment probability to the light fission fragment is a measure of the nuclear energy dissipation between the outer fission barrier and the scission point.
NTIS
Muons; Fission; Friction; Nuclear Models

19990027200 Department of Energy, Office of Energy Research, Washington, DC USA
Experiments with neutron-rich isomeric beams
Rykaczewski, K., Department of Energy, USA; Grzywacz, R., Department of Energy, USA; Lewitowicz, M., Department of Energy, USA; Pfuetzner, M., Department of Energy, USA; Grawe, H., Department of Energy, USA; Jan. 31, 1998; 17p; In English; Fission and properties of neutron-rich nuclei, USA
Report No.(s): DE98-004065; ORNL/CP-96503; CONF-9711113; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A review of experimental results obtained on microsecond-isomeric states in neutron-rich nuclei produced in fragmentation reactions and studied with SISSI-Alpha-LISE3 spectrometer system at GANIL Caen is given. The perspectives of experiments based on secondary reactions with isomeric beams are presented.
NTIS
Neutron Beams; Neutrons; Isomers

19990027212 Department of Energy, Office of Energy Research, Washington, DC USA
25--30 T water cooled pulse magnet concept for neutron scattering experiment
Eyssa, Y. M., Department of Energy, USA; Walsh, R. P., Department of Energy, USA; Miller, J. R., Department of Energy, USA; Pernambuco-Wise, P., Department of Energy, USA; Bird, M. D., Department of Energy, USA; Dec. 31, 1997; 6p; In English; 15th; Magnet technology, USA
Report No.(s): DE98-002925; LA-UR-97-4477; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Manuel Lujan Jr. Neutron Scattering Center, Los Alamos National Laboratory is in need of a high field, split-pair, pulse magnet that would provide a 25--30 T field in a 25 mm bore and 10 mm split gap for 2--4 ms at a repetition rate of 2 Hz. Single stack Bitter magnets of this type providing less than 20 T vertical field in the split gap have been constructed before. To produce higher fields, there is a need to use a multiple layer coil with internal reinforcement. The magnet should withstand up to 10,000,000 cycles of loading and unloading. The authors have conducted a feasibility study that addresses these unique requirements.
NTIS
Liquid Cooling; Neutron Scattering; Electromagnets; Neutron Sources

19990027213 Department of Energy, Office of Energy Research, Washington, DC USA
BNL future plans
Littenberg, L., Department of Energy, USA; Jan. 31, 1998; 22p; In English; Kaon, muon and neutrino physics and the future at high energy accelerator research organization (KEK)
Report No.(s): DE98-002802; BNL-65188; CONF-9710190; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In 1999, after almost 40 years of independent existence, the Brookhaven Alternating Gradient Synchrotron (AGS) is scheduled to be pressed into service as an injector to the Relativistic Heavy Ion Collider (RHIC). Although at first sight this seems like the end of an era, in actuality, it represents a very attractive new opportunity. For the AGS is actually needed by RHIC for only a few hours per day. The balance of the time it is available for extracted proton beam work at a very small incremental cost. This represents the reverse of the current situation in which the nuclear physics program gets access to the AGS (for fixed target heavy ion experiments) at incremental cost, while the base cost of maintaining the accelerator is borne by the high energy physics program. Retaining the AGS for particle physics work would broaden the US HEP program considerably, allowing continued exploitation of the world's most intense source of medium energy protons. High energy possibilities include incisive probes of Standard Model and non-SM CP-violation, and of low energy manifestations of supersymmetry.
NTIS
Nuclear Physics; Planning

19990027344 Department of Energy, Washington, DC USA
Spallation Neutron Source (SNS) conceptual design shielding analysis
Johnson, J. O., Department of Energy, USA; Odano, N., Department of Energy, USA; Lillie, R. A., Department of Energy, USA; Mar. 31, 1998; 13p; In English; Radiation protection and shielding: technologies for the new century, USA
Report No.(s): DE98-004118; ORNL/CP-96527; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The shielding design is important for the construction of an intense high-energy accelerator facility like the proposed Spallation Neutron Source (SNS) due to its impact on conventional facility design, maintenance operations, and since the cost for the radiation shielding shares a considerable part of the total facility costs. A calculational strategy utilizing coupled high energy Monte Carlo calculations and multi-dimensional discrete ordinates calculations, along with semi-empirical calculations, was implemented to perform the conceptual design shielding assessment of the proposed SNS. Biological shields have been designed and assessed for the proton beam transport system and associated beam dumps, the target station, and the target service cell and general remote maintenance cell. Shielding requirements have been assessed with respect to weight, space, and dose-rate constraints for operating, shutdown, and accident conditions. A discussion of the proposed facility design, conceptual design shielding requirements calculational strategy, source terms, preliminary results and conclusions, and recommendations for additional analyses are presented.
NTIS
Spallation; Neutron Sources; Design Analysis; Radiation Shielding

19990027346 Department of Energy, Office of Energy Research, Washington, DC USA
AGS experiments, *1995-1997*
Depken, J. C., Department of Energy, USA; Presti, P. L., Department of Energy, USA; Dec. 31, 1997; 210p; In English
Report No.(s): DE98-004607; BNL-34518-ED.14; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report contains: (1) FY 1995 AGS schedule as run; (2) FY 1996 AGS schedule as run; (3) FY 1997 AGS schedule as run; (4) FY 1998--1999 AGS schedule (proposed); (5) AGS beams 1997; (6) AGS experimental area FY 1995 physics program; (7) AGS experimental area FY 1996 physics program; (8) AGS experimental area FY 1997 physics program; (9) AGS

experimental area FY 1998-- 1999 physics program (proposed); (10) a listing of experiments by number; (11) two-page summaries of each experiment, in order by number; and (12) listing of publications of AGS experiments.
NTIS
Experimentation; Research Facilities; Particle Accelerators; Research and Development

19990027489 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Fission, total and neutron capture cross section measurements at ORELA
Guber, K. H., Department of Energy, USA; Spencer, R. R., Department of Energy, USA; Leal, L. C., Department of Energy, USA; Larson, D. C., Department of Energy, USA; DosSantos, G., Department of Energy, USA; Dec. 31, 1998; 6p; In English; Physics of Nuclear Science and Technology, USA
Report No.(s): DE98-007219; ORNL/CP-96311; CONF-981003; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In support of the Nuclear Criticality Predictability Program established in response to the Defense Nuclear Facility Safety Board Recommendation 93-2, time-of-flight (TOF) measurements of the fission cross sections of U-233 in the neutron energy range from 0.36 eV to several hundred keV have been initiated at the Oak Ridge Electron Linear Accelerator (ORELA). Also total and capture cross sections of Al, Cl, and K in the energy range from about 100 eV to several hundred keV have been measured or are under way. The goal is to derive accurate cross section representations for the materials involved in criticality calculations of fuel storage, transportation, etc., configurations. Additional high-resolution measurements of the total cross sections of U-233 below a few keV neutron energy are being planned for 1998, as well as for the other involved material. Evaluated data files in ENDF-6 format will be processed into formats for use in criticality analysis and utilized in benchmark data testing. Finally the data will be submitted for inclusion in ENDF/B.
NTIS
Absorption Cross Sections; Fission; Neutrons; Capture Effect

19990027556 Department of Energy, Office of Energy Research, Washington, DC USA
High energy collider physics *Final Report*
Ruchti, R. C., Department of Energy, USA; Biswas, N. N., Department of Energy, USA; Wayne, M. R., Department of Energy, USA; Dec. 31, 1997; 3p; In English
Report No.(s): DE98-006429; DOE/ER/40649-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

With the demise of the Superconducting Super collider (SSC) Project, there was great concern that the technological developments for that accelerator and its associated detectors might well be lost in the aftermath. In the case of scintillating fiber tracking, such as not been the case. During the period 1990- -1993, several tracking technologies were under development for SDC, including Scintillating Fiber Tracking, Straw-tubes, and Microstrip Gas Chambers. In summer 1990, several members of the Fiber Tracking Group (FTG) proposed the use of Scintillating Fiber Tracking to the D0 experiment at Fermilab. This proposal was accepted, and D0 now is building a 75,000 fiber channel tracking detector with readout via Visible Light Photon Counters (VLPC) which were devices pioneered by the SDC Fiber Tracking Group. In addition, all the preshower detectors for D0 also make use of fiber readout (in this case wave shifting fibers) and VLPC for photosensing. In February 1993, a full 7 months prior to cancellation of the SSC project by Congress, the SDC experiment rejected scintillating fiber tracking for further development. Fortunately for all concerned, the D0 experiment had already embraced this technology, so this important detector concept could be further developed, refined, and utilized for physics experimentation. In early 2000, data will be taken with the D0 fiber tracker to study Top Quarks, Beauty Particles, Electroweak Physics, Quantum Chromodynamics (QCD) phenomena, and to search for new phenomena. The University of Notre Dame has played a fundamental and seminal role in the development and implementation of this detector technology. R. Ruchti has served as cospokesman of the Fiber Tracking Group since its inception in 1989, and has been a pioneer of fiber tracking technology since 1980. In addition, at least one other experiment at Fermilab, E835, has utilized scintillating fibers with VLPC readout to study Charmonium in proton-antiproton collisions using a gas-jet target in the Tevatron antiproton accumulator ring. This fiber detector has been operated successfully for over 1 year of actual beam conditions.
NTIS
Superconducting Super Collider; Particle Tracks

19990027654 National Inst. for Fusion Science, Toki, Japan
Development of a High-Current Hydrogen-Negative Ion Source for LHD-NBI System
Takeiri, Yasuhiko, National Inst. for Fusion Science, Japan; Osakabe, Masaki, National Inst. for Fusion Science, Japan; Tsumori, Katsuyoshi, National Inst. for Fusion Science, Japan; Oka, Yoshihide, National Inst. for Fusion Science, Japan; Kaneko, Osamu, National Inst. for Fusion Science, Japan; Asano, Eiji, National Inst. for Fusion Science, Japan; Kawamoto, Toshikazu, National

Inst. for Fusion Science, Japan; Akiyama, Ryuichi, National Inst. for Fusion Science, Japan; Tanaka, Masanobu, Hitachi Ltd., Japan; Aug. 1998; ISSN 0915-633X; 10p; In English
Report No.(s): NIFS-557; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have developed a high-current hydrogen-negative ion source for a negative-ion-based NBI system in Large Helical Device (LHD). The ion source is a cesium-seeded volume-production source equipped with an external magnetic filter. An arc chamber is rectangular, the dimensions of which are 35 cm x 145 cm in cross section and 21 cm in depth. A three-grid single-stage accelerator is divided into five sections longitudinally, each of which has 154 (14 x 11) apertures in an area of 25 cm x 25 cm. The ion source was tested in the negative-NBI teststand, and 25 A of the negative ion beam is incident on a beamdump 13 in downstream with an energy of 104 keV for 1 sec. Multibeamlets of 770 are focused on a focal point 13 in downstream with an averaged divergence angle of 10 mrad by the geometrical arrangement of five sections of grid and the aperture displacement technique of the grounded grid. A uniform beam in the vertical direction over 125 cm is obtained with uniform plasma production in the arc chamber by balancing individual arc currents flowing through each filament. Long-pulse beam production was perfoffned, and 1.3 MW of the negative ion beam is incident on the beamdump for 10 sec, and the temperature rise of the cooling water is almost saturated for the extraction and the grounded grids. These results satisfy the first-step specification of the LHD-NBI system.
Author
Ion Sources; Negative Ions; Hydrogen Ions; Heliotrons; Cesium; High Current; Ion Beams

19990028200 Department of Energy, Office of Energy Research, Washington, DC USA
Drell-Hearn-Gerasimov sum-rule at polarized HERA
Bass, S. D., Department of Energy, USA; Brisudova, M. M., Department of Energy, USA; DeRoeck, A., Department of Energy, USA; Nov. 30, 1997; 11p; In English; Physics with polarized protons, USA
Report No.(s): DE98-003358; LA-UR-97-4445; CONF-9710185; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Drell-Hearn-Gerasimov sum-rule for spin dependent photoproduction relates the difference of the two cross-sections for the absorption of a real photon with spin anti-parallel (sigma)(sub A) and parallel (sigma)(sub P) to the target spin to the square of the anomalous magnetic moment of the target nucleon. The authors discuss the potential of polarized HERA to measure the spin dependent part of the total photoproduction cross section at large radical(s(sub gamma)p).
NTIS
Sum Rules; Photoproduction; Storage Rings (Particle Accelerators)

19990028223 Department of Energy, Office of Energy Research, Washington, DC USA
Coupling of Monte Carlo adjoint leakages with three-dimensional discrete ordinates forward fluences
Slater, C. O., Department of Energy, USA; Lillie, R. A., Department of Energy, USA; Johnson, J. O., Department of Energy, USA; Simpson, D. B., Department of Energy, USA; Apr. 30, 1998; 12p; In English; Radiation protection and shielding: technologies for the new century, USA
Report No.(s): DE98-003378; ORNL/CP-96968; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A computer code, DRC3, has been developed for coupling Monte Carlo adjoint leakages with three-dimensional discrete ordinates forward fluences in order to solve a special category of geometrically-complex deep penetration shielding problems. The code extends the capabilities of earlier methods that coupled Monte Carlo adjoint leakages with two-dimensional discrete ordinates forward fluences. The problems involve the calculation of fluences and responses in a perturbation to an otherwise simple two- or three-dimensional radiation field. In general, the perturbation complicates the geometry such that it cannot be modeled exactly using any of the discrete ordinates geometry options and thus a direct discrete ordinates solution is not possible. Also, the calculation of radiation transport from the source to the perturbation involves deep penetration. One approach to solving such problems is to perform the calculations in three steps: (1) a forward discrete ordinates calculation, (2) a localized adjoint Monte Carlo calculation, and (3) a coupling of forward fluences from the first calculation with adjoint leakages from the second calculation to obtain the response of interest (fluence, dose, etc.). A description of this approach is presented along with results from test problems used to verify the method. The test problems that were selected could also be solved directly by the discrete ordinates method. The good agreement between the DRC3 results and the direct-solution results verify the correctness of DRC3.
NTIS
Monte Carlo Method; Leakage; Computer Programs; Coupling; Fluence

19990028257 Department of Energy, Office of Energy Research, Washington, DC USA

Measurement of the polarized forward-backward asymmetry of s-quarks at SLD

Narita, S., Department of Energy, USA; Mar. 31, 1998; 133p; In English

Report No.(s): DE98-059291; SLAC-R-520; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This thesis presents a direct measurement of the parity-violating parameter A(sub s) by analyzing the polarized forward-backward asymmetry of s quarks in e(sup +)e(sup (minus)) (r-arrow) Z(sup 0) (r-arrow) s(anti s). The author has used the data taken at the Stanford Linear Accelerator Center (SLAC), from the SLAC Large Detector (SLD), which records the products of e(sup +)e(sup (minus)) interactions at a center of mass energy (radical)s = 91.2 GeV at the SLAC Linear Collider (SLC). The unique features of the SLC/SLD experimental apparatus provide interesting tests of the electroweak and the QCD physics. The small, stable SLC beam spot, and the precise tracking capability of the SLD allow the isolation of light flavor events. Charged hadrons are identified over wide momentum range with the Cherenkov Ring Imaging Detector (CRID). High momentum charged kaon, (Lambda)(sup 0)/(anti (Lambda))(sup 0), and K(sub s)(sup 0) are used to select Z(sup 0) (r-arrow) s(anti s) events and to identify the s- quark direction. The averaged polarization was 63.0% in 1993 SLD run and 77.3% in 1994--95 run. The author obtained A(sub s) = 0.86 (+/-) 0.17(stat.) (+/-) 0.10(syst.). This value is consistent with the prediction from the Standard Model and with the values of A(sub b) measurements from SLD and LEP experiments.

NTIS

Asymmetry; Quarks; Polarized Radiation; Linear Alternators; Radiation Detectors; Mathematical Models; Imaging Techniques

19990028266 Department of Energy, Office of Energy Research, Washington, DC USA

Light-fronts approach to electron-positron pair production in ultrarelativistic heavy-ion collisions

Wells, J. C., Department of Energy, USA; Segev, B., Department of Energy, USA; Mar. 31, 1998; 12p; In English; Quantum aspects of beam physics, USA; Sponsored by International Committee for Future Accelerators, Unknown

Report No.(s): DE98-003393; ORNL/CP-97040; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors solve, in an ultrarelativistic limit, the time-dependent Dirac equation describing electron-positron pair production in peripheral relativistic heavy ion collisions using light-front variables and a light-fronts representation, obtaining nonperturbative results for the free pair-creation amplitudes in the collider frame. Their result reproduces the result of second-order perturbation theory in the small charge limit while nonperturbative effects arise for realistic charges of the ions.

NTIS

Electron-Positron Pairs; Pair Production; Ions; Ionic Collisions

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OPTICS

Includes light phenomena; and optical devices. For lasers see 36 Lasers and Masers.

19990026829 Department of Energy, Washington, DC USA

Shadowgraph illumination techniques for framing cameras

Malone, R. M., Department of Energy, USA; Flurer, R. L., Department of Energy, USA; Frogget, B. C., Department of Energy, USA; Sorenson, D. S., Department of Energy, USA; Holmes, V. H., Department of Energy, USA; Dec. 31, 1997; 6p; In English; 11th; Pulsed Power; Sponsored by Institute of Electrical and Electronics Engineers, USA

Report No.(s): DE97-054129; DOE/NV/11718-140; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Many pulse power applications in use at the Pegasus facility at the Los Alamos National Laboratory require specialized imaging techniques. Due to the short event duration times, visible images are recorded by high-speed electronic framing cameras. Framing cameras provide the advantages of high speed movies of back light experiments. These high-speed framing cameras require bright illumination sources to record images with 10 ns integration times. High-power lasers offer sufficient light for back illuminating the target assemblies; however, laser speckle noise lowers the contrast in the image. Laser speckle noise also limits the effective resolution. This discussion focuses on the use of telescopes to collect images 50 feet away. Both light field and dark field illumination techniques are compared. by adding relay lenses between the assembly target and the telescope, a high-resolution magnified image can be recorded. For dark field illumination, these relay lenses can be used to separate the object field from the illumination laser. The illumination laser can be made to focus onto the opaque secondary of a Schmidt telescope. Thus, the telescope only collects scattered light from the target assembly. This dark field illumination eliminates the laser speckle noise and

allows high-resolution images to be recorded. Using the secondary of the telescope to block the illumination laser makes dark field illumination an ideal choice for the framing camera.
NTIS
Shadowgraph Photography; Illuminating; Framing Cameras

19990026889 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Reconstruction of Optical Properties and Bioluminescence Sources in Natural Waters ***Reconstrucao de Propriedades Oticas e de Fontes de Bioluminescencia em Aguas Naturais***
Stephany, Stephan, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 146p; In Portuguese
Contract(s)/Grant(s): FAPESP-96/07200-8
Report No.(s): INPE-6968-TDI/656; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

It is proposed a methodology for the estimation of optical properties and bioluminescence sources in natural waters from in situ irradiances. The implicit inversion algorithm evaluates for each candidate solution the square differences between the irradiances calculated by the direct model for each candidate solution and the experimental irradiances. The objective function value for each step is given by these square differences and the minimization problem is formulated as a non-linear optimization problem. A maximum-entropy regularization term is added to the objective function for noise corrupted data. This term is weighted by a Lagrange multiplier and two criteria are evaluated for its fitting. As the irradiances decay with the depth, an exponential correction factor is used. The proposed methodology was tested for noiseless and noise-corrupted synthetic data and yielded good results. The test cases included estimation of bioluminescence, absorption coefficient or scattering coefficient vertical profiles, as well as joint estimation of all these parameters.
Author
Procedures; Estimating; Optical Properties; Optimization; Bioluminescence; Water

19990026890 Department of the Navy, Washington, DC USA
Optical Fibers With High Acceleration Sensitivity and Low Pressure Sensitivity
Lagakos, Nicholas, Inventor; Bucaro, Joseph A., Inventor; Sep. 08, 1998; 30p; In English
Patent Info.: Filed 25 Sep. 96,; US-Patent-Appl-SN-719,917; US-Patent-5,805,753
Report No.(s): AD-D019212; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An optical fiber which includes a light transmitting center portion, a protecting layer and a stress preventing layer. The protecting layer concentrically surrounds the center portion, and reduces the effect of environmental factors on the center portion. The stress preventing layer concentrically surrounds the center portion and is positioned between the protecting layer and the center portion. The stress preventing layer has a Young's Modulus substantially lower than the Young's Modulus of the protecting layer, for preventing stress from being transferred from the protecting layer to the center portion. The optical fiber can be used in a filler optic sensor system.
DTIC
Fiber Optics; Accelerometers; Light Transmission; Optical Fibers

19990026895 Department of the Navy, Washington, DC USA
Optical Correlator Using Optical Delay Loops
Garcia, Joseph P., Inventor; Sep. 22, 1998; 7p; In English; Supersedes
Patent Info.: US-Patent-Appl-SN-569,920
Report No.(s): AD-D019199; PAT-5,812,292; No Copyright; Avail: US Patent and Trademark Office, Microfiche

An optical correlator is disclosed that compares signals of interest with selected reference signals stored in holograms. The holograms are arranged so that the selected reference signals impinge onto the plane of the entrance of fiber optics arranged with an optical delay line and fiber optic amplifiers to form a delay line amplifier array. The optical delay line receives the signals of interest represented by light modulated pulses. The cooperative action from the light from the hologram and the light from the optical delay line produces signals that are proportional to the correspondence between the signals of interest and the stored reference signals.
DTIC
Optical Correlators; Light Modulators; Holography; Optical Fibers

19990026896 Department of the Navy, Washington, DC USA
Continuous Fiber Pulse Reflecting Means
Ames, Gregory H., Inventor; Gremillion, Jeffrey C., Inventor; Jul. 28, 1998; 5p; In English
Patent Info.: Filed 7 Jul. 89,; US-Patent-Appl-SN-380,480; US-Patent-5,787,053
Report No.(s): AD-D019194; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A device for providing a controlled back-reflection of a preselected portion of incident fiber-guided light while minimizing the affect to light continuing down the fiber. The back-reflected light couples to the reverse traveling fiber mode with minimal loss. These devices are used as reflectors in a pulse sampled fiber optic hydrophone array.
DTIC
Fiber Optics; Hydrophones; Couples

19990027063 Army Aeromedical Research Lab., Fort Rucker, AL USA
External Position Lighting Effects on Night Vision Goggle Performance ***Final Report***
Wildzunas, Robert M.; McLean, William E.; Rash, Clarence E.; Dec. 1998; 12p; In English
Report No.(s): AD-A359651; USAARL-99-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Army aviation depends heavily on image intensification (I(exp 2)) devices to extend operations into the night. Such devices are light amplification systems that adjust their amplification factor (gain) according to the level of ambient illumination. However, these night vision goggles (NVGs) are unable to distinguish between light originating from the exterior scene and light originating from either instruments inside the cockpit or lights mounted to the aircraft. Consequently, the NVG may lower gain unnecessarily, and in doing so, degrade image quality. The compatibility problem is most apparent when light in the red part of the spectrum is present. This is the problem with the UH-1's red lateral position lights. These lights flood into the cockpit, affecting NVG performance - the presence of fog and other weather heightens this effect. A solution to this problem has been to mask appropriate upper and lower portions of the two red position lights, thereby reducing the NVG degradation. However, this solution appeared to conflict with Federal Aviation Regulation (FAR) lighting intensity distributions for each of the two lights. We calculated that the FAR could be satisfied at a distance of one rotor disk radius by masking 82 degrees of each respective position light (leaving 98 degrees unmasked). Objective video recordings and test pilots' subjective observations indicate a significant reduction in NVG degradation with the 82-degree masking scheme as compared to operations with unmasked position lights. The 82-degree masking scheme meets the FAR requirements while reducing simultaneously the performance degradation of the NVG devices.
DTIC
Goggles; Amplification; Illuminating; Night Vision

19990027258 Beijing Univ. of Aeronautics and Astronautics, Beijing, China
Optical Architecture Design of Time-Integrating Acoustic-Optical Correlator
Jiang, Xiufu, Beijing Univ. of Aeronautics and Astronautics, China; Shao, Dingrong, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 518-521; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

The time-integrating acoustic-optical correlator was used to capture long codes. The additive time-integrating acoustic-optical correlator was used as the experimental model. The experimental model was divided into four parts: light source, splitter, beam expansion and detector array parts. Through the analysis and calculation for each part, the optimum experimental model was established. The experiment of time-integrating acoustic-optical correlator was finished by using this experimental model, and the result was analyzed. It is the first time the experimental model of time-integrating acoustic-optical correlator was finished in our country and at the end of this paper, the satisfied experimental results in our laboratory were given.
Author
Acousto-Optics; Optical Correlators; Optical Data Processing; Experiment Design

19990027423 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Performance Analysis of the Simultaneous Optical Multiporcessor Exchange Bus Architecture
Doskocz, Edward K.; Jan. 1998; 134p; In English
Report No.(s): AD-A359922; AFIT-FY99-47; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The computing world has entered an era in which executing high-performance applications has become commonplace in the scientific, engineering, and business workplace. The trend in these applications is toward the execution of larger or more detailed models in less time, with parallel processing seen as a useful tool for performing this work. The focus of this dissertation is the performance evaluation of a parallel-processing architecture, known as the Simultaneous Optical Multiprocessor Exchange Bus

(SOME-Bus), that exploits the parallelism in these applications via efficient data communication between processors. The SOME-Bus is a low-latency, high-bandwidth, broadcast-based fiber-optic interconnection network which can efficiently interconnect over one hundred processing nodes. Performance potential of the SOME-Bus architecture is examined by comparing its quantifiable network characteristics to those of existing static and dynamic network topologies. The need for a broadcast-based parallel-processing design is examined by reviewing research into the workload, communication patterns, and performance of current parallel systems. Theoretical and simulation models are developed for both message-passing and distributed-shared-memory parallel processing paradigms. The message-passing model consists of a closed queueing network. An efficient solution method is developed using Norton's Theorem for Queueing Networks. Two distributed-shared-memory models are constructed, one based on a closed, multi-class queueing network, the other on a Markov-chain. Mean Value Analysis is used to evaluate the first model; the second model is evaluated by examining state probabilities. Performance results from the models and simulations are compared to results from crossbar and torus system simulations. Models and simulators were implemented using MATLAB and C languages.
DTIC
Fiber Optics; Distributed Processing; Parallel Processing (Computers); Optical Data Processing; Computerized Simulation; Queueing Theory

19990027463 NASA Lewis Research Center, Cleveland, OH USA
Optical Evaluation of an As Manufactured Compound Secondary Concentrator
Jaworskel, Donald A., NASA Lewis Research Center, USA; Skowronski, Timothy J., Cleveland State Univ., USA; Miles, Barry J., BWX Technologies, Inc., USA; 1999; In English; Space Technology and Applications International Forum (STAIF-99), 31 Jan. - 4 Feb. 1999, Albuquerque, NM, USA; Sponsored by American Inst. of Physics, USA
Contract(s)/Grant(s): RTOP 632-1A-1E; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Secondary concentrators are needed in solar thermal propulsion to further concentrate the energy collected by large lightweight primary concentrators. Although the physics of secondary concentrators has been worked out in detail and the manufacturing has been successfully completed for a ground demonstration, there is a need to quantify the specific performance of as-manufactured concentrators. This paper summarizes the properties of a secondary concentrator manufactured for the Integrated Solar Upper Stage engine ground demonstration in 1997 and presents data obtained from the optic that describe the performance of the as-manufactured component.
Author
Concentrators; Manufacturing; Solar Thermal Propulsion

19990027464 NASA Lewis Research Center, Cleveland, OH USA
Correlation of Predicted and Observed Optical Properties of Multilayer Thermal Control Coatings
Jaworske, Donald A., NASA Lewis Research Center, USA; 1998; In English; Metallurgical Coatings and Thin Films, 27 Apr. - 1 May 1998, San Diego, CA, USA; Sponsored by American Vacuum Society, USA
Contract(s)/Grant(s): RTOP 632-1A-1E; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Thermal control coatings on spacecraft will be increasingly important, as spacecraft grow smaller and more compact. New thermal control coatings will be needed to meet the demanding requirements of next generation spacecraft. Computer programs are now available to design optical coatings and one such program was used to design several thermal control coatings consisting of alternating layers of WO3 and SiO2. The coatings were subsequently manufactured with electron beam evaporation and characterized with both optical and thermal techniques. Optical data were collected in both the visible region of the spectrum and the infrared. Predictions of solar absorptance and infrared emittance were successfully correlated to the observed thermal control properties. Functional performance of the coatings was verified in a bench top thermal vacuum chamber.
Author
Optical Properties; Thermal Control Coatings; Silicon Dioxide; Computer Programs; Tungsten Oxides

19990027596 Massachusetts Inst. of Tech., Cambridge, MA USA
Perfect Mirror Design Technology
Thomas, Edwin L.; Fink, Yoel; Feb. 1999; 4p; In English
Report No.(s): AD-A360701; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The discovery of a significant advance in mirror design technology, which began with AFOSR funding, offers potential for vast improvements in many Air Force applications. MIT researchers and graduate students have invented a "perfect" mirror which combines the best features of the two previously known types of mirrors - metallic and dielectric - by reflecting light at any angle with virtually no loss of energy. Among other benefits, the anticipated advance will provide: * large diameter low loss mirrors

in space for advanced communication and surveillance systems * coatings on aerospace systems with controlled radiation emission in specific frequency ranges * advanced optical and optoelectronic systems such as non-mechanical laser beam steering devices.
DTIC
Mirrors; Dielectrics; Reflection; Surveillance; Space Communication

19990027676 National Tsing Hua Univ., Inst. of Electrical Engineering, Hsinchu, Taiwan, Province of China
Invariant Image Matching by Compacting and Moment Normalization
Wang, Wen-Hao, National Tsing Hua Univ., Taiwan, Province of China; Chen, Yung-Chang, National Tsing Hua Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering; November 1998; Volume 21, No. 6, pp. 719-730; In English; See also 19990027670
Contract(s)/Grant(s): NSC-86-2612-E007-001; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new approach is proposed in this paper for image matching an invariant to translation, rotation, anisotropic scaling, and skewing. A compact image is acquired by principal component analysis and rescaling the image on the principal axes. However, the direction of the principal axis is susceptible to the skewing effect, which will bring about the failure of the orientation normalization. In addition, overall scale normalization is not taken into consideration. Hence, the central idea of this paper is to find the normalized orientation and overall scale for the compact image by virtue of the moment normalization. In consequence, the resultant image becomes thoroughly normalized and can be directly employed for matching by simple similarity metrics. Alternatively, for the purpose of fast matching, two 1-D projected results are evaluated for matching. These are undoubtly faster than the conventional pixel-based correlation.
Author
Image Processing; Pattern Recognition; Image Correlators; Data Compression; Normalizing (Statistics); Principal Components Analysis

19990027914 NASA Marshall Space Flight Center, Huntsville, AL USA
Process-Parameter-Dependent Optical and Structural Properties of ZrO2MgO Mixed-Composite Films Evaporated from the solid Solution
Sahoo, N. K., NASA Marshall Space Flight Center, USA; Shapiro, A. P., NASA Marshall Space Flight Center, USA; Applied Optics; Feb. 01, 1998; Volume 37, No. 4, pp. 698-718; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The process-parameter-dependent optical and structural properties of ZrO2MgO mixed-composite material have been investigated. Optical properties were derived from spectrophotometric measurements. by use of atomic force microscopy, x-ray diffraction analysis, and energy-dispersive x-ray (EDX) analysis, the surface morphology, grain size distributions, crystallographic phases, and process-dependent material composition of films have been investigated. EDX analysis made evident the correlation between the oxygen enrichment in the films prepared at a high level of oxygen pressure and the very low refractive index. Since oxygen pressure can be dynamically varied during a deposition process, coatings constructed of suitable mixed-composite thin films can benefit from continuous modulation of the index of refraction. A step modulation approach is used to develop various multilayer-equivalent thin-film devices.
Author
Crystallography; Optical Properties; Thin Films; Composite Materials; Evaporation; Zirconium Oxides; Magnesium Oxides

19990028258 Department of Energy, Washington, DC USA
Adaptive optics instrument for long-range imaging *Final Report*
Crawford, T. M., Department of Energy, USA; Jun. 30, 1998; 100p; In English
Report No.(s): DE98-056081; INEEL/EXT-98-00518; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The science and history of imaging through a turbulent atmosphere is reviewed in detail. Traditional methods for reducing the effects of turbulence are presented. A simplified method for turbulence reduction called the Sheared Coherent Interferometric Photography (SCIP) method is presented. Implementation of SCIP is discussed along with experimental results. Limitations in the use of this method are discussed along with recommendations for future improvements.
NTIS
Earth Atmosphere; Turbulence; Turbulence Effects; Optical Equipment; Monitors; Drag Reduction

19990028269 Department of Energy, Office of Energy Research, Washington, DC USA

Subwavelength structured narrow-band integrated optical grating filters

Grann, E. B., Department of Energy, USA; Holcomb, D. E., Department of Energy, USA; Zuhr, R. A., Department of Energy, USA; Moharam, M. G., Department of Energy, USA; Jan. 31, 1998; 6p; In English; Diffractive optic and micro optics, USA

Report No.(s): DE98-003389; ORNL/CP-96094; CONF-980636; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A unique type of narrow band integrated optical filter is investigated based on embedding a subwavelength resonant grating structure within a planar waveguide. Current integrated narrow-band optical filters are limited by their size, density of devices that can be produced, overall performance, and ability to be actively altered for tuning and modulation purposes. In contrast, the integrated optical filters described in this work can have extremely narrow bandwidths--on the order of a few angstroms. Also, their compact size enables multiple filters to be integrated in a single high density device for signal routing or wavelength discrimination. Manipulating any of the resonant structure's parameters will tune the output response of the filter, which can be used for modulation or switching applications.

NTIS

Optical Filters; Narrowband

19990028279 Department of Energy, Washington, DC USA

Optical fabrication and metrology for a visible through thermal infrared multi-band imaging system

Magner, J., Department of Energy, USA; Henson, T., Department of Energy, USA; Apr. 30, 1998; 11p; In English; 12th; Aerospace/defense sensing, simulation and controls, USA

Report No.(s): DE98-003383; SAND-97-2312C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The optical fabrication, metrology, and system wavefront testing of an off-axis three mirror anastigmatic telescope will be presented. The telescope is part of a multi-band imaging system which includes a single mechanically cooled focal plane with 15 spectral bands covering a wavelength range from 0.45 microns to 10.7 microns and an on board calibration subsystem. The imaging system is to be operated in a low earth orbit in a pushbroom scanning mode. The telescope has a 36 cm aperture, a 1.38 degree cross track by 1.82 degree along-track field of view (FOV), near diffraction limited performance in the visible, and strictly diffraction limited performance from 1.3 microns to 10.7 microns. The primary and the tertiary mirrors are general aspheres which have undergone 80% lightweighting. The secondary mirror is a hyperbola. The primary mirror was extremely difficult to fabricate and test due to its large departure from sphericity, fast f-number, and large off axis distance. The tertiary mirror has a small departure from sphericity and is only slightly off-axis, but it has a very fast f-number also. The surface wavefront measurements for the three mirrors after final figuring and lightweighting are 0.048 waves rms (at)0.6328 microns for the primary mirror and 0.025 waves rms (at)0.6328 microns for the secondary and tertiary mirrors. The telescope wavefront requirement at the center of the along-track FOV is 0.178 waves rms (at)0.6328 microns and at the edge of the along-track FOV is 0.677 waves rms (at) 0.6328 microns.

NTIS

Fabrication; Metrology; Infrared Imagery; Imaging Techniques; Spectral Bands; Aspheric Optics; Mirrors; Wave Fronts; Telescopes; Light (Visible Radiation)

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990026818 National Inst. for Fusion Science, Toki, Japan

Kinetic Stabilization of Tilt Disruption in Field-Reversed Configurations

Horiuchi, Ritoku, National Inst. for Fusion Science, Japan; Nishimura, Kazumi, National Inst. for Fusion Science, Japan; Watanabe, Tomohiko, National Inst. for Fusion Science, Japan; Sato, Tetsuya, National Inst. for Fusion Science, Japan; September 1998; ISSN 0915-633X; 8p; In English; 17th; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria

Report No.(s): IAEA-CN-69/THP1/11; NIFS-559; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The kinetic stabilization process of the tilt disruption in a field-reversed configuration is investigated by means of a three-dimensional particle simulation. For the case of no ion beam the growth rate of tilt instability decreases as the plasma beta value at magnetic separatrix beta(sub sp) increases. This stabilization effect originates from the character of anchoring ions which exist

in the vicinity of the magnetic separatrix and play a role as an ”anchor” to hold the internal plasma to the external plasma. The tilt mode is also found to be stabilized by injecting an ion beam with about 20% of the ion thermal energy at the neighborhood of the null point even for small beta(sub sp) plasmas.
Author
Kinetics; Stabilization; Computerized Simulation; Magnetic Field Configurations

19990026832 National Inst. for Fusion Science, Toki, Japan
Steady State Heating Technology Development for LHD
Watari, T., National Inst. for Fusion Science, Japan; Shimozuma, T., National Inst. for Fusion Science, Japan; Takeiri, Y., National Inst. for Fusion Science, Japan; Kumazawa, R., National Inst. for Fusion Science, Japan; Mutoh, T., National Inst. for Fusion Science, Japan; Sato, M., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Ohkubo, K., National Inst. for Fusion Science, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Idei, H., National Inst. for Fusion Science, Japan; Oka, Y., National Inst. for Fusion Science, Japan; Osakabe, M., National Inst. for Fusion Science, Japan; Seki, T., National Inst. for Fusion Science, Japan; Tsumori, K., National Inst. for Fusion Science, Japan; Yoshimura, Y., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Kawamoto, T., National Inst. for Fusion Science, Japan; Kobayashi, S., National Inst. for Fusion Science, Japan; Shimpo, F., National Inst. for Fusion Science, Japan; Takita, Y., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 10p; In English; 17th; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/FTP/21; NIFS-564; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The LHD has finished construction and went into Experimental phase in early April 1998. The first plasma was obtained with ECH with the power level of 300 kW. Three heating schemes, ECH, ICRF, and NBI are adopted and join the heating experiment in the second experimental campaign. Since the LHD has super-conducting coils, one of the missions of plasma heating in LHD is demonstration of steady state plasma. Intensive technology development for steady state plasma heating has been carried out at NIFS since 1992. This paper summarizes the achievement of these developmental activities in the past several years. The knowledge obtained may be applicable to ITER, where steady state plasma heating is essential.
Author
Steady State; Technology Assessment; Conferences; Plasmas (Physics); Plasma Heating; Construction

19990026869 Department of Energy, Office of Energy Research, Washington, DC USA
Critical heat flux performance of hypervapotrons proposed for use in the ITER divertor vertical target
Youchison, D. L., Department of Energy, USA; Marshall, T. D., Department of Energy, USA; McDonald, J. M., Department of Energy, USA; Lutz, T. J., Department of Energy, USA; Watson, R. D., Department of Energy, USA; Sep. 30, 1997; 19p; In English, USA; Sponsored by International Society for Optical Engineering, USA
Report No.(s): DE98-000176; SAND-97-2281C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Task T-222 of the International Thermonuclear Experimental Reactor (ITER) program addresses the manufacturing and testing of permanent components for use in the ITER divertor. Thermal hydraulic and critical heat flux performance of the heat sinks proposed for use in the divertor vertical target are part of subtask T-222.4. As part of this effort, two single channel, medium scale, bare copper alloy, hypervapotron mockups were designed, fabricated, and tested using the EB-1200 electron beam system. The objectives of the effort were to develop the design and manufacturing procedures required for construction of robust high heat flux (HHF) components, verify thermalhydraulic, thermomechanical and critical heat flux (CHF) performance under ITER relevant conditions, and perform analyses of HHF data to identify design guidelines and failure criteria and possibly modify any applicable CHF correlations. The design, fabrication, and finite element modeling of two types of hypervapotrons are described; a common version already in use at the Joint European Torus (JET) and a new attached fin design. HHF test data on the attached fin hypervapotron will be used to compare the CHF performance under uniform heating profiles on long heated lengths with that of localized, highly peaked, off nominal profiles.
NTIS
Heat Flux; Thermonuclear Reactions; Reactor Design

19990027006 Department of Energy, Washington, DC USA
Measurement of RT amplitudes and wavelengths of laser driven plates
Frank, A. M., Department of Energy, USA; Gillespie, C. H., Department of Energy, USA; Oct. 16, 1997; 9p; In English; New Models and Numerical Codes for Shock Wave Processes in Condensed Media, USA
Report No.(s): DE98-050730; UCRL-JC-127179; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A laser drive plate, that is a dense solid plate drive by a laser heated, lower density plasma, is inherently Raleigh-Taylor (R-T) unstable, We have previously indicated that observed surface perturbation on the plate are probably R-T instabilities, initiated by the mode structure of the driving laser beam. Using a semi- transparent impact target viewed with a polarized Epi- Illuminated Confocal Streak Microscope, has allowed us to measure the amplitude and growth of the instability.
NTIS
Laser Targets; Conferences; Electromagnetic Measurement; Wavelengths; Stability; Laser Beams

19990027059 Rutherford Appleton Lab., Chilton, UK
Third International Workshop on the Fast Ignition of Fusion Targets
Norreys, Peter A., Rutherford Appleton Lab., UK; Jan. 08, 1999; ISSN 1358-6254; In English; 3rd, 21-23 Sep. 1998, Chilton, UK
Report No.(s): RAL-TR-1998-085; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The proceeding here demonstrate that tremendous progress is being made both in theory and experiment. In addition to new physical insights provided by two and three dimensional particle in cell simulations to describe relativistic laser plasma interactions, new hybrid codes have been developed to provide integrated descriptions of electron transport in solid density plasmas. A striking feature of the presentations was the necessity to integrate electron acceleration mechanisms arising in the coronal plasma, mechanisms which had previously been thought to be useful only to new accelerator concepts. Another new feature of this workshop was the inclusion of a session devoted to nuclear physics techniques to diagnose the plasma conditions, techniques which will undoubtedly grow in importance in future experimental work in the field.
Derived from text
Conferences; Nuclear Fusion; Laser Fusion; Laser Plasma Interactions; Laser Targets; Ignition

19990027071 National Inst. for Fusion Science, Dept. of Engineering and Technical Services, Nagoya, Japan
Proceedings of Symposium on Technology in Laboratories
Mar. 1998; ISSN 0915-0372; 336p; In Japanese; Technology in Laboratories, 11-12 Sep. 1997, Toki City, Japan
Report No.(s): NIFS-MEMO-26; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The Symposium on Technology in Laboratories was held on September 11 and 12 at Ceratopia Toki in Toki City, Gifu Prefecture, Japan. This symposium was hosted by the National Institute for Fusion Science (NIFS). There were about 280 participants from many Japanese Universities, Laboratories, and Industries. Seventy-eight papers were presented in the symposium. Technical experience and new techniques were reported and discussed being divided into five sessions; technologies of fabrication, cryogenics, diagnostic and control systems, computer and experimental apparatus.
Author
Conferences; Technologies; Cryogenics; Control; Computers; Laboratory Equipment; Research Facilities; Laboratories

19990027072 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA
Ion Beam and Plasma Technology Development for Surface Modification at Los Alamos National Laboratory
Davis, H. A., Department of Energy, USA; Munson, C. P., Department of Energy, USA; Wood, B. P., Department of Energy, USA; Bitteker, L. J., Department of Energy, USA; Nastasi, M. A., Department of Energy, USA; Sep. 30, 1997; 20p; In English; 4th; Sponsored by Materials Research Society, USA
Report No.(s): DE98-002673; LA-UR-97-4105; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We are developing two high-throughput technologies for materials modification. The first is a repetitive intense ion beam source for materials modification through rapid surface melt and resolidification (up to 10(exp 10) deg/sec cooling rates) and for ablative deposition of coatings. The short range of the ions (typically 0.1 to 5 micrometers) allows vaporization or melting at moderate beam energy density (typically 1-50 J/cm(exp 2)). A new repetitive intense ion beam accelerator called CHAMP is under development at Los Alamos. The design beam parameters are: E = 200 keV, I = 15 kA, (tau) = 1 (micro)s, and 1 Hz. This accelerator will enable applications such as film deposition, alloying and mixing, cleaning and polishing, corrosion and wear resistance, polymer surface treatments, and nanophase powder synthesis. The second technology is plasma source ion implantation (PSII) using plasmas generated from both gas phase (using radio frequency excitation) and solid phase (using a cathodic arc) sources. We have used PSII to directly implant ions for surface modification or as method for generating graded interfaces to enhance the adhesion of surface coatings. Surfaces with areas of up to 16 m(exp 2) and weighing more than a thousand kilograms have been treated in the Los Alamos PSII chamber. In addition, PSII in combination with cathodic source deposition has been used to form highly

adherent, thick Er2O3 coatings on steel for reactive metal containment in casting. These coatings resist delamination under extreme mechanical and thermal stress.
NTIS
Ion Beams; Plasmas (Physics); Surface Treatment; Design Analysis; Ion Sources

19990027073 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Selective Etching of Wide Bandgap Nitrides
Shul, R. J., Department of Energy, USA; Willison, C. G., Department of Energy, USA; Bridges, M. M., Department of Energy, USA; Han, J., Department of Energy, USA; Lee, J. W., Department of Energy, USA; Dec. 31, 1997; 9p; In English, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE98-002674; SAND-98-0257C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
High-density plasma etching has been an effective patterning technique for the Group-III nitrides due to ion fluxes which are 2 to 4 orders of magnitude higher than more conventional reactive ion etch (RIE) systems. Gan etch rates exceeding 0.68 micrometer/min have been reported in C12/H2/AR inductively coupled plasmas (ICP) at -280 V DC-BIAS. Under these conditions, the etch mechanism is dominated by ion bombardment energies which can induce damage and minimize etch selectivity. High selectivity etch processes are often necessary for heterostructure devices which are becoming more prominent as growth techniques improve. In this study, we will report high-density ICP etch rates and selectivities for GAN, ALN, and INN as a function of cathode power, ICP- source power, and chamber pressure. GAN:ALN selectivities (gt) 8:1 were observed in a C12/Ar plasma at 10 mTorr pressure, 500 W ICP-source power, and 130 W cathode rf-power, while the GaN:InN selectivity was optimized at approx. 6.5:1 at 5 mTorr, 500 W ICP-source power, and 130 W cathode rf-power.
NTIS
Energy Gaps (Solid State); Plasmas (Physics); Plasma Etching

19990027102 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Measuring the EOS of a Dense, Strongly Coupled Plasma: Description of the Technique
Benage, J. F., Department of Energy, USA; Kyraka, G., Department of Energy, USA; Workman, J., Department of Energy, USA; Tierney, T., Department of Energy, USA; Aug. 31, 1997; 7p; In English; Strongly coupled coulomb systems
Report No.(s): DE98-002661; LA-UR-97-4254; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This paper describes a new experimental design which we believe can produce reasonably accurate data for the equation of state (EOS) of a dense plasma. This design takes advantage of the standard shock technique used for determining the high pressure EOS of solids. It also utilizes recently developed experimental techniques for producing dense, strongly coupled plasmas as well as new diagnostic techniques for measuring the properties of these plasmas. The results should be able to distinguish among theoretical models for plasmas at just under solid density and temperatures of 10's of eV.
NTIS
Strongly Coupled Plasmas; Equations of State

19990027103 Department of Energy, Office of Energy Research, Washington, DC USA
DIII-D ECH multiple gyrotron control system
Ponce, D., Department of Energy, USA; Lohr, J., Department of Energy, USA; Tooker, J. F., Department of Energy, USA; Cary, W. P., Department of Energy, USA; Harris, T. E., Department of Energy, USA; Nov. 30, 1997; 8p; In English; 17th; Fusion engineering; Sponsored by Institute of Electrical and Electronics Engineers, USA; Meeting sponsored in part by NPSS
Report No.(s): DE98-002643; GA-A22720; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
DIII-D's ECH upgrade with 1 MW, 110 GHz gyrotrons is ongoing, and with it, an upgrade of the control system. The Electron Cyclotron Heating (ECH) Multiple Gyrotron Control System uses software distributed among networked computers, interfaced to a programmable logic controller (PLC), the timing and pulse system, power supplies, vacuum and wave guide controls, and instrumentation. During DIII-D operations, the system will allow a chief and a co-operator to control and monitor a number of gyrotrons from different manufacturers. The software, written using LabVIEW, allows for remote and multiple operator control. Thus any supported computer can become a control station and multiple projects can be simultaneously accommodated. Each operator can be given access to the controls of all gyrotrons or to a subset of controls. Status information is also remotely available. The use of a PLC simplifies the hardware and software design. It reduces interlock and control circuitry, includes monitoring for slow analog signals, and allows one software driver to efficiently interface to a number of systems. In addition, the interlock logic can be easily changed and control points can be forced as needed. The pulse system is designed around arbitrary function genera-

tors. Various modulation schemes can be accommodated, including real-time control of the modulation. This discussion will include the hardware and software design of the control system and its current implementation.
NTIS
Electron Cyclotron Heating; Control Systems Design; Tokamak Devices; Computer Programs; Cyclotron Resonance Devices; Numerical Control

19990027104 Department of Energy, Office of Energy Research, Washington, DC USA
Multi-megawatt 110 GHz ECH system for the DIII-D tokamak
Callis, R. W., Department of Energy, USA; Lohr, J., Department of Energy, USA; O'Neill, R. C., Department of Energy, USA; Ponce, D., Department of Energy, USA; Prater, R., Department of Energy, USA; Nov. 30, 1997; 8p; In English; 17th; Fusion engineering; Sponsored by Institute of Electrical and Electronics Engineers, USA; Meeting sponsored in part by NPSS
Report No.(s): DE98-002642; GA-A22707; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Two 110 GHz gyrotrons with nominal output power of 1 MW each have been installed on the DIII-D tokamak. The first 110 GHz gyrotron built by Gycom has a nominal rating of 1 MW and a 2s pulse length, with the pulse length being determined by the maximum temperature allowed on the edge cooled boron nitride window. This gyrotron was first operated into the DIII-D tokamak in late 1996. The second gyrotron was built by Communications and Power Industries (CPI) was commissioned during the spring of 1997. The CPI gyrotron uses a double disc FC-75 cooled sapphire window which has a pulse length rating of 0.8 s at 1 MW, 2 s at 0.5 MW and 10 s at 0.2 MW. Both gyrotrons are connected to the tokamak by a low-loss-windowless evacuated transmission line using circular corrugated waveguide for propagation in the HE(11) mode. Using short pulse lengths to avoid breakdown inside the air filled waveguide, the microwave beam has been measured inside the DIII-D vacuum vessel using a paper target and an IR camera. The resultant microwave beam was found to be well focused with a spot size of approximately 8 cm. The beam can be steered poloidially from the center to the outer edge of the plasma. The initial operation of the Gycom gyrotron with about 0.5 MW delivered to a low density plasma for 0.5 s showed good central electron heating, with peak temperature in excess of 10 keV. A third gyrotron, being built by CPI, will be installed later this year. Progress with the first CPI tube will also be discussed and future plans for the ECH installation and physics experiments will be presented.
NTIS
Tokamak Devices; Cyclotron Resonance Devices; Electron Cyclotron Heating

19990027132 Department of Energy, Washington, DC USA
Use of Z-pinch radiation sources for high-pressure shock wave studies
Asay, J. R., Department of Energy, USA; Konrad, C. H., Department of Energy, USA; Hall, C. A., Department of Energy, USA; Trott, W. M., Department of Energy, USA; Chandler, G. A., Department of Energy, USA; Dec. 31, 1998; 6p; In English; 1998 Hypervelocity Impact, 1998, USA
Report No.(s): DE98-007225; SAND-98-0063C; CONF-981109; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors are developing a new shock wave diagnostic using Z pinch sources for high-pressure equation of state (EOS) measurements. Specifically, they are employing VISAR interferometry to measure the particle velocity of shocked materials and fiber optic probes to measure the shock speed. Combination of these measurements will allow absolute EOS data with Z accelerators. This report is a progress report on the development of this new approach to EOS measurements; however, preliminary data obtained with the diagnostics are encouraging. With further development of Z pinch sources, it is envisioned that a variety of EOS and constitutive property measurements can be made. Time-resolved wave profile measurements will then provide a variety of EOS and material property data, such as isentropic EOS, initial compressive strength and shock-induced compressive strength, dynamic tensile strength, kinetics of phase transitions, and surface stability studies.
NTIS
Zeta Pinch; Radiation Sources; High Pressure; Shock Waves

19990027133 Department of Energy, Washington, DC USA
Use of Z pinch radiation sources for high pressure shock wave studies
Asay, J. R., Department of Energy, USA; Konrad, C. H., Department of Energy, USA; Hall, C. A., Department of Energy, USA; Trott, W. M., Department of Energy, USA; Chandler, G. A., Department of Energy, USA; Dec. 31, 1998; 5p; In English; Hypervelocity Impact, 1998, USA
Report No.(s): DE98-007226; SAND-98-0061C; CONF-981109; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent developments in pulsed power technology demonstrate use of intense radiation sources (Z pinches) for driving planar shock waves in samples with spatial dimensions larger than possible with other radiation sources. Initial indications are that the use of Z pinch sources can be used to produce planar shock waves in samples with diameters of a few millimeters and thicknesses approaching one half millimeter. These dimensions allow increased accuracy of both shock velocity and particle velocity measurements. The Z pinch radiation source uses imploding metal plasma induced by self-magnetic fields applied to wire arrays to produce high temperature x-ray environments in vacuum hohlraum enclosures. Previous experiments have demonstrated that planar shock waves can be produced with this approach. A photograph of a wire array located inside the vacuum hohlraum is shown here. Typically, a few hundred individual wires are used to produce the Z pinch source. For the shock wave experiments being designed, arrays of 120 to 240 tungsten wires with a diameter of 40 mm and with individual diameters of about 10 (micro)m are used. Preliminary experiments have been performed on the Z pulsed radiation source to demonstrate the ability to obtain VISAR measurements in the Z accelerator environment. Analysis of these results indicate that another effect, not initially anticipated, is an apparent change in refractive index that occurs in the various optical components used in the system. This effect results in an apparent shift in the frequency of reflected laser light, and causes an error in the measured particle velocity. Experiments are in progress to understand and minimize this effect.

NTIS

Radiation Sources; High Pressure; Shock Waves; Pulsed Radiation; Pinch Effect; Zeta Pinch

19990027137 Department of Energy, Office of Energy Research, Washington, DC USA

3 MW, 110 GHz ECH system for the D3-D tokamak

Callis, R. W., Department of Energy, USA; Lohr, J., Department of Energy, USA; Ponce, D., Department of Energy, USA; Harris, T. E., Department of Energy, USA; ONeill, R. C., Department of Energy, USA; Jul. 31, 1998; 5p; In English; 20th; Fusion Technology (SOFT '98), USA

Report No.(s): DE98-007259; GA-A22906; CONF-980922; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

To support the Advanced Tokamak (AT) operating regimes in the DIII-D tokamak, methods need to be developed to control the current and pressure profiles across the plasma discharge. In particular, AT plasmas require substantial off-axis current in contrast to normal tokamak discharges where the current peaks on-axis. An effort is under way to use Electron Cyclotron Current Drive (ECCD) as a method of sustaining the off-axis current in AT plasmas. The first step in this campaign is the installation of three megawatts of electron cyclotron heating power. This involves the installation of three rf systems operating at 110 GHz, the second harmonic resonance frequency on DIII-D, with each system generating nominally 1 MW. The three systems will use one GYCOM (Russian) gyrotron and two CPI (formerly Varian) gyrotrons, all with windowless evacuated corrugated low loss transmission lines. The first two of three 1 MW ECH systems is operating routinely at DIII-D with injected power at 110 GHz of approximately 1.5 MW with good power accountability. Transport experiments using modulated ECH have been performed confirming the power deposition location. On-axis and off-axis current drive experiments have been successfully performed with on-axis ECCD currents of 170 kA being observed.

NTIS

Electron Cyclotron Heating; Tokamak Devices; Cyclotron Resonance Devices

19990027138 Department of Energy, Office of Energy Research, Washington, DC USA

Performance and development of the D3-D tokamak core

Anderson, P. M., Department of Energy, USA; Johnson, W. R., Department of Energy, USA; Busath, J. L., Department of Energy, USA; Allen, S. L., Department of Energy, USA; Jul. 31, 1998; 5p; In English; 20th; Fusion Technology (SOFT'98), USA

Report No.(s): DE98-007260; GA-A22884; CONF-980922; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The D3-D tokamak is an upgrade of the Doublet 3 configuration which has operated since early 1986. This paper presents recent advances in performance using the upper divertor, fabrication development for vanadium components, operation of the helium leak checking in a high deuterium background, and restoration of the damaged Ohmic heating solenoid.

NTIS

Performance Prediction; Tokamak Devices; Reactor Cores; Fabrication

19990027145 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA

Calibration methods for neutron diagnostics at Omega: DOE/NLUF ***Final Report***

Padalino, S., Department of Energy, USA; Jan. 15, 1998; 8p; In English

Report No.(s): DE98-007335; DOE/SF/21019-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The investigation of Calibration Methods for Neutron Diagnostics at Omega is still underway. The data in this report is a compilation of measurements taken at Omega during the time of the grant. The data set has been updated with additional information taken this year. The neutron yield from an ICF event was determined by measuring the activity of an aluminum sample activated by target- produced DT neutrons. The radioactive nuclei Na-24 and Mg-27, which were produced via the Al-27(n,alpha)Na-24 and Al-27(n,p)Mg-27 direct reactions, beta decay to excited states of Mg-24 and Al-27 respectively. These excited states then emitted gamma rays as the nuclei de-excite to their respective ground states. The gamma rays are detected and counted. From their numbers the neutron yield is determined.
NTIS
Calibrating; Procedures; Data Management; Research Facilities; Neutrons

19990027150 Air Force Research Lab., Kirkland AFB, NM USA
Experimental Studies of Explosively-Driven Magnetohydrodynamic Generators ***Final Report, 1 Oct. 1994 - 31 Oct. 1997***
Agee, F. J.; Baca, G.; Chama, D.; Lehr, F. M.; Englert, T.; Oct. 1997; 41p; In English
Contract(s)/Grant(s): AF Proj. 5797
Report No.(s): AD-A359509; AFRL-DE-PS-TR-1998-1073; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The field of High Power Microwaves (HPM) has evolved as a result of advances in the field of pulsed power, which has made pulses of electrical energy available that can drive HPM sources to gigawatt levels. One of the most compact forms of pulsed power involves the storage of chemical energy in the form of explosive charges. Explosive magnetohydrodynamic (MHD) generators are electrical power sources, which convert the kinetic energy of moving plasma into useful electrical energy through the magnetic portion of the Lorentz force. This report describes research conducted by the Air Force Research Laboratory to test specific designs of explosively driven magnetohydrodynamic generators. The goal of the research was to investigate the use of gigawatt generators in driving reactive loads appropriate to diode, and ultimately HPM applications. Two test series were performed, the first of which consisted of experiments on a low voltage generator and the second of which had the goal of scaling the existing design to higher voltage while retaining the reactive-type load. The complex problem of diagnostics of the plasma in this explosive test was addressed using fast, temporally resolved, plasma measurements, as well as spectroscopic plasma constituent measurements.
DTIC
Magnetohydrodynamic Generators; Plasmas (Physics); Kinetic Energy; Voltage Generators; Microwaves

19990027177 Department of Energy, Office of Energy Research, Washington, DC USA
Characterization of Plasma Sprayed Beryllium ITER First Wall Mockups
Castro, R. G., Department of Energy, USA; Vaidya, R. U., Department of Energy, USA; Hollis, K. J., Department of Energy, USA; Oct. 31, 1997; 12p; In English; 3rd; Beryllium technology for fusion, USA; Sponsored by International Energy Agency, France
Report No.(s): DE98-003007; LA-UR-97-4201; CONF-9710153; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
ITER first wall beryllium mockups, which were fabricated by vacuum plasma spraying the beryllium armor, have survived 3000 thermal fatigue cycles at 1 MW/sq m without damage during high heat flux testing at the Plasma Materials Test Facility at Sandia National Laboratory in New Mexico. The thermal and mechanical properties of the plasma sprayed beryllium armor have been characterized. Results are reported on the chemical composition of the beryllium armor in the as-deposited condition, the through thickness and normal to the through thickness thermal conductivity and thermal expansion, the four- point bend flexure strength and edge-notch fracture toughness of the beryllium armor, the bond strength between the beryllium armor and the underlying heat sink material, and ultrasonic C-scans of the Be/heat sink interface.
NTIS
Plasmas (Physics); Plasma Spraying; Beryllium; Walls; Tokamak Devices

19990027186 Department of Energy, Office of Energy Research, Washington, DC USA
Tearing mode analysis in tokamaks, revisited
Nishimura, Y., Department of Energy, USA; Callen, J. D., Department of Energy, USA; Hegna, C. C., Department of Energy, USA; Dec. 31, 1997; 30p; In English, USA
Report No.(s): DE98-003891; UW-CPTC-97-21; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A new Delta(prime) shooting code has been developed to investigate tokamak plasma tearing mode stability in a cylinder and large aspect ratio ((epsilon) (le)0.25) toroidal geometries, neglecting toroidal mode coupling. A different computational algorithm is used (shooting out from the singular surface instead of into it) to resolve the strong singularities at the mode rational surface, particularly in the presence of finite pressure term. Numerical results compare favorably with Furth et al. results. The effects

of finite pressure, which are shown to decrease Delta (prime), are discussed. It is shown that the distortion of the flux surfaces by the Shafranov shift, which modifies the geometry metric element stabilizes the tearing mode significantly, even in a low (beta) regime before the toroidal magnetic curvature effects come into play. Double tearing modes in toroidal geometries are examined as well. Furthermore, m (ge)2 tearing mode stability criteria are compared with three dimensional initial value MHD simulation by the FAR code.
NTIS
Tokamak Devices; Coupled Modes; Tearing Modes (Plasmas)

19990027195 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Ion cyclotron system for the KSTAR tokamak
Swain, D. W., Department of Energy, USA; Ryan, P. W., Department of Energy, USA; Taylor, D. J., Department of Energy, USA; Hong, B. G., Department of Energy, USA; Bae, Y. D., Department of Energy, USA; Jan. 31, 1998; 4p; In English; 2nd; Radio Frequencies heating and current drive of fusion devices, USA
Report No.(s): DE98-004057; ORNL/CP-96280; CONF-980130; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The KSTAR (Korean Superconducting Tokamak Advanced Research) tokamak (Ro = 1.8 m, a = 0.5 m, (kappa)(lt)= 2, BT(lt)= 3.5 T, Ip(lt)= 2 MA, (tau) pulse(lt)= 300 s) is being constructed to do long pulse, high beta, advanced operating mode fusion physics experiments. The ion cyclotron (IC) system (in conjunction with an 8 MW neutral beam and a 1.5 MW lower hybrid system) will provide heating and current drive capability for the machine. The IC system will deliver 6 MW of rf power to the plasma in the 25 to 60 MHz frequency range, using a single four-strap antenna mounted in a midplane port. It will be used for ion heating, fast wave current drive (FWCD), and mode conversion current drive (MCCD). The phasing between current straps in the antenna will be adjustable quickly during operation to provide the capability of changing the current drive efficiency. This paper describes the design of the IC system hardware: the electrical characteristics of the antenna and the matching system, the requirements on the power sources, and electrical analyses of the launcher; IC physics requirements and analyses are covered in a companion paper.
NTIS
Ion Cyclotron Radiation; Tokamak Devices; Ion Currents; Antenna Design

19990027211 Department of Energy, Washington, DC USA
Time resolved plasma spectroscopy of imploded gas-filled microballoons: The next generation ***Final Report, 17 Apr. 1995 - 30 Sep. 1997***
Hooper, C. F., Department of Energy, USA; Mar. 31, 1998; 100p; In English, USA
Report No.(s): DE98-002953; DOE/SF/20717-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This report is comprised of three documents which deal with plasma spectroscopy of laser-produced plasmas. In section 2 of this paper, the authors discuss the theoretical techniques employed to interpret these spectra and describe two sets of implosion experiments. In section 3 they list some conclusions. In Appendix A, the authors present a discussion of plasma line broadening with emphasis on the effects of accounting for ion-dynamic corrections. Appendix B presents more research related to ion-dynamic corrections. The authors examine the combined effects of ion dynamics and opacity on line profiles used in the analysis of hot dense plasmas. Specifically, they have calculated Stark broadened line profiles for both resonance and satellite lines in highly stripped Ar ions, both in the quasi-static ion approximation, and including the effects of ion dynamics. Using the results of an NLTE kinetics code, combined with an escape factor formalism to account for the effects of radiative transfer, they have calculated the relative intensities of these lines, as well as the effects of opacity on their profiles. This model spectra is used in the analysis of experimental data. In a series of experiments performed at the Laboratory for Laser Energetics plastic microballoons filled with DD and doped with Ar were imploded using the Omega laser system. The authors use time-resolved K-shell Ar spectra from the implosions. Varying the relative concentration of Ar in DD provides an opportunity to study the combined and individual effects of ion motion and opacity on the Stark broadened line profiles. Appendix C addresses the use of high opacity Krypton lines to diagnose high temperature implosions, and provides additional detail about the effects of ion dynamics.
NTIS
Spectroscopy; Microballoons; Plasma Diagnostics; Plasma Spectra

19990027404 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Motion of Microwave Plasma Electrons in the Action of Magnetic Field

Song, Ruan, Beijing Univ. of Aeronautics and Astronautics, China; Cheng, Xianan, Beijing Univ. of Aeronautics and Astronautics, China; Qi, Xianglin, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 599-602; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

In a rectangular microwave resonator, under the action of high frequency electromagnetic field and inhomogeneous static magnetic field, the electron cyclotron resonance motion of the plasma electrons have been studied. Writing out the Newton equations of motion of the electrons and by using the numerical method, the trajectory and the behavior of the motion of the electrons were computed and drawn out by computer. The energy of the electrons were also computed. Form the computed results, the characteristics of the motion and the energy absorbed by the electrons were analyzed.

Author

Electron Cyclotron Resonance; Computerized Simulation; Particle Trajectories; Equations of Motion; Newton Methods

19990027448 Naval Research Lab., Surface Chemistry Branch, Washington, DC USA

Thermal Plasma Waste Remediation Technology: Historical Perspective and Current Trends *Final Report*

Counts, Dacid A.; Sartwell, Bruce D.; Peterson, Steven H.; Kirkland, Robert; Kolak, Nicholas P.; Jan. 29, 1999; 37p; In English; Original contains color plates

Contract(s)/Grant(s): F19628-96-C-0145; AF Proj. 4266

Report No.(s): AD-A360057; NRL/MR/6170--99-8335; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The idea of utilizing thermal plasma technology for waste processing goes back to the mid-1970's during the energy crisis. Since then, more interest has been shown by universities, industry, and government in developing thermal plasma waste processing technology for hazardous and non-hazardous waste treatment. Much of the development has occurred outside of the USA, most significantly in Japan and France, while the market growth for thermal plasma waste treatment technology has remained slow in the USA. Despite the slow expansion of the marked in the USA, since the early 1990's there has been an increase in interest in utilizing thermal plasma technology for environmental remediation and treatment in lieu of the more historical methods of incineration and landfilling. Currently within the Department of Defense there are several demonstration projects underway, and details of some of these projects are provided. Prior to these efforts by the U.S. Government, the State of New York had investigated the use of thermal plasma technology for treating PCB contaminated solvent wastes from the Love Canal cleanup. As interest continues to expand in the application of thermal plasma technology for waste treatment and remediation, more and more personnel are becoming involved with treatment, regulation, monitoring, and commercial operations and many have little understanding of this emerging technology. To address these needs, this report will describe: (1) characteristics of plasmas; (2) methods for generating sustained thermal plasmas; (3) types of thermal plasma sources for waste processing; (4) the development of thermal plasma waste treatment systems; and (5) Department of Defense plasma arc waste treatment demonstration projects.

DTIC

Waste Treatment; Thermal Plasmas; Hazardous Wastes; Waste Disposal

19990027542 Department of Energy, Washington, DC USA

Development of soft x-ray tracer diagnostics for hohlraum experiments

MacFarlane, J. J., Department of Energy, USA; Cohen, D. H., Department of Energy, USA; Wang, P., Department of Energy, USA; Peterson, R. R., Department of Energy, USA; Moses, G. A., Department of Energy, USA; Apr. 30, 1998; 23p; In English

Report No.(s): DE98-006351; DOE/SF/21015-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The purpose of this report is to summarize work performed by the University of Wisconsin during fiscal year 1996 under the NLUF contract DE-FG-96SF21015. This contract involved the development of soft x-ray spectral diagnostics from tracer layers in hohlraum witness plates. This effort was originally intended to be focused on OMEGA experiments, but the experiments were changed to NOVA because initial indirect drive shots had not yet been performed on the OMEGA upgrade. Data were collected in a series of experiments between January 1997 and October 1997. Experiments were delayed somewhat due to bringing up the Hettrick spectrometer on the NOVA target chamber. The tasks related to the planning, carrying out, and modeling of the experiments are outlined in Table 1.1 and detailed in the remainder of this report.

NTIS

Hohlraums; Diagnosis; Plasma Diagnostics; X Ray Spectra; Tracers

19990027628 Department of Energy, Washington, DC USA

Spatially and temporally resolved crystal spectrometer for diagnosing high temperature pinch plasmas on Z

Nash, T., Department of Energy, USA; Derzon, M., Department of Energy, USA; Leeper, R., Department of Energy, USA; Jobe, D., Department of Energy, USA; Hurst, M., Department of Energy, USA; Jun. 30, 1998; 14p; In English; 12th; High-Temperature Plasma Diagnostics, USA

Report No.(s): DE98-005527; SAND-98-0321C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have developed a spatially and temporally resolved crystal spectrometer for analyzing a variety of pinch experiments on Z. The spectrometer uses a convex curved crystal to disperse spectra onto a flat microchannel plate framing camera detector. A single wide, 1 cm, strip on the MCP is gated to provide temporal resolution. The spectral range governed by the 4 cm length of the MCP strip varies with the central Bragg angle and crystal. For a KAP crystal a typical range is 1500 to 2000 eV. This range can be shifted by translating the crystal along the optical axis to access different Bragg angles. The spectrometer can therefore measure K shell spectra of a wide variety of elements such as Al, Ti, and Fe. The short 1 cm width of the strip is spatially resolved with an imaging cross slit. With a 500 microns cross slit and magnification 1 the spatial resolution at the pinch is 1 mm. The instrument may also be fielded with 7 time frames using a 7 strip-line microchannel plate as the detector by sacrificing the spatial resolution. The authors will present data obtained from an aluminum pinch on Z.

NTIS

Plasma Diagnostics; Crystals; Spatial Resolution; Spectrometers; Fabrication; Pinch Effect; Temporal Resolution

19990027629 Department of Energy, Washington, DC USA

Implications of high-energy photons and electrons on target preheat at Z

Derzon, M., Department of Energy, USA; Nash, T., Department of Energy, USA; Chandler, G., Department of Energy, USA; Jun. 30, 1998; 8p; In English; 12th; High-Temperature Plasma Diagnostics, USA

Report No.(s): DE98-005526; SAND-98-0556C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High-energy photons and electrons on the Z accelerator will deposit energy into a capsule and fuel; this may create a potential preheat problem for ICF. In this paper the authors discuss heating of the capsule and fuel by high- energy photons and electrons. The fuel is heated to <2 eV, in a time- integrated sense, on Z by these particles. Because peak implosion occurs at the peak in the soft x-ray emission on Z, the heating at times of interest is reduced roughly an order of magnitude to (approximately)0.2 eV for times of interest and fuel preheat from this mechanism is concluded to be small. These estimates are generated from time-integrated bremsstrahlung measurements. The uncertainty in the heating is high because the electron spectrum is not known directly, but inferred. In addition the influence of the particles between 5 keV and 60 keV is not known. Given the uncertainties the authors do not know the impact on the feasibility of internal dynamic hohlraums on z-pinch driven ICF implosions on X-1. The authors discuss these issues and suggest directions for further study.

NTIS

Electrons; Photons; Zeta Pinch; Heating; Estimates; Electron Spectroscopy; Deposits; Particle Accelerators

19990027630 Department of Energy, Washington, DC USA

Measurement of the photon field on Sandia's Z facility

Rochau, G. E., Department of Energy, USA; Derzon, M., Department of Energy, USA; Fehl, D., Department of Energy, USA; Jun. 30, 1998; 12p; In English; 12th; High-Temperature Plasma Diagnostics, USA

Report No.(s): DE98-005525; SAND-98-0473C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Z Facility at Sandia National Laboratories utilizes z-pinch implosions to produce up to 2 MJ of X-rays. On Z, bremsstrahlung radiation is produced as a product of both power flow electrons and those accelerated in the pinch region. An understanding of the energy spectra and intensity of this radiation is important to both the explanation of the z-pinch physics and the design of new diagnostics. This paper describes the techniques and results used to date for mapping the bremsstrahlung radiation in the vacuum section of the Z Accelerator.

NTIS

X Ray Sources; Photons; Field Emission; Diagnosis; Electrons; Implosions; X Rays; Zeta Pinch

19990027631 Department of Energy, Washington, DC USA

Fielding of the on-axis diagnostic package at Z

Hurst, M. J., Department of Energy, USA; Nash, T. J., Department of Energy, USA; Derzon, M., Department of Energy, USA; Kellogg, J. W., Department of Energy, USA; Torres, J., Department of Energy, USA; Jun. 30, 1998; 10p; In English; 12th; High-Temperature Plasma Diagnostics, USA

Report No.(s): DE98-005524; SAND-98-1282C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have developed a comprehensive diagnostic package for observing z-pinch radiation along the pinch axis on the Z accelerator. The instrumentation, which was fielded on the axial package, are x-ray diagnostics requiring direct lines of sight to the target. The diagnostics require vacuum access to the center of the accelerator. The environment is a hostile one, where one must deal with an intense, energetic photon flux (alpha amp greater than 100 keV), EMP, debris (e.g. bullets or shrapnel), and mechanical shock in order for the diagnostics to survive. In addition, practical constraints require the package be refurbished and utilized on a once a day shot schedule. In spite of this harsh environment, the authors have successfully fielded the diagnostic package with a high survivability of the data and the instruments. In this paper, they describe the environment and issues related to the re-entrant diagnostic package's implementation and maintenance.
NTIS
Procedures; Pinch Effect; Zeta Pinch; Fusion Reactors; Emission; Nuclear Radiation

19990027633 Department of Energy, Washington, DC USA
Pulsed Power Fusion Program update
Quintenz, J. P., Department of Energy, USA; Adams, R. G., Department of Energy, USA; Allshouse, G. O., Department of Energy, USA; Jun. 30, 1998; 9p; In English; 12th; High Power Particle Beams, USA
Report No.(s): DE98-005520; SAND-98-0161C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The US Department of Energy has supported a substantial research program in Inertial Confinement Fusion (ICF) since the early 1970s. Over the course of the ensuing 25 years, pulsed power energy, efficiency, and relatively low cost of the technology when compared to the mainline ICF approach involving large glass lasers. These compelling advantages of pulsed power, however, have been tempered with the difficulty that has been encountered in concentrating the energy in space and time to create the high energy and power density required to achieve temperatures useful in indirect drive ICF. Since the Beams '96 meeting two years ago, the situation has changed dramatically and extremely high x-ray power ((approximately)290 TW) and energy ((approximately)1.8 MJ) have been produced in fast x-pinch implosions on the Z accelerator. These sources have been utilized to heat hohlraums to alpha greater than 150 eV and have opened the door to important ICF capsule experiments.
NTIS
Research; Fusion (Melting); Technology Assessment; Energy Conservation; Inertial Confinement Fusion

19990027648 National Inst. for Fusion Science, Toki, Japan
Various Neutrino Beams Generated by D2 Gas Discharge
Uramoto, Joshin, National Inst. for Fusion Science, Japan; Mar. 1998; ISSN 0915-633X; 16p; In English
Report No.(s): NIFS-545; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

From outside of a D2 gas discharge in magnetic field, positive K mesonlike particles K(+) are extracted with D(+), D3(+) ions in a low voltage (80OV) and are shot into a thick metal plates MP. When positive ions (above a critical ion energy) are supplied in the opposite side of MP, negative muonlike particles mu(-), negative K mesonlike particles K(-) and negative tau-like particles tau(-) appear continuously while the energies are corresponding to the extraction voltage (80OV). From the total thickness of MP, the unknown particles penetrating MP are estimated to be mu-neutrino nu(sub mu), (K-neutrino nu(sub k)) and tau-neutrino nu(sub tau). If electrons (above a critical electron energy are supplied in the opposite side of MP, positive muonlike particles mu(+), positive K mesonlike particles K(+) and positive tau-like particles tau(+) appear. Then, the unknown particles are estimated to be anti-mu-neutrino (bar)nu(sub mu), (anti-K-neutrino (bar)nu(sub k)) and anti-tau-neutrino (bar)nu(sub tau).
Author
Neutrino Beams; Neutrinos; Positive Ions; Electric Potential; Magnetic Fields

19990027650 National Inst. for Fusion Science, Toki, Japan
Electromagnetic Effects on Rippling Instability and Tokamak Edge Fluctuations
Murakami, Sadayoshi, National Inst. for Fusion Science, Japan; Saleem, Hamid, National Inst. for Fusion Science, Japan; Jul. 1998; ISSN 0915-633X; 16p; In English
Report No.(s): NIFS-554; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Electromagnetic effects on rippling mode are investigated as a cause of low frequency electromagnetic fluctuations in tokamak edge region. It is shown that, in a current-carrying resistive plasma, the purely growing electrostatic rippling mode can turn out to be an electromagnetic oscillatory instability. The resistivity fluctuation and temperature gradient are the main sources of this instability, which requires both parallel and perpendicular wave vectors. The Alfven waves in a coupled dispersion relation are found heavily damped in such dissipative plasmas.
Author
Tokamak Devices; Magnetohydrodynamic Stability; Electrical Resistivity; Plasmas (Physics); Magnetohydrodynamic Waves

19990027665 Department of Energy, Office of Energy Research, Washington, DC USA

Control of nonlinear systems using periodic parametric perturbations with application to a reversed field pinch

Mirus, K. A., Department of Energy, USA; Jun. 30, 1998; 162p; In English

Report No.(s): DE98-007453; DOE/ER/54345-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this thesis, the possibility of controlling low- and high-dimensional chaotic systems by periodically driving an accessible system parameter is examined. This method has been carried out on several numerical systems and the MST Reversed Field Pinch. The numerical systems investigated include the logistic equation, the Lorenz equations, the Roessler equations, a coupled lattice of logistic equations, a coupled lattice of Lorenz equations, the Yoshida equations, which model tearing mode fluctuations in a plasma, and a neural net model for magnetic fluctuations on MST. This method was tested on the MST by sinusoidally driving a magnetic flux through the toroidal gap of the device. Numerically, periodic drives were found to be most effective at producing limit cycle behavior or significantly reducing the dimension of the system when the perturbation frequency was near natural frequencies of unstable periodic orbits embedded in the attractor of the unperturbed system. Several different unstable periodic orbits have been stabilized in this way for the low- dimensional numerical systems, sometimes with perturbation amplitudes that were less than 5% of the nominal value of the parameter being perturbed. In high-dimensional systems, limit cycle behavior and significant decreases in the system dimension were also achieved using perturbations with frequencies near the natural unstable periodic orbit frequencies. Results for the MST were not this encouraging, most likely because of an insufficient drive amplitude, the extremely high dimension of the plasma behavior, large amounts of noise, and a lack of stationarity in the transient plasma pulses. NTIS

Perturbation; Nonlinear Systems; Reverse Field Pinch

19990027737 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Electron Beam-Plasma Interaction Study in a Quiescent Plasma Machine ***Estudo da Interacao Feixe de Electrons-Plasma em uma Maquina de Plasma Quiescente***

doPrado, Fabio, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 204p; In Portuguese

Report No.(s): INPE-6819-TDI/640; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This work is an experimental study of Langmuir wave generation by the interaction between a weak electron beam and a plasma created in a quiescent plasma machine, called PQUI. This work describes the evolution of such beam-plasma system to a strong Langmuir turbulence regime. The non-linear effects of modulational instability are studied by means of the changes in the processes of beam relaxation and in the Langmuir wave spectrum.

Author

Beam Interactions; Plasma-Particle Interactions; Wave Generation; Langmuir Turbulence; Plasma Waves; Electron Beams

19990027958 Department of Energy, Washington, DC USA

National Ignition Facility integrated computer control system

VanArsdall, P. J., Department of Energy, USA; Jun. 01, 1998; 14p; In English; 3rd; Solid state lasers for application to inertial confinement fusion, USA

Report No.(s): DE98-058704; UCRL-JC-129873; CONF-980653; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The NIF design team is developing the Integrated Computer Control System (ICCS), which is based on an object-oriented software framework applicable to event-driven control systems. The framework provides an open, extensible architecture that is sufficiently abstract to construct future mission-critical control systems. The ICCS will become operational when the first 8 out of 192 beams are activated in mid 2000. The ICCS consists of 300 front-end processors attached to 60,000 control points coordinated by a supervisory system. Computers running either Solaris or VxWorks are networked over a hybrid configuration of switched fast Ethernet and asynchronous transfer mode (ATM). ATM carries digital motion video from sensors to operator consoles. Supervisory software is constructed by extending the reusable framework components for each specific application. The framework incorporates services for database persistence, system configuration, graphical user interface, status monitoring, event logging, scripting language, alert management, and access control. More than twenty collaborating software applications are derived from the common framework. The framework is interoperable among different kinds of computers and functions as a plug-in software bus by leveraging a common object request brokering architecture (CORBA). CORBA transparently distributes the software objects across the network. Because of the pivotal role played, CORBA was tested to ensure adequate performance. NTIS

Computers; Access Control; Numerical Control; Control Systems Design

19990027959 Department of Energy, Washington, DC USA

Optimization of the alignment sensitivity and energy stability of the NIF regenerative amplifier cavity/011

Hopps, N., Department of Energy, USA; Jun. 24, 1998; 9p; In English; 3rd; Solid state lasers for application to inertial confinement fusion, USA

Report No.(s): DE98-058701; UCRL-JC-130961; CONF-980653; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The work to improve the energy stability of the regenerative amplifier ('regen') for the National Ignition Facility is described. This includes a fast feed-forward system, designed to regulate the output energy of the regen by monitoring how quickly a pulse builds up over many round trips. Shot-to-shot energy fluctuations of all elements prior to (and including) the regen may be compensated for in this way, at the expense of a loss of approximately 50%. Also included is a detailed study into the alignment sensitivity of the regen cavity, with the goal of quantifying the effect of misalignment on the output energy. This is done by calculating the displacement of the eigenmode by augmenting the cavity ABCD matrix with the misalignment matrix elements, E, F. In this way, cavity misalignment issues due to thermal loading of the gain medium are investigated. Alternative cavity designs, which reduce the alignment sensitivity and therefore the energy drift over periods of continuous operation, are considered. Alterations to the amplifier head design are also considered.

NTIS

Optimization; Alignment; Sensitivity; Stability; Amplifier Design; Cavities

19990027960 Department of Energy, Washington, DC USA

Simulations of a phase corrector plate for the National Ignition Facility

Williams, W., Department of Energy, USA; Jul. 01, 1998; 10p; In English; 3rd; Solid state lasers for application to inertial fusion, USA

Report No.(s): DE98-058636; UCRL-JC-130033; CONF-980653; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Simulations are presented on the effect of placing a static phase corrector plate in each beamline of the National Ignition Facility (NIF) to assist the adaptive optic in correcting beam phase aberrations. Results indicate such a plate could significantly improve the focal spot, reducing a 3(omega), 80% spot half-angle from 21 to 8 (micro)rad for poorer-quality optics, and 17 to 7 for better optics. Such a plate appears to be within the range of current fabrication technologies. It would have an alignment requirement of +/-0.5 mm, if placed in the front end. In NIF operation, the occasional replacement of laser slabs would slowly degrade the beam quality for a fixed corrector plate, with the spot size increasing from 8 to 15 (micro)rad after four new slabs for poorer optics, and 7 to 12 (micro)rad for better optics. The energy fraction clipped on the injection pinhole (+/-100 (micro)rad) would be 0.5% due to this pre-correction.

NTIS

Phases; Correction; Computerized Simulation; Plates (Structural Members)

19990027973 Wisconsin Univ., Dept. of Electrical and Computer Engineering, Madison, WI USA

Advanced Vacuum Equipment for Laser Plasma Research ***Final Report, 1 Mar. 1997 - 31 Aug. 1998***

Scharer, J.; Aug. 31, 1998; 7p; In English

Contract(s)/Grant(s): F49620-97-1-0120; AF Proj. 3484

Report No.(s): AD-A359985; AFRL-SR-BL-TR-99-0035; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This equipment grant was utilized to provide two state-of-the-art vacuum facilities for seeded air plasma research on the AFOSR Grant F49620-97-0262 entitled

DTIC

Plasma Diagnostics; Laser Plasmas; Vacuum

19990028183 Department of Energy, Washington, DC USA

Z accelerator as a source of greater than 100 kJ of x-rays above 4.8 keV

Deeney, C., Department of Energy, USA; Coverdale, C. A., Department of Energy, USA; Spielman, R. B., Department of Energy, USA; Apr. 13, 1998; 20p; In English; HEART Conference, USA

Report No.(s): DE98-004758; SAND-98-0976C; CONF-980362; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent K-shell scaling experiments on the 20 MA Z accelerator at Sandia National Laboratories have shown that large diameter (40 and 55 mm) arrays can be imploded with 80 to 210 wires of titanium or stainless steel. These implosions have produced up to 150 kJ of greater than 4.5 keV x-rays and 65 kJ of greater than 6.0 keV x-rays in 7 to 18 ns FWHM pulses. This is a major

advance in plasma radiation source (PRS) capability since there is presently limited test capability above 3 keV. In fact, Z produces greater than 4.5 keV x-rays than previous above ground simulators produced at 1.5 keV. Z also produces some 200 kJ of x-rays between 1 and 3 keV in a continuous spectrum for these loads. The measured spectra and yields are consistent with 1-dimensional MHD calculations performed by NRL. Thermoelastic calorimeters, PVDF gauges, and optical impulse gauges have been successfully fielded with these sources.
NTIS
Scaling Laws; Experimentation; Simulators; Radiation Sources; Plasma Radiation; Measuring Instruments; Particle Accelerators; X Rays

19990028230 Department of Energy, Washington, DC USA
Development and advantages of beryllium capsules for the National Ignition Facility
Wilson, D. C., Department of Energy, USA; Bradley, P. A., Department of Energy, USA; Hoffman, N. M., Department of Energy, USA; Feb. 28, 1998; 21p; In English; 39th, USA; Sponsored by American Physical Society, USA
Report No.(s): DE98-003311; LA-UR-97-4711; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Capsules with beryllium ablators have long been considered as alternatives to plastic for the National Ignition Facility laser; now the superior performance of beryllium is becoming well substantiated. Beryllium capsules have the advantages of relative insensitivity to instability growth, low opacity, high tensile strength, and high thermal conductivity. 3-D calculation with the HYDRA code NTIS Document No. DE-96004569 (M. M. Marinak et.al. in UCRL- LR-105821-95-3) confirm 2-D LASNEX U. B. Zimmerman and W. L. Kruer, Comments Plasmas Phys. Controlled Thermonucl. Fusion, 2, 51(2975) results that particular beryllium capsule designs are several times less sensitive than the CH point design to instability growth from DT ice roughness. These capsule designs contain more ablator mass and leave some beryllium unablated at ignition. by adjusting the level of copper dopant, the unablated mass can increase or decrease, with a corresponding decrease or increase in sensitivity to perturbations. A plastic capsule with the same ablator mass as the beryllium and leaving the same unablated mass also shows this reduced perturbation sensitivity. Beryllium's low opacity permits the creation of 250 eV capsule designs. Its high tensile strength allows it to contain DT fuel at room temperature. Its high thermal conductivity simplifies cryogenic fielding.
NTIS
Beryllium; Ablative Materials

19990028277 Department of Energy, Office of Energy Research, Washington, DC USA
Radiative divertor plasmas with convection in D3-D
Leornard, A. W., Department of Energy, USA; Porter, G. D., Department of Energy, USA; Wood, R. D., Department of Energy, USA; Jan. 31, 1998; 34p; In English; 39th; Plasma Physics, USA; Sponsored by American Physical Society, USA
Report No.(s): DE98-004686; GA-A22787; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The radiation of divertor heat flux on D3-D is shown to greatly exceed the limits imposed by assumptions of energy transport dominated by electron thermal conduction parallel to the magnetic field. Approximately 90% of the power flowing into the divertor is dissipated through low Z radiation and plasma recombination. The dissipation is made possible by an extended region of low electron temperature in the divertor. A one-dimensional analysis of the parallel heat flux finds that the electron temperature profile is incompatible with conduction dominated parallel transport. Plasma flow at up to the ion acoustic speed, produced by upstream ionization, can account for the parallel heat flux. Modeling with the two-dimensional fluid code UEDGE has reproduced many of the observed experimental features.
NTIS
Plasma Drift; Plasmas (Physics); Magnetohydrodynamic Flow; Electron Energy; Diverters; Conductive Heat Transfer; Acoustic Velocity

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SOLID-STATE PHYSICS

Includes superconductivity. For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

19990026855 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Shock-induced defects in bulk materials
Gray, G. T., Department of Energy, USA; Mar. 31, 1998; 15p; In English; High-Pressure Materials Research, USA
Report No.(s): DE98-004358; LA-UR-97-5058; CONF-971233; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper examples of the shock-induced defects produced during shock compression which correlate with microstructure/mechanical property changes induced in materials due to shock prestraining are discussed. The characteristics of the shock impulse(peak shock pressure, pulse duration, and rarefaction rate) imparted to the material under investigation and the shock-induced defects produced in numerous metals and alloys are compared with their deformation behavior at ordinary rates of deformation. Examples of the range of defects observed in shock-recovered metals and alloys, include: dislocations, deformation twins, point defects, and residual metastable remnants from pressure-induced phase transformations. Results concerning the influence of interstitial content on the propensity of omega-phase formation and its structure in high-purity and A-7O Ti are presented. The influence of shock-wave deformation on the phase stability and substructure evolution of high-purity (low-interstitial) titanium and A-7O (3,700 ppm oxygen) titanium were probed utilizing real-time velocity interferometry (VISAR) and soft shock-recovery techniques. Suppression of the alpha-omega pressure-induced phase transformation in A-70 Ti, containing a high interstitial oxygen content, is seen to simultaneously correspond with the suppression of deformation twinning.
NTIS
Shock Waves; Crystal Defects; Mechanical Properties; Mechanical Twinning; Metals; Metastable State; Point Defects; Shock Loads; Substructures

19990027051 Department of Energy, Washington, DC USA
Efficient computation of volume of hexahedral cells
Grandy, J., Department of Energy, USA; Oct. 30, 1997; 7p; In English
Report No.(s): DE98-051032; UCRL-ID-128886; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report describes an efficient method to compute the volume of hexahedral cells used in three-dimensional hydrodynamics simulation. Two common methods for creating the hexahedron using triangular boundaries are considered.
NTIS
Computation; Volume; Hexagonal Cells

19990027075 Department of Energy, Office of Energy Research, Washington, DC USA
Growth and nonlinearity ***Final Report, 1 Apr. 1985 - 1 Jan. 1996***
Sander, L. M., Department of Energy, USA; Savit, R., Department of Energy, USA; May 31, 1998; 5p; In English
Report No.(s): DE98-006450; DOE/ER/45189-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This research had three major themes: Fractal growth, pattern formation and the analysis of complexity; that is, the effects of random processes in creating hidden order in statistical system, the interplay between this hidden order and macroscopic order, and the analysis of these complex systems. For example, a dendritic crystal such as a snowflake has a complicated and beautiful pattern with much evidence of the underlying six-fold symmetry of ice. It is a pattern forming system. However, in a disordered environment (such as growth on a rough or dirty surface) this order is replaced by a new order, the fractal or scaling symmetry of a disordered crystal. In this case every part of the crystal is similar on the average to the whole (up to a change in scale). The description of these new kinds of order may require the introduction of new analytic and numerical methods.
NTIS
Nonlinearity; Fractals; Complex Systems; Crystal Growth

19990027105 Department of Energy, Office of Energy Research, Washington, DC USA
Charge Stripes and Antiferromagnetism in Copper-Oxide Superconductors
Tranquada, J. M., Department of Energy, USA; Oct. 31, 1997; 8p; In English; 10th; Superconductivity
Report No.(s): DE98-002641; BNL-65025; CONF-971021; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Superconducting cuprate compounds are obtained by doping holes into antiferromagnetic insulators. Neutron scattering studies have provided evidence that the doped holes tend to segregate into charge stripes, which act like domain walls between antiferromagnetic regions. The interaction between the spatially segregated holes and the magnetic domains may be responsible for the strong pairing interaction found in the cuprates.
NTIS
Antiferromagnetism; Copper Oxides; Superconductors (Materials); Charge Carriers

19990027183 Department of Energy, Office of Energy Research, Washington, DC USA

Ion-implantation doping of silicon carbide

Gardner, J., Department of Energy, USA; Edwards, A., Department of Energy, USA; Rao, M. V., Department of Energy, USA; Papanicolaou, N., Department of Energy, USA; Kelner, G., Department of Energy, USA; Oct. 31, 1997; 7p; In English; Semiconductor device research, USA

Report No.(s): DE98-003167; ORNL/CP-95077; CONF-971213; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Because of their commercial availability in bulk single crystal form, the 6H- and 4H- polytypes of SiC are gaining importance for high-power, high-temperature, and high-frequency device applications. Selective area doping is a crucial processing step in integrated circuit manufacturing. In Si technology, selective area doping is accomplished by thermal diffusion or ion-implantation. Because of the low diffusion coefficients of most impurities in SiC, ion implantation is indispensable in SiC device manufacturing. In this paper the authors present their results on donor, acceptor, and compensation implants in 6H-SiC.

NTIS

Ion Implantation; Silicon Carbides; Additives

19990027185 Department of Energy, Office of Energy Research, Washington, DC USA

First principles calculations of interlayer exchange coupling in bcc Fe/Cu/Fe structures

Kowalewski, M., Department of Energy, USA; Heninrich, B., Department of Energy, USA; Schulthess, T. C., Department of Energy, USA; Butler, W. H., Department of Energy, USA; Jan. 31, 1998; 5p; In English; 7th; Joint MMM-intermag, USA

Report No.(s): DE98-003169; ORNL/CP-96024; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors report on theoretical calculations of interlayer exchange coupling between two Fe layers separated by a modified Cu spacer. These calculations were motivated by experimental investigations of similar structures by the SFU group. The multilayer structures of interest have the general form: Fe/Cu(k)/Fe and Fe/Cu(m)/X(1)/Cu(n)/Fe where X indicates one AL (atomic layer) of foreign atoms X (Cr, Ag, or Fe) and k, m, n represent the number of atomic layers of Cu. The purpose of the experimental and theoretical work was to determine the effect of modifying the pure Cu spacer by replacing the central Cu atomic layer with the atomic layer of foreign atoms X. The first principles calculation were performed using the Layer Korringa-Kohn-Rostoker (LKKR) method. The theoretical thickness dependence of the exchange coupling between two semi-infinite Fe layers was calculated for pure Cu spacer thicknesses in the range of 0 < k < 16. The effect of the foreign atoms X on the exchange coupling was investigated using the structure with 9 AL Cu spacer as a reference sample. The calculated changes in the exchange coupling are in qualitative agreement with experiment.

NTIS

Interlayers; Coupling; Iron; Copper; Body Centered Cubic Lattices; Computation

19990027347 Department of Energy, Office of Energy Research, Washington, DC USA

Processing of R-Ba-Cu-O superconductors

Wu, H., Department of Energy, USA; Feb. 23, 1998; 97p; In English

Report No.(s): DE98-004614; IS-T-1834; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Precipitation processes were developed to introduce second phases as flux pinning centers in Gd-Ba-Cu-O and Nd-Ba-Cu-O superconductors. In Gd-Ba-Cu-O, precipitation is caused by the decrease of the upper solubility limit of Gd(1+x)Ba(sub 2-x)Cu3O7 solid solution (Gd123ss) in low oxygen partial pressure. Processing of supersaturated Gd(1.2)Ba(1.8)Cu3 O7 in low oxygen partial pressure can produce dispersed second phases. Gd211 is formed as a separate phase while extensive Gd124 type stacking fault is formed instead of a separate CuO phase. As a result of the precipitation reaction, the transition temperature and critical current density are increased. In Nd-Ba-Cu-O, precipitation is caused by the decrease of the lower solubility limit of Nd(1+x)Ba(2-x)Cu3O7 solid solution (Nd123ss) in oxygen. DTA results reveal the relative stability of Nd123ss in different oxygen partial pressures. In 1 bar oxygen partial pressure, Nd123ss with x = 0.1 is the most stable phase. In lower oxygen partial pressures, the most stable composition shifts towards the stoichiometric composition. The relative stability changes faster with decreasing oxygen partial pressure. Therefore, processing in oxygen and air tends to produce broad superconducting transitions but sharp transitions can be achieved in 0.01 bar and 0.001 bar oxygen partial pressures. While the lower solubility limits in 0.01 bar and 0.001 bar oxygen partial pressures remain at x = 0.00, the solubility limits in oxygen and air show a narrowing with decreasing temperature. Because of the narrowing of the solubility range in oxygen, oxygen annealing of Nd123 initially processed in low oxygen partial pressures will result in precipitation of second phases. The equilibrium second phase is BaCuO2 for temperature above 608 C, and at lower temperatures the equilibrium second phases are Ba2CuO(3.3) and Ba2Cu3O(5+y). However, annealing at low temperature may produce a fine metastable transition phase. A coherent intermediate perovskite structure with a composition of BaCuO2 is observed along with a high density of dislocations during the precipitation process at 500 C in oxygen.

It is believed that oxygen annealing at 900 C produces the equilibrium BaCuO2 phase. These precipitates are responsible for the strong flux pinning in Nd123 melt-textured in low oxygen partial pressure.
NTIS
Barium Oxides; Copper Oxides; Superconductors (Materials); Metastable State; Neodymium Compounds

19990027663 Department of Energy, Office of Energy Research, Washington, DC USA
Irradiation-induced phase transformations ***Final Report, 1 Jul. 1995 - 30 Jun. 1997***
Atwater, H. A., Department of Energy, USA; Aug. 01, 1998; 6p; In English
Report No.(s): DE98-006449; DOE/ER/45395-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

During the course of this two year program, the authors attention focused largely on the synthesis, structure and properties of group IV semiconductor nanocrystals. They also drew to a close the investigations of defects in amorphous silicon. Work on control of nucleation in amorphous silicon and germanium is ongoing, and has taken important new directions at the interface between basic and applied research under DOE Office of Energy Efficiency support via a subcontract from the National Renewable Energy Laboratory and the BES Center for Synthesis and Processing of Advanced Materials' project on High Efficiency Thin Film Photovoltaics. During the course of this project, scientific and scholarly output included: (1) 10 invited talks related to work on Si and Ge nanocrystals; (2) 5 Applied Physics Letters published on Si and Ge nanocrystals; (3) 3 Caltech Ph.D. Theses on Si and Ge Nanocrystal work; and (4) New directions on control of crystallization in thin semiconductor films.
NTIS
Phase Transformations; Nucleation; Amorphous Silicon

19990027673 Lawrence Livermore National Lab., Livermore, CA USA
Fine-Structure Superplasticity in Materials
Nieh, Tai-Gang, Lawrence Livermore National Lab., USA; Wadsworth, Jeffrey, Lawrence Livermore National Lab., USA; Journal of the Chinese Institute of Engineers. Special Issue: Materials Science and Engineering; November 1998; Volume 21, No. 6, pp. 659-689; In English; See also 19990027670; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Superplastic forming is a viable net-shape forming technology. It is an attractive manufacturing technique because it bypasses machining, joining and riveting, and reduces material waste. This paper reviews the history and progress in the field of superplasticity. Fundamental understandings, such as microstructural prerequisites and deformation mechanisms, and technological applications for superplasticity are discussed. A wide range of structural materials, including metals, intermetallics, and ceramics are presented. Some of the most recent advances, for example, high strain rate superplasticity, low temperature superplasticity, and the development of ultrafine-grained materials for superplasticity are also described.
Author
Superplastic Forming; Microstructure; Manufacturing; Intermetallics; Superplasticity; Forming Techniques

19990027830 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Solid State Research ***Quarterly Report***
Feb. 23, 1999; 91p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A360556; 1998-3; ESC*-TR-97-145; 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 1998. The topics covered are Quantum Electronics, Electro-optical Materials and Devices, Submicrometer Technology, High Speed Electronics, Microelectronics, Analog Device Technology, and Advanced Silicon Technology. Funding is provided by several DoD organizations - including the Air Force, Army, BMDO, DARPA, Navy, NSA, and OSD - and also by the DOE, NASA, and NIST.
DTIC
Solid State; Research; Quantum Electronics; Optoelectronic Devices

19990027869 Rutherford Appleton Lab., ISIS Facility, Chilton, UK
Ordered Stack of Spin Valves in a Layered Magnetoresistive Perovskite
Perring, T. G., Rutherford Appleton Lab., UK; Aeppli, G., NEC Research Inst., USA; Kimura, T., Joint Research Center for Atom Technology, Japan; Tokura, Y., Joint Research Center for Atom Technology, Japan; Adams, M. A., Rutherford Appleton Lab., UK; Nov. 25, 1998; ISSN 1358-6254; 20p; In English
Report No.(s): PB99--120578; RAL-TR-1998-074; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The layered compound consists of bilayers of metallic MnO2 sheets separated by insulating material. The compound exhibits markedly anisotropic magnetoresistance at temperatures well below the three-dimensional magnetic ordering temperature Tc = 90 K in addition to colossal magnetoresistance around Tc. The authors present neutron diffraction data which show that the magnetic structure of this material switches from antiferromagnetic stacking of the (ferromagnetically ordered) sheets in zero field to ferromagnetics stacking in a field of 1.5 Telsa. The data are the first to be collected on any manganite as a function of applied field, exactly as the magnetoresistance data themselves are collected. They provide a natural explanation of the low-field magnetoresistance in the ordered phase in terms of spin-polarized tunneling between the magnetic layers and suggest that the material is a bulk stack of spin-valve devices.
NTIS
Perovskites; Magnetoresistivity; Spin; Valves

19990027956 Department of Energy, Washington, DC USA
Magnetic domain structure and magnetization reversal in submicron-scale Co dots
Fernandez, A., Department of Energy, USA; Feb. 17, 1998; 25p; In English; 7th; Joint MMM-intermag, USA
Report No.(s): DE98-058761; UCRL-JC-130117; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We present a magnetic force microscopy (MFM) analysis of arrays of submicron-scale Co dots fabricated by interference lithography. The dots are thin (180-300 A) and are elliptical in shape. MFM of these structures reveals that they relax into highly ordered remanent states whose symmetry and configuration are governed by their shape anisotropy. In particular, when the dots are saturated along the easy-axis, a uniformly magnetized state persists at remanence. However, when the dots are saturated in hard-axis, they relax into a single-vortex state in which the circulation can have either sign. Both remanent states are characterized by smoothly varying magnetization patterns and a high degree of uniformity across the array. We attribute the ordered behavior of these structures to the film microstructure, which allows the shape anisotropy to dominate over magnetocrystalline anisotropy. by imaging a series of minor-loop remanent states, we show that magnetization reversal in these structures occurs via the nucleation and annihilation of a single vortex. Magnetic hysteresis loop measurements are consistent with these observations and provide additional details. Furthermore, we present the results of micromagnetic simulations, which are in excellent agreement with both the MFM images and the hysteresis loop measurements.
NTIS
Magnetization; Magnetic Domains

19990028022 California Univ., Dept. of Chemical Biochemical Engineering and Materials Science, Irvine, CA USA
Creep Behavior of Solid Solution Strengthened Y3Al5O12 ***Final Report, 14 Feb. - 31 Aug. 1997***
Wolfenstine, Jeff; Nov. 03, 1998; 10p; In English
Contract(s)/Grant(s): F49620-97-1-0097
Report No.(s): AD-A360419; AFRL-SR-BL-TR-99-0049; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
It is the intent of this study to: (1) provide fundamental insight into creep mechanism of single crystal Y3Al5O12 and (2) provide a method of increasing the creep resistance of oxide single crystals which are under consideration as potential fiber reinforcements for use in elevated temperature oxide/oxide composites.
DTIC
Creep Properties; Solid Solutions; Yttrium Compounds; Aluminum Oxides

19990028168 North Carolina Univ., Office of Research, Charlotte, NC USA
Spectral Properties of Periodic and Disordered Dielectric and Acoustic Media ***Final Report, 1 Mar. 1994 - 28 Feb. 1998***
Figotin, Alex; Dec. 1998; 6p; In English
Contract(s)/Grant(s): F49620-94-1-0172
Report No.(s): AD-A360464; AFRL-SR-BL-TR-99-0064; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
This report discusses research done on the problems on the band-gap structure of 2D and 3D photonic crystals and the localization of electromagnetic and acoustic waves in periodic media and in media with single defects: (1) The model and time efficient code for the computation of the optimal parameters for the 2D photonic crystals have been developed. The results of the work have been used to compute the optimal design parameter of 2D photonic crystals for Dr. L. Webb and Dr. G. Sullivan from Boeing (former Rockwell). An asymptotic model of 3D photonic crystals has been developed and we has begun its computer implementation. (2) The mathematical theory of cavity eigenmodes has been extended to the case of electromagnetic and acoustic waves. We have also developed algorithms based on the lattice models for the computing of localized classical waves generated by defects in the background periodic media. The algorithms have been implemented in a code which demonstrated all expected phenomena

including tunneling. It also gives an estimation of the localization radius of a cavity eigenmode. The code produces also nice graphical images of the cavity eigenmodes and spectra.
DTIC
Photonics; Mathematical Models; Cavities; Electromagnetic Radiation; Order-Disorder Transformations; Sound Waves; Energy Gaps (Solid State)

19990028182 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Ultra-high implant activation efficiency in GaN using novel high temperature RTP system
Cao, X. A., Department of Energy, USA; Abernathy, C. R., Department of Energy, USA; Singh, R. K., Department of Energy, USA; Apr. 30, 1998; 8p; In English; Sponsored by Materials Research Society, USA
Report No.(s): DE98-004759; SAND-98-0950C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Si(+) implant activation efficiencies above 90%, even at doses of 5 x 10(exp 15) power/sq cm, have been achieved in GaN by RTP at 1,400 - 1,500 C for 10 secs. The annealing system utilizes with MoSi2 heating elements capable of operation up to 1,900 C, producing high heating and cooling rates (up to 100 C/s). Unencapsulated GaN show severe surface pitting at 1,300 C, and complete loss of the film by evaporation at 1,400 C. Dissociation of nitrogen from the surface is found to occur with an approximate activation energy of 3.8 eV for GaN (compared to 4.4 eV for AlN and 3.4 eV for InN). Encapsulation with either rf-magnetron reactively sputtered or MOMBE-grown AlN thin films provide protection against GaN surface degradation up to 1,400 C, where peak electron concentrations of approximately 5 x 10 to the 20th power/cu cm can be achieved in Si-implanted GaN. SIMS profiling showed little measurable redistribution of Si, suggesting D(sub Si) less than 10(exp 13) power/sq cm/s at 1,400 C . The implant activation efficiency decreases at higher temperatures, which may result from Si(sub Ga) to Si(sub N) site switching and resultant self-compensation.
NTIS
Gallium Nitrides; Field Effect Transistors; Activation Energy; Efficiency; Crystal Dislocations

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THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

19990027099 Florence Univ., Inst. Nazionale di Ottica, Italy
Control of Chaos: New Perspectives in Experimental and Theoretical Science
Arecchi, F. T.; Boccaletti, S.; Ciofini, M.; Grebogi, G.; Meucci, R.; International Journal of Bifurcation and Chaos in Applied Sciences and Engineering: Theme Issue; Aug. 1998; Volume 8, No. 8; 116p; In English
Contract(s)/Grant(s): F61708-97-W-0108
Report No.(s): AD-A359776; EOARD-CSP-97-1053; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Final Proceedings for Control of Chaos: New Perspectives in Experimental and Theoretical Science, 16 May 1997 - 18 May 1997 nonlinear, adaptive and robust control; synchronization of chaotic processes; and applications of control of chaos in science and technology. The discipline of cliaos has created a universal paradigm, a scientific parlance, and a mathematical tool for grappling with izonlinear phenomena. In every field of the applied sciences (astronomy, atmospheric sciences, biology, chemistry, economics, geophysics, life and medical sciences, physics, social sciences, zoology, etc.) and engneering (aerospace, chemical, civil, computer, information, mechanical, software, telecommunication, etc.) the local and global manifestations of Chaos and Bifurcation have burst forth in an unprecedented universality, linking scientists heretofore unfamiliar with one another's fields, and offering an opportunity to reshape our grasp of reality. The primary objective of this journal is to provide a single forum for this multidisciplinary discipline - a forum specifically designed for an interdisciplinary audience, a forum accessible and affordable to all. Real-world problems and applications will be emphasized. Our goal is to bring together, in one periodical, papers of the highest quality and greatest importance on every aspect of nonlinear dynamics, phenomena, modeling, and complexity, thereby providing a focus and catalyst for the timely dissemination and cross- fertilization of new ideas, principles, and techniques across a broad interdisciplinary front.
DTIC
Research and Development; Adaptive Control; Chaos; Conferences; Nonlinear Systems

19990028003 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France

Supersymmetric Quantum Theory and Non-Commutative Geometry

Froehlich, J., Eidgenoessische Technische Hochschule, Switzerland; Grandjean, O., Harvard Univ., USA; Recknagel, A., Institut des Hautes Etudes Scientifiques, France; Aug. 1998; 84p; In English

Report No.(s): PB99--122335; IHES/P/98/46; ETH-TH/96-45; HUTMP-98/B374; math-ph/9807006; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Classical differential geometry can be encoded in spectral data, such as Connes' spectral triples, involving supersymmetry algebras. In this paper, the authors formulate non-commutative geometry in terms of supersymmetric spectral data. This leads to generalizations of Connes' non-commutative spin geometry encompassing non-geometry. A general framework for non-communicative geometry is developed from the point of view of supersymmetry and illustrated in terms of examples. In particular, the non-commutative torus and the non-commutative 3-sphere are studied in some detail.

NTIS

Supersymmetry; Quantum Theory

80
SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19990026846 Mei Technology Corp., San Antonio, TX USA

Interactive Multimedia Distance Learning (IMDL) ***Final Report, Apr. 1994 - Oct. 1997***

Crhistinaz, Daniel U.; Walsh, William J.; Filipski, Gary; Escobar, Susan; Jan. 1999; 76p; In English

Contract(s)/Grant(s): F41624-94-C-5003; AF Proj. 1123

Report No.(s): AD-A360086; AFRL-HE-BR-TR-1999-0004; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

As a result of shrinking training budgets, the Air Force is looking for ways to stretch its training dollars. One avenue of investigation has been to evaluate emerging computer and network technologies to determine if training can be delivered at a distance more efficiently than traditional classroom training. This effort focused on developing and demonstrating a PC-based distance learning system that was fully interactive and multimedia capable. Bandwidth between the instructor and distance class was provided by a dedicated T-1 landline. The class was comprised of 12 student workstations with individual cameras networked together. The network provided two-way video, audio and data as well as a link into the internet. The instructor's image or presentation materials could be delivered to large screen monitors/speakers at the front of the class or to the student's individual computer screens. The demonstration phase consisted of delivering an Air Force counseling course which is required training for Air Education and Training Command (AETC) instructors. The course was taught successfully in terms of students' performance on the final exam; however, some issues were identified that need to be addressed if such a system were to be deployed.

DTIC

Computer Networks; Learning; Computers; Education

19990027058 NASA, Washington, DC USA

University Program Management Information System, ***FY 1998***

1999; 726p; In English

Report No.(s): NASA/TM-1999-209011; NAS 1.15:209011; 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. NASA field codes and certain Headquarters program offices provide funds for those activities in universities which contribute to the mission needs of that particular NASA element. Although NASA has no predetermined amount of money to devote to university activities, the effort funded each year is substantial. (See the bar chart on the next page). 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.
Author
Financial Management; Management Information Systems; University Program; Human Resources

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990026981 Institute for Human Factors TNO, Technische Menskunde, Soesterberg, Netherlands
Handbook Structured Troubleshooting for the Technical Training School of the Royal Netherlands Navy: Guidelines for Designing, Executing and Evaluating Training in Structured Troubleshooting ***Final Report Handboek gestructureerd storingzoeken Technische Opleidingen Koninklijke Marine: Richtlijnen ten behoeve van het ontwikkelen, uitvoeren en evalueren van GSZ-opleidingen***
Schaafstal, A. M., Institute for Human Factors TNO, Netherlands; vanBerlo, M. P. W., Institute for Human Factors TNO, Netherlands; Nov. 09, 1998; 152p; In Dutch
Contract(s)/Grant(s): A95/KM/365; TNO Proj. 730.2
Report No.(s): TD98-0271; TM-98-A059; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

In this report guidelines with respect to designing, executing and evaluating training programs aimed at structured troubleshooting are described. This handbook is based on research and practical experiences during 1991-1998 with respect to enhancing the quality of maintenance training programs at the Technical Training School of the Royal Netherlands Navy. The experiences of both TNO Human Factors Research Institute and the Technical Training School are integrated in this handbook, and many of the described ideas have been jointly developed. This handbook is primarily aimed at the instructors and training designers of the Technical Training School of the Royal Netherlands Navy. The guidelines of the handbook give a detailed prescription of which tasks should be conducted during the process of designing, executing and evaluating Structured Troubleshooting training programs: (1) forming a project-team; (2) conducting a task analysis; (3) designing functional block-diagrams; (4) formulating instructional objectives; (5) composing the methodology; (6) teaching in a Structured Troubleshooting training program; (7) designing and evaluating practical exercises; (8) designing and evaluating written questions and tests; (9) developing the curriculum; and (10) attending an industrial training program. Every chapter ends with a 'Question and Answer' in which several questions and answers briefly summarize the most important aspects of the respective chapter.
Author
Block Diagrams; Experiment Design; Evaluation; Education; Maintenance Training; Maintenance

19990027242 Norwegian Defence Research Establishment, Kjeller, Norway
Decision Training- a Diagnosis of Demand and Supply ***Beslutningstrening: En Kartlegging av Ettersporsel og Tilbud***
Taugbol, Asbjorn, Norwegian Defence Research Establishment, Norway; Oct. 27, 1998; 40p; In Norwegian
Contract(s)/Grant(s): Proj. FFISYS/735/410
Report No.(s): FFI/RAPPORT-98/04711; ISBN 82-464-0304-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Military decision making can be categorized as dynamic decision making, and theories for dynamic decision making can be applied to military decision making. This report gives a broad overview of human decision making and typical shortcomings in general and in a military context. It claims that there is a need for decision training and in view of the existing portfolio of training events, it concludes that this need is largely unfulfilled. In decision training one should focus on building mental models, criticizing their hypothesis and recognize indicators in the environment that require a decision. An environment for decision training is the learning lab. The learning lab is characterized by several features. The most crucial ones are exploration and a high volume of exposure to unforeseen, complex dynamics. This again requires inexpensive, off-line, computer simulation and many repetitions made in the training sessions.
Author
Decision Making; Education; Diagnosis

19990027878 Alabama Univ., Huntsville, AL USA

Value Engineering Management Information System and Operation and Support Cost Reduction Database ***Final Report, 16 Jun. 1998 - 31 Jan. 1999***

Aldijaili, Sharon S.; Maddux, Gary; Jan. 1999; 38p; In English

Contract(s)/Grant(s): DAAH01-98-D-R001

Report No.(s): AD-A360552; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Value Engineering (VE)/Operating and Support Cost Reduction (OSCR) Office of the Industrial Operations Division (JOD), Systems Engineering and Production Directorate (SEPD), Research, Development, and Engineering Center (RDEC), US Army Aviation and Missile Command (AMCOM) is responsible for performing system engineering cost analyses for weapon systems from design through full scale production. This effort includes evaluating reported cost analyses and performing appropriate modifications to information systems. This information is transferred monthly to the US Army Materiel Command (AMC) Headquarters. Reporting requirement changes have resulted in the modification of the operational information system, and the development and integration of an upgraded information system for tracking VE and OSCR cost analyses. Data validation between the operational information system and the upgraded information system was required during development of the upgraded information system software package.

DTIC

Data Bases; Management Information Systems; Cost Analysis; Value Engineering; Engineering Management; Information Systems; Cost Reduction

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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.

19990026878 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia

Checksum Testing of Remote Synchronization Tool

Taylor, Richard, Defence Science and Technology Organisation, Australia; Jana, Rittwik, Defence Science and Technology Organisation, Australia; Grigg, Mark, Defence Science and Technology Organisation, Australia; Mar. 1998; 12p; In English

Report No.(s): DSTO-TR-0627; DODA-AR-010-457; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, South Australia 5108), Hardcopy, Microfiche

This report presents testing and improvements to a protocol, rsync, for the synchronisation of similar data files in different locations. When copying a file A at location alpha to a remote location beta it is often the case that A has much in common with some data file B already stored at beta. In this situation rsync may be used to effectively send File A from alpha to beta in such a way that much less data than that contained in A is transmitted. Moreover this is achieved without requiring both files to be located at either alpha or beta. This paper provides new checksum functions that offer significant improvements over the existing functions, and proposes that checksum sizes be adaptive based on a verified model of the required checksum size.

Author

Performance Tests; Computer Programs; Synchronism; Improvement

19990026960 Naval Postgraduate School, Monterey, CA USA

Design and Implementation of an Enterprise Information System Utilizing a Component Based Three-Tier Client/Server Database System

Akbay, Murat; Lewis, Steven C.; Mar. 1999; 282p; In English

Report No.(s): AD-A360103; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The Naval Security Group currently requires a modem architecture to merge existing command databases into a single Enterprise Information System through which each command may manipulate administrative data. There are numerous technologies available to build and implement such a system. Component-based architectures are extremely well-suited for creating scalable and flexible three-tier Client/Server systems because the data and business logic are encapsulated within objects, allowing them to be located anywhere on a network. The first tier represents the visual aspects of the data on the client side. The middle tier consists of server objects that represent the persistent data and enforce the business logic functions. The third tier maintains the database management systems. The client interacts with the middle-tier server objects via Common Object Request Broker Architecture. CORBA provides a language and platform independent architecture that enables objects to transparently make requests and receive responses in a distributed environment. Java is an object-oriented, multi-threaded, secure mobile code system

that allows applications to run on all major computing platforms. This thesis examines the design of an EIS using Java Applets that use Inter-Orb Protocol to communicate with CORBA middle-tier server objects. The third tier will incorporate Java Database Connectivity to communicate with database management systems.
DTIC
Data Bases; Information Systems; Data Base Management Systems; Client Server Systems; Modems; Object-Oriented Programming

19990026961 Naval Postgraduate School, Monterey, CA USA
Design, Implementation and Testing of MSHN's Resource Monitoring Library
Schnaidt, Matthew C.; Dec. 1998; 117p; In English
Report No.(s): AD-A360104; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Management System for Heterogeneous Networks (MSHN) requires the gathering of resource usage information of applications that run within the MSHN system and status information of the resources within the scope of the MSHN scheduler. The MSHN scheduler uses this information to make decisions. This thesis investigates one method of gathering the required information: a client library. This research develops the mechanism and policy for the client library's resource monitoring role and carefully documents how applications can be easily linked with this client library. During run time the client library gathers information on an application's resource utilization by intercepting system calls and through the use of operating system functions. Resource information gathered includes total runtime, local and remote disk use, network use, memory use, CPU use, and time blocked waiting on user input. The client library also determines end-to-end perceived status of the resources that the application uses. Specifically, this thesis develops a policy for passively gathering network performance characteristics, i.e., latency and throughput. The per system call overhead added varied from less than 1% to 326%, with an average of 3% overhead added to the run-time of test programs.
DTIC
Libraries; Information Management; Management Systems

19990027129 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Revised evaluations of fission-product cross sections
Wright, R. Q., Department of Energy, USA; Dec. 31, 1998; 8p; In English; Pysics of Nuclear Science and Technology, USA
Report No.(s): DE98-007147; ORNL/CP-96307; CONF-981003; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper reports on revised cross-section evaluations for Ba-134, Sm-149, Eu-154, Eu-155, Dy-160, Dy-161, Dy-162, Dy-163, and Dy-164. The evaluations for Ba-134, Eu-154, and Eu-155 were previously revised for ENDF/B-VI. The other 6 evaluations, carried over from ENDF/B-V, were completed in the 1974--1980 time period. The evaluations for the dysprosium isotopes go back to ENDF/B-IV. Newer experimental data, not considered for the current ENDF/B-VI evaluations, was used in all of the revised evaluations. In the present work the primary emphasis was placed on the resolved and unresolved resonance regions, but newer measured data were also used for energies above the unresolved resonance region. Elastic, capture, and total cross sections are revised.
NTIS
Absorption Cross Sections; Fission Products; Evaluation

19990027180 Department of Energy, Office of Energy Research, Washington, DC USA
Panel on increasing the visibility and publicity for data activities and assuring the open exchange of data
Schultz, D. R., Department of Energy, USA; Jan. 31, 1998; 7p; In English; 1st; Atomic and molecular data and their standards, USA
Report No.(s): DE98-003161; ORNL/CP-96127; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This panel was charged with leading and stimulating discussion regarding two principal issues: (1) the need to increase the visibility of atomic data production and collection activities in recognition of their role as vitally important resources for diverse applications, and (2) the need to assure the open exchange of this data. Comments by the panelists, supplemented by interaction with the audience, are summarized here along with the principal conclusions.
NTIS
Visibility; Data Acquisition; Atomic Physics

19990027210 Department of Energy, Office of Energy Research, Washington, DC USA

Risk assessment information system

Kerr, S. B., Department of Energy, USA; Bonczek, R. R., Department of Energy, USA; McGinn, C. W., Department of Energy, USA; Land, M. L., Department of Energy, USA; Bloom, L. D., Department of Energy, USA; Apr. 30, 1998; 21p; In English

Report No.(s): DE98-006100; ORNL/M-6942; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In an effort to provide service-oriented environmental risk assessment expertise, the Department of Energy (DOE) Center for Risk Excellence (CRE) and DOE Oak Ridge Operations Office (ORO) are sponsoring Oak Ridge National Laboratory (ORNL) to develop a web-based system for disseminating risk tools and information to its users. This system, the Risk Assessment Information System (RAIS), was initially developed to support the site-specific needs of the DOE-ORO Environmental Restoration Risk Assessment Program. With support from the CRE, the system is currently being expanded to benefit all DOE risk information users and can be tailored to meet site-specific needs. Taking advantage of searchable and executable databases, menu-driven queries, and data downloads, using the latest World Wide Web technologies, the RAIS offers essential tools that are used in the risk assessment process or anywhere from project scoping to implementation. The RAIS tools can be located directly at http://risk.lsd.ornl. gov/homepage/rap(-)tool.htm or through the CRE's homepage at http://www.doe.gov/ riskcenter/ home.html.

NTIS

Information Systems; Document Markup Languages; Data Bases; Assessments

19990027245 Beijing Univ. of Aeronautics and Astronautics, Beijing, China

Implementation of Data Management Method Oriented Engineering Design

Cai, Yunhong, Beijing Univ. of Aeronautics and Astronautics, China; Fan, Yuqing, Beijing Univ. of Aeronautics and Astronautics, China; Wang, Deng, Beijing Univ. of Aeronautics and Astronautics, China; Journal of Beijing University of Aeronautics and Astronautics; October 1998; ISSN 1001-5965; Volume 24, No. 5, pp. 567-570; In Chinese; Copyright; Avail: Issuing Activity (Editorial Dept. of BUAA, No. 37 Xueyuan Road, Haidian District, Beijing, China, 100083), Hardcopy, Microfiche

This paper aims at providing a product data management method oriented engineering design by describing its implementation in the Pressure Vessel CAD system (PVCAD). by this method, a CAD system can efficiently manage and automatically visit those product data in normal engineering design. It comprehensively describes the data classification, expressive form, data structure and implementation method for the model of product data in the system.

Author

Computer Aided Design; Pressure Vessel Design; Data Management

19990027726 Assistant Secretary of Defense (Public Affairs), Directorate for Freedom of Information and Security Review, Washington, DC USA

Department of Defense Freedom of Information Act Program

Sep. 1998; 107p; In English

Report No.(s): AD-A359645; DOD-5400.7-R; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This Regulation provides policies and procedures for the DoD implementation of the Freedom of Information Act (5 USC 552, as amended) and DoD Directive 5400.7 (references (a) and (b)), and promotes uniformity in the DoD Freedom of Information Act (FOlA) Program. This regulation applies to the Office of the Secretary of Defense (OSD), the Military Departments, the Chairman of the Joint Chiefs of Staff, the Combatant Commands, the Inspector General of the Department of Defense (IG DoD), the Defense Agencies, and the DoD Field Activities (hereafter referred to collectively as "the DoD Components"). This Regulation takes precedence over all DoD Component publications that supplement and implement the DoD FOlA Program. A list of DoD Components is at Appendix AP6.

DTIC

Defense Program; Information Management

19990027835 Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA

Index to FAA Office of Aviation Medicine Reports: 1961 through 1998 ***Final Report***

Collins, William E.; Wayda, Michael E.; Jan. 1999; 83p; In English

Report No.(s): AD-A360592; DOT/FAA/AM-99/1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An index to Federal Aviation Administration Office of Aviation Medicine Reports (1964-1998) and Civil Aeromedical Institute Reports is presented for those engaged in aviation medicine and related activities. The index lists all FAA aviation medicine reports published from 1961 through 1998: chronologically, alphabetically by author, and alphabetically by subject. A foreword

describes aspects of the Civil Aeromedical Institute's 38 years of service, describes the index's sections, and explains how to obtain copies of published Office of Aviation Medicine technical reports.
DTIC
Aerospace Medicine; Safety; Gravitational Physiology

19990028264 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Real time 3D and heterogeneous data fusion
Little, C. Q., Department of Energy, USA; Small, D. E., Department of Energy, USA; Mar. 31, 1998; 20p; In English, USA
Report No.(s): DE98-003408; SAND-98-0584; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This project visualizes characterization data in a 3D setting, in real time. Real time in this sense means collecting the data and presenting it before it delays the user, and processing faster than the acquisition systems so no bottlenecks occur. The goals have been to build a volumetric viewer to display 3D data, demonstrate projecting other data, such as images, onto the 3D data, and display both the 3D and projected images as fast as the data became available. The authors have examined several ways to display 3D surface data. The most effective was generating polygonal surface meshes. They have created surface maps form a continuous stream of 3D range data, fused image data onto the geometry, and displayed the data with a standard 3D rendering package. In parallel with this, they have developed a method to project real-time images onto the surface created. A key component is mapping the data on the correct surfaces, which requires a-priori positional information along with accurate calibration of the camera and lens system.
NTIS
Real Time Operation; Heterogeneity; Data Acquisition; Multisensor Fusion

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URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see also 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

19990026993 Physics and Electronics Lab. TNO, The Hague, Netherlands
Technology Forecast Defence: Interim Report *Final Report Technologievekenningen Defensie: Interim Rapportage*
Dexel, J., Physics and Electronics Lab. TNO, Netherlands; July 1998; 23p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A96/D/828; TNO Proj. 26573
Report No.(s): TD98-0156; FEL-98-A087; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG the Hague, The Netherlands), Hardcopy, Microfiche

This document describes the results of first phase of the project 'Technology Forecast Defence'. Matters at issue are: impact of (technology) forecast on strategic management; assessment of priority setting in technology forecast; defence innovation mechanisms, development of methodology and survey of literature.
Author
Planning; Operations Research; Management; Military Technology

89
ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

19990027054 Department of Energy, Washington, DC USA
Celebration of the contributions of Art Cox to stellar pulsation interpretations
Castor, J. I., Department of Energy, USA; Oct. 02, 1997; 14p; In English; A Half Century of Stellar Pulsation Interpretatons: A Tribute to Arthur N. Cox, USA
Report No.(s): DE98-051073; UCRL-JC-127782; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A roughly chronological account is given of Arthur N. Coxs published work of 1953-1996 in, mostly, stellar pulsation theory, with a digression into stellar opacity. When possible, his work is placed in the context of the contemporary efforts.
NTIS
Stars; Pulses; Documents; CCD Star Tracker

19990027273 Oxford Univ., Dept. of Physics, Astrophysics, Oxford, UK

Orbital and Quasi-Periodic Optical Variations in the Black-Hole X-Ray Binary V404 CYG

Pavlenko, E. P., Crimean Astrophysical Observatory, USSR; Martin, A. C., Oxford Univ., UK; Casares, J., Oxford Univ., UK; Charles, P. A., Oxford Univ., UK; Ketsaris, N. A., Moscow State Univ., Russia; 1996; 24p; In English

Report No.(s): OUAST/96/13; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present 2 weeks of CCD photometry of V404 Cyg, the optical counterpart of the soft X-ray transient (SXT) GS2023+338, taken from La Palma in July 1992. The R band light curve shows a clear 0 min 3 sec ellipsoidal modulation on the established 6.5-d orbital period, but with substantial (up to 0 min 3 sec) superposed variations that occur during each night on a timescale of 6 h. We have modelled both the mean orbital light curve and its lower envelope (which we presume to show the secondary star with minimum contamination from the accretion disc). With a mass ratio already known from optical spectroscopy, the analysis of the lower envelope light curve leads to an orbital inclination of i = 56 deg +/- 2 deg. Our best model requires no hot spot contribution. The shorter timescale of variability is consistent with the 6-h quasi-periodicities that have been seen in outburst and during the early quiescent period. Using periodogram analysis we find three components to the 6-h peak (at 5.90 h, 6.07 h and 6.24 h). The periodograms show the outside peaks to be stronger than the smaller, central peak. A peak in the power spectrum at 4.5 d coincides with the beat period of these outside peaks. The nature of these periodicities is unknown.

Author

Black Holes (Astronomy); Ellipsoids; Mass Ratios; Periodic Variations; X Ray Binaries; Spectroscopy

19990027276 National Optical Astronomy Observatories, Tucson, AZ USA

Integral Field Spectroscopy on the WIYN Telescope Using a Fiber Array

Barden, Samuel C., National Optical Astronomy Observatories, USA; Sawyer, David G., National Optical Astronomy Observatories, USA; Honeycutt, R. Kent, Indiana Univ., USA; Mar. 1998; 10p; In English

Report No.(s): NOAO-Preprint-782; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A fiber optic array, called DensePak, has been built for the University of Wisconsin, Indiana University, Yale University and the National Optical Astronomy Observatory (WIYN) 3.5 meter telescope located on Kitt Peak, Arizona. DensePak incorporated the use of existing instruments at WIYN to provide a low-cost option for integral field spectroscopy. The array consists of 91, 310 micrometer diameter fibers bonded into a 7 x 13 rectangle with fibers spaced at 400 micrometer center-to-center. The array provides spatial coverage on the sky of approximately 30 x 45 arc-seconds at the WIYN F/6.4 Nasmyth focus. The fiber bundle feeds the same bench spectrograph as that used for the Hydra multi-object spectrograph which provides many configuration options. DensePak has been used successfully in several scientific programs where mapping of spectral characteristics of extended objects such as galaxies, planetary nebulae, and comets is desired. The options of low to high resolution spectroscopy with DensePak allow two-dimensional spatial measurements of abundances, velocity kinematics, and line ratios to be obtained. Proven success of DensePak at WIYN has led to consideration of future upgrades to expand scientific capability through improved spatial resolution.

Author

Fiber Optics; Low Cost; Spatial Resolution; Spectrographs; Telescopes; Synthetic Arrays

19990027391 National Optical Astronomy Observatories, Tucson, AZ USA

CCD Detector Upgrade for NOAO's 8192 by 8192 MOSAIC

Wolfe, Thomas, National Optical Astronomy Observatories, USA; Reed, Rich, National Optical Astronomy Observatories, USA; Blouke, Morley, Scientific Imaging Technologies, Inc., USA; Boroson, Todd, National Optical Astronomy Observatories, USA; Armandroff, Taft, National Optical Astronomy Observatories, USA; Jacoby, George, National Optical Astronomy Observatories, USA; Mar. 1998; 11p; In English

Report No.(s): NOAO-Preprint-791; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

National Optical Astronomy Observatory (NOAO) is testing Scientific Imaging Technologies, Inc. (SITE) thinned backside 2k by 4k charge coupled devices (CCDS) to be used at Kitt Peak National Observatory (KPNO) and Cerro Tololo Inter-American Observatory (CTIO). NOAO's Mosaics will use as the basic "tile" the SITE ST-002A CCD Imager. These CCDs will be used to upgrade the wide field Mosaic imager now in use at KPNO's 4-Meter Mayall telescope and 0.9-Meter telescope. SITE 2k by 4k CCDs will also be used in MOSAIC 11 now under construction for CTIO's 4-Meter Blanco telescope. Additionally NOAO will implement 2 Mini-Mosaics in the two device 4K by 4K configuration. The first of the ST-002As arrived in mid August 97 and this paper will discuss test results of all devices received and tested prior to publication. Additionally this paper will discuss the

mounting methods of Mosaics. This will include; geometric stability, techniques used for measuring CCD surface flatness and co-planer requirements for NOAO's Mosaic Instruments.
Author
Charge Coupled Devices; Construction; Mosaics; Telescopes; Checkout

19990027436 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Research with Large Area Imaging X-Ray Telescope Sounding Rocket Program ***Final Report, 1 Dec. 1976 - 28 Feb. 1999***
Gorenstein, Paul, Smithsonian Astrophysical Observatory, USA; February 1999; 24p; In English
Contract(s)/Grant(s): NsG-5138; NAG8-1194; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We are engaged in a program to develop focussing hard X-ray telescopes in a double conical or Wolter 1 geometry that function up to 100 keV by employing small graze angles and multilayer coatings. Directly polished substrates are not an option because they are too thick to be nested efficiently. The only alternative is to fabricate the very thin substrates by replication. Our objective is the production of integral cylindrical substrates because they should result in better angular resolution than segmented foil geometries. In addition, integral cylinders would be more resistant to possible stress from deep multilayer coatings than segmented ones. Both electroforming of nickel (method of SkX, JET-X, and XMM) and epoxy replication are under consideration. Both processes can utilize the same types of mandrels and separation agents- While electroforming can produce substrates that are thin, the high density of the nickel may result in high weight optics for some missions. For convenience, experimentation with replication and coating is being carried out initially on flats. Our replication studies include trials with gold and carbon separation agents. This paper reports on our efforts with epoxy replicated optics.
Author
Sounding Rockets; X Ray Telescopes; Imaging Techniques; Coating; Substrates; Angular Resolution

19990027437 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA
Far Infrared Line Profiles from Photodissociation Regions and Warm Molecular Clouds ***Final Report, 1 Apr. 1996 - 31 Dec. 1998***
Boreiko, R. T., Colorado Univ., USA; Betz, A. L., Colorado Univ., USA; 1998; 5p; In English
Contract(s)/Grant(s): NAG2-1056; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report summarizes the work done under NASA Grant NAG2-1056 awarded to the University of Colorado. The aim of the project was to analyze data obtained over the past several years with the University of Colorado far-infrared heterodyne spectrometer (Betz Boreiko 1993) aboard the Kuiper Airborne Observatory. of particular interest were observations of CO and ionized carbon (C II) in photodissociation regions (PDRS) at the interface between UV-ionized H II regions and the neutral molecular clouds supporting star formation. These data, obtained with a heterodyne spectrometer having a resolution of 3.2 MHz, which is equivalent to a velocity resolution of 0.2 km/s at 60 microns and 1.0 km/s at 300 microns, were analyzed to obtain physical parameters such as density and temperature in the observed PDR. The publication resulting from the work reported here is appended. No inventions were made nor was any federally owned property acquired as a result of the activities under this grant.
Derived from text
Far Infrared Radiation; H II Regions; Molecular Clouds; Photodissociation

19990027787 National Optical Astronomy Observatories, Tucson, AZ USA
Infrared Astronomical Spectroscopy with a Non-Cryogenic Spectrograph
Joyce, R. R., Kitt Peak National Observatory, USA; Hinkle, K. H., Kitt Peak National Observatory, USA; Meyer, M. R., Arizona Univ., USA; Skrutskie, M. F., Massachusetts Univ., USA; Apr. 1998; 10p; In English
Report No.(s): NOAO-Preprint-792; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Large astronomical spectrographs designed for use in the visible can operate efficiently well beyond the long wave-length cutoff of CCD detectors. Given the expense and complexity of constructing Infrared (IR)-optimized high resolution or multi-object spectrographs, it is prudent to explore the range of scientific programs possible utilizing modern near-infrared arrays at the focal plane of historically visible wavelength instruments. For the past three years, we have used the NICMASS camera, a 256 by 256 HgCdTe imager developed at the University of Massachusetts, at the camera 5 focus of the Coude Feed Spectrograph on Kitt Peak for moderate and high resolution infrared spectroscopy in the 1 - 1.8 micrometer range. This configuration has been used at a spectral resolution of 7200 using a 316 I/mm grating and 44000 using a 31.6 l/mm echelle grating. With the latter configuration we find the Coude Spectrograph to be an extremely stable platform permitting radial velocity determinations to better than 1 km-s(exp-1). We will discuss some scientific results obtained with this novel configuration and the performance limitations imposed by the ambient temperature spectrograph beyond a wavelength of 1 micrometer. We also discuss plans to evaluate the

suitability of NICMASS for multi-object near-infrared spectroscopy on the Hydra Bench Spectrograph at the WIYN telescope on Kitt Peak.
Author
Infrared Spectroscopy; Cameras; Spectrographs; Infrared Telescopes; Infrared Astronomy

19990027826 NASA Goddard Space Flight Center, Greenbelt, MD USA
New Hubble Space Telescope Observations of High-Velocity Ly(alpha) and H(alpha) in SNR 1987A
Michael, Eli, Colorado Univ., USA; McCray, Richard, Colorado Univ., USA; Pun, C. S. J., NASA Goddard Space Flight Center, USA; Borkowski, Kazimierz, North Carolina State Univ., USA; Garnavich, Peter, Harvard-Smithsonian Center for Astrophysics, USA; Challis, Peter, Harvard-Smithsonian Center for Astrophysics, USA; Kirshner, Robert P., Harvard-Smithsonian Center for Astrophysics, USA; Chevalier, Roger, Virginia Univ., USA; Filippenko, Alexei V., California Univ., USA; Fransson, Claes, S-tockholm Observatory, Sweden; Panagia, Nino, Space Telescope Science Inst., USA; Phillips, Mark, Cerro Tololo Inter-American Observatory, Chile; Schmidt, Brian, Mount Stromlo and Siding Spring Observatories, Australia; Suntzef, Nicholas, Cerro Tololo Inter-American Observatory, Chile; Astrophysical Journal; Dec. 20, 1998; Volume 509, pp. L117-L120; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-26555; NAG5-3313; NAG5-2844; GO-2563.01-87A; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We describe and model high-velocity (approximately 15,000 km S(exp -1)) Ly Alpha and H Alpha emission from the supernova remnant SNR 1987A seen in 1997 September and October with the Space Telescope Imaging Spectrograph. Part of this emission comes from a reverse shock located at approximately 75% of the radius of the inner boundary ofthe innercircumstellar ring and confined within + or - 30 degrees of the equatorial plane. Departure from axisymmetry in the Ly Alpha and H Alpha emission correlates with that seen in nonthermal radio emission and reveals an asymmetry in the circumstellar gas distribution. We also see diffuse high-velocity Ly-Alpha emission from supernova debris inside the reverse shock that may be due to excitation by nonthermal particles accelerated by the shock.
Author
Imaging Techniques; Radio Emission; Supernova Remnants; Spectrographs; Asymmetry; X Ray Astronomy

19990027827 Wyoming Univ., Dept. of Physics and Astronomy, Laramie, WY USA
RXTE Observation of Cygnus X-1 Spectral Analysis
Dove, J. B., Wyoming Univ., USA; Wilms, Joern, Tuebingen Univ., Germany; Nowak, M. A., Colorado Univ., USA; Vaughan, B. A., California Inst. of Tech., USA; Begelman, M. C., Colorado Univ., USA; Nuclear Physics B: Proceedings Supplements; 1998; ISSN 0920-5632; 69/1, pp. 302-307; In English
Contract(s)/Grant(s): NAG5-2026; NAG5-3310; NAG5-3225; DARA-50-OR-92054; NSF AST-91-20599; NSF AST-95-29175; NSF INT-95-13899; NAG5-3239; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present the results of the analysis of the broad-band spectrum of Cygnus X-1 from 3.0 to 200 keV, using data from a 10 ksec observation by the Rossi X-ray Timing Explorer. Although the spectrum can be well described phenomenologically by an exponentially cut-off power law (photon index Gamma = 1.45+0.01 -0.02 , e-folding energy e(sub f) = 162+9 -8 keV, plus a deviation from a power law that formally can be modeled as a thermal blackbody, with temperature kT(sub BB) = 1.2 +0.0 -0.1 keV), the inclusion of a reflection component does not improve the fit. As a physical description of this system, we apply the accretion disc corona (ADC) models. A slab-geometry ADC model is unable to describe the data. However, a spherical corona, with a total optical depth tau- = 1.6 + or - 0.1 and an average temperature kTc = 87 + or - 5 keV, surrounded by an exterior cold disc, does provide a good description of the data (X red (exp 2) = 1.55). These models deviate from the data bv up to 7% in the 5-10 keV range. However, considering how successfully the spherical corona reproduces the 10-200 keV data, such ”photon-starved” coronal geometries seem very promising for explaining the accretion processes of Cygnus X-1.
Author
Astronomical Models; Coronas; Black Holes (Astronomy); Accretion Disks; X Ray Astronomy

19990027948 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
ASCA Observations of the T Tauri Star SU Aurigae and the Surrounding L1517 Dark Cloud
Skinner, Stephen L., Colorado Univ., USA; Walter, Frederick M., State Univ. of New York, USA; Astrophysical Journal; Dec. 20, 1998; Volume 509, pp. 761-767; In English
Contract(s)/Grant(s): NAG5-3224; NAG5-2936; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present the results of a approximately equals 40 ks pointed Advanced Satellite for Cosmology and Astrophysics (ASCA) observation of the L1517 star-forming region, centered on the X-ray-bright T Tauri star SU Aurigae. This star has the highest X-ray

luminosity of any classical T Tauri star in the Taurus-Auriga region, and its optical spectra show evidence for both mass inflow and outflow. Strong X-ray emission was detected from SU Aur (L(sub x) = 10(exp 30.9) ergs s(exp -1)) as well as weaker emission from five other pre-main-sequence stars. Although no large-amplitude flares were detected, the X-ray emission of SU Aur showed clear variability in the form of a slow decline in count rate during the 1.3 day observation. We provide the first direct comparison of the coronal differential emission measure (DEM) distribution of a classical T Tauri star with that of a young main-sequence star of similar spectral type. The DEM distributions of SU Aur (G2; age 3 Myr) and the young solar-like star EK Draconis (GO V; age 70 Myr) are qualitatively similar, with both showing a bimodal temperature distribution characterized by a cool plasma component peaking at approximately 8-9 MK and a hot component peaking at approximately 20-21 MK. However, there is a striking difference in the relative proportion of plasma at high temperatures in the two stars, with hot plasma (>20 MK) accounting for approximately equals 80% of the volume emission measure of SU Aur, compared to only approximately equals 40% in EK Dra. These results provide new insight into the changes that will occur in the corona of a T Tauri star as it descends onto the main sequence. A sharp decline in the fraction of coronal plasma at flarelike temperatures will occur during the late-T Tauri and post-T Tauri phases, and other recent X-ray studies have shown that this decline will continue after the young solar-like star reaches the main sequence.
Author
Coronas; Cosmology; Luminosity; Main Sequence Stars; Pre-Main Sequence Stars; T Tauri Stars; X Ray Astronomy; X Ray Sources

19990028246 NASA Marshall Space Flight Center, Huntsville, AL USA
New Mission Concept Study: Energetic X-Ray Imaging Survey Telescope (EXIST) ***Final Report, 1 Oct. 1995 - 30 Sep. 1998***
1998; 16p; In English
Contract(s)/Grant(s): NAG8-1212; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Report summarizes the activity carried out under the New Mission Concept (NMC) study for a mission to conduct a sensitive all-sky imaging survey in the hard x-ray (HX) band (approximately 10-600 keV). The Energetic X-ray Imaging Survey Telescope (EXIST) mission was originally proposed for this NMC study and was then subsequently proposed for a MIDEX mission as part of this study effort. Development of the EXIST (and related) concepts continues for a future flight proposal. The hard x-ray band (approximately 10-600 keV) is nearly the final band of the astronomical spectrum still without a sensitive imaging all-sky survey. This is despite the enormous potential of this band to address a wide range of fundamental and timely objectives - from the origin and physical mechanisms of cosmological gamma-ray bursts (GRBs) to the processes on strongly magnetic neutron stars that produce soft gamma-repeaters and bursting pulsars; from the study of active galactic nuclei (AGN) and quasars to the origin and evolution of the hard x-ray diffuse background; from the nature and number of black holes and neutron stars and the accretion processes onto them to the extreme non-thermal flares of normal stars; and from searches for expected diffuse (but relatively compact) nuclear line (Ti-44) emission in uncatalogued supernova remnants to diffuse non-thermal inverse Compton emission from galaxy clusters. A high sensitivity all-sky survey mission in the hard x-ray band, with imaging to both address source confusion and time-variable background radiations, is very much needed.
Derived from text
X Ray Imagery; X Ray Telescopes; Imaging Techniques; Galactic Clusters; Gamma Rays; Magnetic Stars; Neutron Stars

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also 75 Plasma Physics.

19990026742 SpaceDev, Inc., San Diego, CA USA
Near-Earth Asteroid Prospector and the Commercial Development of Space Resources
Benson, Jim, SpaceDev, Inc., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 2; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

With the recent bad news that there may be little or no budget money for NASA to continue funding programs aimed at the human exploration of space beyond Earth's orbit, it becomes even more important for other initiatives to be considered. SpaceDev is the world' s first commercial space exploration company, and enjoys the strong support of Dan Goldin, Wes Huntress, Carl Pilcher, Alan Ladwig, and others at NASA headquarters. SpaceDev is also supported by such scientists as Jim Arnold, Paul Coleman, John Lewis, Steve Ostro, and many others. Taxpayers cannot be expected to carry the entire burden of exploration, construction, and settlement. The private sector must be involved, and the SpaceDev Near Earth Asteroid Prospector (NEAP) venture may

provide a good example of how governments and the private sector can cooperate to accomplish these goals. SpaceDev believes that the utilization of in situ resources will take place on near-Earth asteroids before the Moon or Mars because many NEOs are energetically closer than the Moon or Mars and have a highly concentrated composition. SpaceDev currently expects to perform the following three missions: NEAP (science data gathering); NEAP 2, near-Earth asteroid or short-term comet sample return mission; and NEAP 3, in situ fuel production or resource extraction and utilization. These missions could pioneer the way for in situ resources for construction.
Author
Asteroids; Extraterrestrial Resources; Fuel Production; Space Commercialization; Space Exploration; Asteroid Missions

19990027076 Department of Energy, Office of Energy Research, Washington, DC USA
Research in theoretical physics ***Final Report***
Domokos, G., Department of Energy, USA; Kovesi-Domokos, S., Department of Energy, USA; Jun. 30, 1998; 48p; In English
Report No.(s): DE98-006454; DOE/ER/40211-9; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report summarizes the research carried out under Grant DE-FG02-85ER40211. The main topics covered are: astroparticle physics at very high and ultrahigh energies; search for new physics by means of detectors of ultrahigh energy particles of extraterrestrial origin. Methods for searching in heavy quark decays for signatures of physics beyond the standard model are developed.
NTIS
Theoretical Physics; Quarks; Particle Decay

19990027090 Oxford Univ., Dept. of Physics, Oxford UK
Giant Comets, Evolution and Civilization
Clube, S. V.; Hoyle, F.; Napier, W. M.; Wickramasinghe, N. C.; Jan. 1998; 40p; In English; Prepared in cooperation with Armagh Observatory, Northern Ireland.
Contract(s)/Grant(s): F61708-94-W-0621
Report No.(s): AD-A359881; EOARD-SPC-93-4076-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Climatic cycles, ice epochs, mass extinctions and other global disturbances may be attributed to episodes of bombardment by giant comets. Such bodies now in chaotic orbits beyond Jupiter present the most serious current celestial hazard. A point at issue is the greater complexity of the cometary as opposed to the asteroidal hazard, as well as its more pervasive effects.
DTIC
Comets; Asteroids; Asteroid Collisions; Climatology; Cometary Collisions

19990027275 National Optical Astronomy Observatories, Tucson, AZ USA
Massive Stars in the MCs: What They Tell Us About the IMF Stellar Evolution, and Upper Mass "Cutoffs"
Massey, Philip, National Optical Astronomy Observatories, USA; Sep. 1998; 7p; In English; New Views of the Magellanic Clouds, USA; Sponsored by International Astronomical Union, Netherlands
Report No.(s): NOAO-Preprint-814; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Studies over the past decade have shown that the initial mass function (IMF) is the same for massive stars born in the OB associations of the LMC and SMC as in the associations of the Milky Way: the slope of the IMF is essentially Salpeter (Gamma approx. -1.3), despite the factor of 4 difference in metallicity between these systems, and despite a factor of several hundred in stellar density between the sparsest and richest OB associations. However, there does appears to be a number of massive stars that are born in relative isolation, and the IMF of this mixed-age, field population is quite different than that of OB associations, with Gamma approx. -4 in all three galaxies. The distribution of stars in the HR diagram is in excellent agreement with the Geneva group's evolutionary models for stars with masses greater than 25 solar mass, with no "main-sequence widening problem" left to be solved. The massive stars born in clusters are formed quite coevally (Delta(sub tau) less than 1 - 2 M yr), which allows us to use the "turn-off masses" to determine what mass objects become Wolf-Rayet stars of various types, and new results are briefly described: for the LMC, WNEs come from a wide range of masses, WCs come only from the highest mass stars, and Ofpe/WN9 "slash" stars come from lower mass OBs. Recent work on the R136a cluster (described in Hunter's review talk) suggest that there is no such thing as an upper mass cutoff to the IMF, at least not one that has been found observationally: for the youngest clusters (2 M yr and younger), the mass of the highest mass star present is simply dependent upon how populous the cluster is; i.e., the IMF is truncated by statistics, not physics.
Author
Massive Stars; Stellar Evolution; Stellar Mass; Stellar Models

19990027302 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA

RXTE Observation of Cygnus X-1: III. Implications for Compton Corona and ADAF Models, Report 3, Implications for Compton Corona and ADAF Models

Nowak, Michael A., Colorado Univ., USA; Wilms, Joern, Tuebingen Univ., Germany; Vaughan, Brian A., California Inst. of Tech., USA; Dove, James B., Colorado Univ., USA; Begelman, Mitchell C., Colorado Univ., USA; Astrophysical Journal; 1999, pp. 1-13; In English

Contract(s)/Grant(s): NSF AST-91-20599; NSF AST-95-29175; NSF INT-95-13899; NAG5-2026; NAG5-3225; NAG5-3310; DARA-50-OR-92054

Report No.(s): astro-ph/9810406; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have recently shown that a 'sphere + disk' geometry Compton corona model provides a good description of Rossi X-ray Timing Explorer (RXTE) observations of the hard/low state of Cygnus X-1. Separately, we have analyzed the temporal data provided by RXTE. In this paper we consider the implications of this timing analysis for our best-fit 'sphere + disk' Comptonization models. We focus our attention on the observed Fourier frequency-dependent time delays between hard and soft photons. We consider whether the observed time delays are: created in the disk but are merely reprocessed by the corona; created by differences between the hard and soft photon diffusion times in coronae with extremely large radii; or are due to 'propagation' of disturbances through the corona. We find that the time delays are most likely created directly within the corona; however, it is currently uncertain which specific model is the most likely explanation. Models that posit a large coronal radius [or equivalently, a large Advection Dominated Accretion Flow (ADAF) region] do not fully address all the details of the observed spectrum. The Compton corona models that do address the full spectrum do not contain dynamical information. We show, however, that simple phenomenological propagation models for the observed time delays for these latter models imply extremely slow characteristic propagation speeds within the coronal region.

Author

X Ray Timing Explorer; Cygnus Constellation; Fourier Analysis; Time Lag; Coronas; Spectra; Binary Stars

19990027619 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA

Far Infrared Line Profiles from Photodissociation Regions and Warm Molecular Clouds ***Final Report, 1 Apr. 1996 - 31 Dec. 1998***

Boreiko, R. T., Colorado Univ., USA; Betz, A. L., Colorado Univ., USA; 1998; 5p; In English

Contract(s)/Grant(s): NAG2-1056; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report summarizes the work done under NASA Grant NAG2-1056 awarded to the University of Colorado. The aim of the project was to analyze data obtained over the past several years with the University of Colorado far-infrared heterodyne spectrometer (Betz & Boreiko 1993) aboard the Kuiper Airborne Observatory. of particular interest were observations of CO and ionized carbon (C II) in photodissociation regions (PDRs) at the interface between UV-ionized H II regions and the neutral molecular clouds supporting star formation. These data, obtained with a heterodyne spectrometer having a resolution of 3.2 MHz, which is equivalent to a velocity resolution of 0.2 km/s at 60 microns and 1.0 km/s at 300 microns, were analyzed to obtain physical parameters such as density and temperature in the observed PDR. The publication resulting from the work reported here is appended. No inventions were made nor was any federally owned property acquired as a result of the activities under this grant.

Author

Photodissociation; Molecular Clouds; Heterodyning; H II Regions; Far Infrared Radiation

19990027770 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France

Pre-Big Bang Bubbles from the Gravitational Instability of Generic String Vacua

Buonanno, A., Institut des Hautes Etudes Scientifiques, France; Damour, T., Institut des Hautes Etudes Scientifiques, France; Veneziano, G., European Organization for Nuclear Research, Switzerland; Jun. 1998; 66p; In English

Report No.(s): PB99--122343; IHES/P/98/44; CERN-TH/98-187; hep-th/9806230; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We formulate the basic postulate of pre-big bang cosmology as one of 'asymptotic past triviality', by which we mean that the initial state is a generic perturbative solution of the tree-level low-energy effective action. Each such singular space-like hypersurface of gravitational collapse becomes, in the string-frame metric, the usual big-bang t = 0 hypersurface, i.e. the place of birth of a baby Friedmann universe after a period of dilaton-driven inflation. Specializing to the spherically-symmetric case, we review and reinterpret previous work on the subject, and propose a simple, scale-invariant criterion for collapse/inflation in terms of asymptotic data at past null infinity. Those data should determine whether, when, and where collapse/inflation occurs, and, when it does, fix its characteristics, including anisotropies on the big bang hypersurface whose imprint could have survived till now.

Using Bayesian probability concepts, we finally attempt to answer some fine-tuning objections recently moved to the pre-gib bang scenario.
NTIS
Probability Theory; Bubbles; Big Bang Cosmology; Gravitational Instability; Strings; String Theory

19990027792 Maxwell Technologies, Inc., Federal Div., San Diego, CA USA
Space System Environment Interactions Investigation
Mandell, M. J.; Jongeward, G. A.; Kuharski, R. A.; Davis, V. A.; Dec. 1997; 105p; In English
Report No.(s): AD-A360006; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report describes work conducted to support research into the interactions of space systems with the space environment. This report covers theoretical and calculational research in support of the SPEAR 3 program using the EPSAT and DynaPAC computer codes. Analysis of CHAWS and PASP Plus flight data is discussed.
DTIC
Aerospace Environments; Aerospace Systems; Interactions

19990027937 Department of Energy, Washington, DC USA
Highest redshift radio galaxy known in the Southern Hemisphere
DeBreuck, C., Department of Energy, USA; Dec. 01, 1997; 5p; In English; Looking deep in the southern sky, USA
Report No.(s): DE98-058629; UCRL-JC-131160; CONF-971257; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We present the discovery of a z = 413 galaxy TN J1338-1942, the most distant radio galaxy in the southern hemisphere known to date. The source was selected from a sample of Ultra Steep Spectrum (USS; (alpha) -13; S (proportional-to) (nu)(sup (alpha)) radio sauces using the Texas and NVSS catalogs. The discovery spectrum, obtained with the ES0 36m telescope, shows bright extended Ly-(alpha) emission. The radio source has a very asymmetric morphology, suggesting a strong interaction with an inhomogeneous surrounding medium.
NTIS
Red Shift; Radio Galaxies; Southern Hemisphere

19990027938 Department of Energy, Washington, DC USA
Are there clouds in the BLR. Keck observations of NGC 4151
Arav, N., Department of Energy, USA; Mar. 01, 1998; 9p; In English; Structure and Kinematics of Quasar Broad Line Regions, USA
Report No.(s): DE98-058608; UCRL-JC-130899; CONF-9803110; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We search for a direct signature of discrete 'clouds' in the broad line region (BLR) of the Seyfert galaxy NGC 4151. For this purpose we apply cross correlation (CC) analysis to a high resolution KECK spectrum of the galaxy. No such signature is found in the data. In order for cloud models to be compatible with this result, there must be at least (approximately) 3 x 10(exp 7) emitting clouds in the BLR, where the limit is based on simulation of a homogeneous cloud population. More realistic distributions increase the lower limit to above 10(exp 8). These numbers are an order of magnitude improvement on our previous limit from Mrk 335, where the improvement comes from higher S/N, broader lines, and refined simulations. Combined with the predicted upper limit for the number of emitting clouds in NGC 4151 (10(exp 6) - 10(exp 7)), the derived lower limit puts a strong constraint on the cloud scenario in the BLR of this object. Similar constraints can be placed on models where the emission originates in streams and sheets. Thus, this investigation suggests that the BELs in NGC 4151, and by extension in all AGNs, are not made of an ensemble of discrete independent emitters.
NTIS
Signatures; Clouds (Meteorology)

19990027953 Department of Energy, Washington, DC USA
Very high redshift radio galaxies
vanBreugel, W. J. M., Department of Energy, USA; Dec. 01, 1997; 13p; In English; Looking deep in the southern sky, USA
Report No.(s): DE98-058841; UCRL-JC-131174; CONF-971257; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High redshift radio galaxies (HzRGs) provide unique targets for the study of the formation and evolution of massive galaxies and galaxy clusters at very high redshifts. We discuss how efficient HzRG samples ae selected, the evidence for strong morphological evolution at near-infrared wavelengths, and for jet-induced star formation in the z = 3 800 HzRG 4C41 17.
NTIS
Red Shift; Radio Galaxies; Galactic Evolution

19990027976 NASA Ames Research Center, Moffett Field, CA USA
A Proposed Comet Nucleus Penetrator for the Comet Rendezvous Asteroid Flyby Mission
Swenson, B. L., NASA Ames Research Center, USA; Squyres, S. W., NASA Ames Research Center, USA; Knight, T. C. D., Martin Marietta Aerospace, USA; Acta Astronautica; 1987; ISSN 0094-5767; Volume 15, No.6/7, pp. 471-479; In English; 37th; Congress of the International Astronautical Federation, 4-11 Oct. 1986, Innsbruck, Austria
Report No.(s): IAF-86-297; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Among the major objectives of NASA's program of space exploration is a better understanding of the origin and evolution of the solar system. Crucial to this objective is the study of comets, which are thought to be the most primitive, pristine bodies remaining in the solar system. The importance of the study of comets has led NASA to plan a mission to rendezvous with comet Tempel 2 in 1997. Critical to the understanding of comets will be measurements of the nucleus material to determine its elemental and isotopic composition, its mechanical properties, and its thermal state and properties. This paper describes a proposal for a Comet Nucleus Penetrator to accomplish these measurement goals. The Comet Nucleus Penetrator will implant instruments into the comet's nucleus beneath a probable volatile-depleted surface mantle into material more representative of the bulk composition of the nucleus.
Author
Chemical Composition; Comet Nuclei; Comets; Solar System; Space Exploration; Tempel 2 Comet; Penetration; Comet Rendezvous Asteroid Flyby Mission

19990028199 NASA Ames Research Center, Moffett Field, CA USA
Midcourse Space Experiment Spectra of the Orion Nebula and the Implications for Abundances in the Interstellar Medium
Simpson, J. P., NASA Ames Research Center, USA; Witteborn, F. C., NASA Ames Research Center, USA; Price, S. D., Air Force Research Lab., USA; Cohen, M., California Univ., USA; The Astrophysical Journal; Nov. 20, 1998; Volume 508, pp. 268-274; In English
Contract(s)/Grant(s): NCC2-900; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Spectra of the Orion Nebula were obtained with the Midcourse Space Experiment Spirit 3 interferometer from 370 to 2000 cm(exp -1) with 2 cm(exp -1) resolution in a 6' x 9' field of view (FOV) in 1996 November. Lines were detected of [S III] 534.4 cm(exp -1), [Ne III] 642.9 cm(exp -1), [Ne II] 780.4 cm(exp -1), [S IV] 951.4 cm(exp -1), [Ar III] 1112.2 cm(exp -1), [Ar II] 1431.6 cm(exp -1), H (7-6) 808.3 cm(exp -1), H (8-6) 1332.9 cm(exp -1), H (6-5) 1340.5 cm(exp -1), H2(S1) 587.0 cm(exp -1), H2(S2) 814.4 cm(exp -1), H2(S3) 1034.7 cm(exp -1), H2(S4) 1246.1 cm(exp -1), and H2(S5) 1447.3 cm(exp -1). The following abundances were determined from these lines: Ne/H = 9.9 +/- 1.1 x 10(exp -5), S/H = 8.1 +/- 1.1 x 10(exp -6), and Ar/H = 2.5 +/- 0.2 x 10(exp -6). These abundances are all less than solar and confirm that the Sun is overabundant in heavy elements without the need for correction for the composition of interstellar dust. The low sulfur abundance compared with solar is an indication that a significant amount of the sulfur in Orion is in dust grains. The FOV-averaged molecular hydrogen column density is approximately 1.6 x 10(exp 20) cm(exp -2) for an excitation temperature of approximately 670 K and an extinction correction corresponding to an optical depth of 1.5 at 9.7 micrometers. The unidentified infrared emission features at 6.2, 7.7, 8.6, 11.3, and 12.7 micrometers, attributable to polycyclic aromatic hydrocarbons, were also detected. A prominent, broad silicate feature centered near 18 micrometer and additional weak features were detected and are discussed.
Author
Orion Nebula; Abundance; Interstellar Matter; Infrared Spectra

19990028224 NASA, Washington, DC USA
Delta Scuti stars: Theory
Guzik, J. A., NASA, USA; Mar. 31, 1998; 11p; In English; 185th; New eyes to see inside the sun and stars, USA; Sponsored by International Astronomy Union, Australia
Report No.(s): DE98-003371; LA-UR-97-4362; CONF-9708156; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The purpose of asteroseismology is not only to derive the internal structure of individual stars from their observed oscillation frequencies, but also to test and extend one's understanding of the physics of matter under the extremes of temperature, density, and pressure found in stellar interiors. In this review, the author hopes to point out what one can learn about the Sun by studying (delta) Scuti stars, as well as what one can learn about stars more massive or evolved than the Sun. He discusses some of the difficulties in theoretical approaches to asteroseismology for (delta) Scuti stars, using FG Vir, (delta) Scuti, and CD-24(degree) 7599 as examples.
NTIS
Sun; Variable Stars

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LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

19990026739 Lunar and Planetary Inst., Houston, TX USA
Workshop on Using In Situ Resources for Construction of Planetary Outposts
Duke, Michael B., Editor, Lunar and Planetary Inst., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998; 63p; In English, 30 Apr. - 1 May 1998, Albuquerque, NM, USA; Sponsored by NASA, USA; See also 19990026740 through 19990026780; Meeting sponsored in part by Space '98
Contract(s)/Grant(s): NASw-4574
Report No.(s): LPI/TR-98-01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The workshop examined the potential uses of indigenous materials on the Moon and Mars, other than those associated with the production of propellants for space transportation. The papers presented concerned the needs for construction, based on analysis of the current NASA Mars reference Mission and past studies studies of lunar outposts; the availability of materials on the Moon and Mars; construction techniques that make use of the natural environment; materials production and fabrication techniques based on indigenous materials; and new technologies that could promote the use of indigenous materials in construction.
Derived from text
Extraterrestrial Resources; Lunar Resources; Conferences; Mars (Planet); Mars Bases; Lunar Bases

19990026740 Lockheed Martin Space Mission Systems and Services, Houston, TX USA
Bricks and Ceramics
Allen, Carlton C., Lockheed Martin Space Mission Systems and Services, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 1-2; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A lunar base will require large amounts of dense, strong construction material for thermal and dust control, as well as for radiation protection. Sintered lunar soil, a fine-grained mixture of crushed rock and glass, has been proposed to meet this need. Our research effort has focused on practical methods of sintering to produce lunar "bricks." We report here the results of two investigations of the sintering of simulated lunar soil. Radiant heating under carefully controlled conditions can reproducibly yield large, strong bricks. Hybrid microwave sintering, using a combination of microwave and radiant heating, is also shown to give promising results.
Derived from text
Lunar Soil; Radiation Protection; Sintering; Radiant Heating; Lunar Bases; Lunar Resources

19990026741 Rutgers Univ., Dept. of Mechanical and Aerospace Engineering, Piscataway, NJ USA
In Situ Resources for Lunar Base Applications
Benaroya, Haym, Rutgers Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 2; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Lunar resources have been cited in two ways within the context of lunar (and Mars) development. The first is that lunar resources are an economic incentive for lunar development. In other words, there are bountiful natural resources on the Moon that could economically justify a return to the Moon. The other context is that lunar resources could be very useful in creating and maintaining a lunar settlement. There is abundant O; about 45% of the weight of lunar rocks and soils is chemically bound 0. These materials also contain considerable Si, Fe, Ca, Al, Mg, and Ti, which can be extracted as a byproduct of O extraction. In addition,

He, H, N, and C can be found in the lunar regolith. All this suggests that many important components can be extracted, resulting in O and H-based rocket fuels that could be used both for Earth-Moon operations and for ships going to Mars. Various metallic ores also suggest other uses. The potentially brightest spot of lunar resources is He-3, a light isotope of He and a potential fuel for nuclear fusion reactors. Unfortunately, these reactors have not been engineered yet. A guess of when they may be on line is in three decades, but that was before Congress cut off funds for the Princeton Tokamak research facility.
Author
Lunar Bases; Lunar Resources; Lunar Rocks; Lunar Soil; Minerals; Regolith; Oxygen; Construction; Construction Materials

19990026746 New Mexico Univ., Albuquerque, NM USA
Martian (and Cold Region Lunar) Soil Mechanics Considerations
Chua, Koon Meng, New Mexico Univ., USA; Johnson, Stewart W., Johnson and Associates, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 4-5; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The exploration of Mars has generated a lot of interest in recent years. With the completion of the Pathfinder Mission and the commencement of detailed mapping by Mars Global Surveyor, the possibility of an inhabited outpost on the planet is becoming more realistic. In spite of the upbeat mood, human exploration of Mars is still many years in the future. Additionally, the earliest return of any martian soil samples will probably not be until 2008. So why the discussion about martian soil mechanics when there are no returned soil samples on hand to examine? In view of the lack of samples, the basis of this or any discussion at this time must necessarily be one that involves conjecture, but not without the advantage of our knowledge of regolith mechanics of the Moon and soil mechanics on Earth. The objective of this presentation/discussion is fourfold: (1) Review some basic engineering-related information about Mars that may be of interest to engineers, and scientists - including characteristics of water and C02 at low temperature; (2) review and bring together principles of soil mechanics pertinent to studying and predicting how martian soil may behave, including the morphology and physical characteristics of coarse-grained and fine-grained soils (including clays), the characteristics of collapsing soils, potentials and factors that affect migration of water in unfrozen and freezing/frozen soils, and the strength and stiffness characteristics of soils at cold temperatures; (3) discuss some preliminary results of engineering experiments performed with frozen lunar soil simulants, JSC-1, in the laboratory that show the response to temperature change with and without water, effects of water on the strength and stiffness at ambient and at below freezing temperatures; and (4) discuss engineering studies that could be performed prior to human exploration and engineering research to be performed alongside future scientific missions to that planet.
Author
Mars Surface; Regolith; Soil Mechanics; Soils; Water; Mars (Planet); Mars Environment

19990026747 NASA Johnson Space Center, Houston, TX USA
Human Exploration of Mars: The Reference Mission of the NASA Mars Exploration Study Team
Connolly, John, NASA Johnson Space Center, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 5; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Reference Mission was developed over a period of several years and was published in NASA Special Publication 6107 in July 1997. The purpose of the Reference Mission was to provide a workable model for the human exploration of Mars, which is described in enough detail that alternative strategies and implementations can be compared and evaluated. NASA is continuing to develop the Reference Mission and expects to update this report in the near future. It was the purpose of the Reference Mission to develop scenarios based on the needs of scientists and explorers who want to conduct research on Mars; however, more work on the surface-mission aspects of the Reference Mission is required and is getting under way. Some aspects of the Reference Mission that are important for the consideration of the surface mission definition include: (1) a split mission strategy, which arrives at the surface two years before the arrival of the first crew; (2) three missions to the outpost site over a 6-year period; (3) a plant capable of producing rocket propellant for lifting off Mars and caches of water, O, and inert gases for the life-support system; (4) a hybrid physico-chemical/bioregenerative life-support system, which emphasizes the bioregenerative system more in later parts of the scenario; (5) a nuclear reactor power supply, which provides enough power for all operations, including the operation of a bioregenerative life-support system as well as the propellant and consumable plant; (6) capability for at least two people to be outside the habitat each day of the surface stay; (7) telerobotic and human-operated transportation vehicles, including a pressurized rover capable of supporting trips of several days' duration from the habitat; (7) crew stay times of 500 days on the surface, with six-person crews; and (8) multiple functional redundancies to reduce risks to the crews on the surface. New concepts are being sought that would reduce the overall cost for this exploration program and reducing the risks that are indigenous to Mars explora-

tion. Among those areas being explored are alternative space propulsion approaches, solar vs. nuclear power, and reductions in the size of crews.
Author
Life Support Systems; Mars Exploration; Rocket Propellants; Manned Mars Missions; Mars Bases; Nuclear Reactors; Space Habitats; Water Reclamation; Water Resources

19990026750 Lunar and Planetary Inst., Houston, TX USA
Opportunities for ISRU Applications in the Mars Reference Mission
Duke, Michael B., Lunar and Planetary Inst., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 7; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The NASA Mars Exploration Reference Mission envisions sending three crews of six astronauts to Mars, each for 500-day stays on the surface. In situ Resourse Unitlization (ISRU) has been baselined for the production of propellant for crews leaving the surface, as well as to create reservoirs of water and life-support consumables These applications improve performance (by reducing the mass of hardware and supplies that must be brought to Mars for the propulsion system) and reduce risk (by creating consumables as backups to stores brought from Earth). Similar applications of other types of ISRU-derived materials should be sought and selected if they similarly improve performance or reduce risk. Some possible concepts for consideration, based on a review of the components included in the Reference Mission, include (1) emplacement of a hardened landing pad; (2) construction of a roadway for transporting the nuclear power system to a safe distance from the habitat; (3) radiation shielding for inflatable structures; (4) tanks and plumbing for bioregenerative life-support system; (5) drilling rig; (6) additional access structures for equipment and personnel and unpressurized structures for vehicle storage; (7) utilitarian manufactured products (e.g., stools and benches) for habitat and laboratory; (8) thermal radiators; (9) photovoltaic devices and support structures; and (10) external structures for storage and preservation of Mars samples. These may be viewed principally as mission- enhancing concepts for the Reference Mission. Selection would require a clear rationale for performance improvement or risk reduction and a demonstration that the cost of developing and transporting the needed equipment would be recovered within the budget for the program. Additional work is also necessary to ascertain whether early applications of ISRU for these types of purposes could lead to the modification of later missions, allowing the replacement of infrastructure payloads currently envisioned for the Reference Mission with science or technology payloads (improving performance). This class of ISRU use can be tested on the Moon before sending people to Mars and much of the production and assembly could be done robotically. The technology developed would lead to the capability for expansion of the outpost beyond the Reference Mission, with diminished need for materials from Earth.
Author
Life Support Systems; Supplying; Water; Mars Bases; Construction; Lunar Bases

19990026754 Charles Univ., Prague, Inst. of Geochemistry, Mineralogy and Mineral Resources, Stredocesky, Czechoslovakia
Cast Basalt, Mineral Wool and Oxygen Production: Early Industries for Planetary (Lunar) Outposts
Jakes, Peter, Charles Univ., Prague, Czechoslovakia; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 9-10; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

In the terrestrial environment, transportation cost is the basic limitation on the use of building materials such as sand, cement, gravel, and stones. Because of transport cost, local materials are preferred over imported, higher-quality materials. This is apparently the case for lunar and martian outposts as well, and this fact is augmented by the need to transport as little technological equipment as possible. In order to optimize the energy that will be available at planetary outposts, it is suggested that the production of cast-basalt building bricks, isolation materials such as mineral wool, and O should be achieved contemporaneously.
Author
Basalt; Mars (Planet); Oxygen Production; Transportation; Casting; Sand Casting

19990026755 Shimizu Corp., Space Systems Div., Japan
Considerations on the Technologies for Lunar Resource Utilization
Kanamori, Hiroshi, Shimizu Corp., Japan; Matsumoto, Shinji, Shimizu Corp., Japan; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 10-11; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Various types of lunar-derived materials will be required for lunar base construction and other lunar activities. They include O, nonprocessed lunar regolith, cast basalt, glass, ceramics, cement, and metals. Activities on the Moon will be gradually expanded following the lunar developmental scenario as suggested in many previous studies. A possible scenario could consist

of the following phases: (1) Survey of the Moon- Unmanned missions such as scientific explorations using lunar roving vehicles and lunar orbiters will be conducted. Simple experiments could be also performed on the Moon; (2) Lunar outpost- A small lunar surface station will be constructed using structural materials transported from Earth. The station will provide a living environment, an observatory, and a laboratory for humans to stay for short periods; (3) Initial lunar base- The lunar surface station will be expanded. The base structure will be partially constructed using lunar-derived materials. Advanced studies on lunar material processing and life support will be conducted; (4) Expanded lunar base- Most of the base structure will be constructed from lunar materials. Large-scale material processing plants will be developed; (5) Autonomous lunar base- Dependence of lunar activities on terrestrial materials will become minimum. The lunar base will become a logistics support station for further space exploration. The scenario for lunar resource utilization will be greatly affected by this scenario of lunar development. The outlines of each material are summarized.
Derived from text
Lunar Resources; Lunar Bases; Construction Materials

19990026756 Geological Survey, Flagstaff, AZ USA
The Salts of Mars: A Rich and Ubiquitous Natural Resource
Kargel, Jeff S., Geological Survey, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 11; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Viking and Pathfinder Mars landers have shown that martian soil is highly enriched in Cl, S, P, and perhaps Br. which, in all likelihood, occur as salts (chlorides, sulfates, phosphates, and perhaps bromides). Carbonates also may be present Many martian salt minerals are believed to be hydrated. These water-soluble constituents of the soil will offer the first colonists a rich source of many industrial commodities needed to sustain and grow the colony. Being hydrous, martian salts hold a tremendous potential to supply water in regions of Mars where otherwise preferable ice may be absent or difficult to access A caliche-like form of concrete or adobe may be manufactured by the drying of briny mud. Sulfates and phosphates may be used as additives for the manufacture of soil prepared and balanced for agriculture. Sulfates and chlorides offer a raw material for the manufacture of sulfuric and hydrochloric acids. Electrolytic processes applied to magnesium sulfate solution may yield metallic Mg. In short, martian salts will offer colonists abroad industrial base of chemical substances potentially useful in development of indigenous construction, chemical, and agricultural industries. Best of all, such salty dust deposits are among the most widespread and chemically uniform (i.e., dependable) raw materials on Mars. A simple method of preprocessing martian soil to extract and isolate the major salt consituents and to obtain water will be presented, as will a more thorough presentation of possible industrial uses of these materials in a Mars base.
Author
Chlorides; Mars Surface; Phosphates; Sulfates; Mars (Planet); Mars Bases; Water; Extraterrestrial Resources

19990026757 Ohio Aerospace Inst., Cleveland, OH USA
Materials Refining for Structural Elements From Lunar Resources
Landis, Geoffrey A., Ohio Aerospace Inst., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 11-12; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Use of in situ resources for construction on the Moon will require manufacturing structural materials out of lunar resources. Many materials that are currently used for aerospace and construction require materials that have low availability on the Moon. For example, graphite fiber, SiC fiber, and artificial fiber composites (such as Kevlar, Spectra, etc.) are used as advanced lightweight structural materials on Earth, but the low availability of C on the Moon makes these poor choices. Likewise the polymers used as the matrix for these composites, epoxy or polyester, also suffer from the low availability of C. Bulk paving and construction materials such as cement or concrete suffer from the low availability of water on the Moon, while asphalt, a common paving material on Earth, suffers from the low availability of C.
Author
Construction; Lunar Resources; Manufacturing; Titanium; Aluminum; Glass

19990026758 Lintek International, Inc., USA
Lunar and Martian Resource Utilization: Cement and Concrete
Lin, T. D., Lintek International, Inc., USA; Bhattacharja, S., Construction Technology Labs., USA; Powers-Couche, L., Construction Technology Labs., USA; Skaar, S. B., Notre Dame Univ., USA; Horiguchi, Takashi, Hokkaido Univ., Japan; Saeki, N., Hokkaido Univ., Japan; Munaf, D., Bandung Inst. of Tech., Indonesia; Peng, Y. N., National Chiao Tung Univ., Taiwan, Province of

China; Casanova, Ignacio, Universidad Politecnica de Catalunya, Spain; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 12; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Concrete is used in massive amounts on Earth for the construction of buildings, foundations, roadways, pipes, and specialty uses. Its use on the Moon and Mars has to take into consideration the availability of the natural materials as well as the environment in which it is cast and cured. It has not been considered ideal for planetary surface construction because it requires water, which has been assumed to be in short supply, and because special processes would have to be used in the very low atmospheric pressure environment of the Moon and Mars. However, the authors have conducted a cement/ concrete research program using simulated lunar and martian materials over a period of several years. Funding has come from governmental agencies in the USA, Japan, Indonesia, and Taiwan. NASA has considered various approaches to building outposts on other planets. Concepts that establish habitation for several crew members, power supplies, and processing plants to produce propellant from indigenous sources have been considered. The availability of construction materials from indigenous sources can enable the construction of shelters for habitats and unpressurized storage areas, as well as radiation, meteoroid, and thermal shielding without the importation of large masses of materials from the Earth. Concrete is a versatile material that can be derived entirely from the natural resources of the planet's surfaces.

Author

Concretes; Construction; Mars Surface; Cements; Lunar Surface; Lunar Bases; Mars Bases

19990026759 Hebrew Univ., Jerusalem, Israel

Volcanic Glasses: Construction Materials

Moskowitz, Samuel E., Hebrew Univ., Israel; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 13-14; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Natural glass is the product of rapidly cooled molten rock. Two natural sources of the melt are volcanic eruption and meteoritic impact. Pure glass is an amorphous aggregate. Volcanic glass is a material that could be utilized in the construction of extraterrestrial outposts. Pumice and perlite are volcanic glasses currently used in the building industry. Samples of natural volcanic glass found in the lunar regolith were returned to Earth as part of the Apollo and Luna programs. An alpha proton X-ray spectrometer onboard the Pathfinder recently examined martian rocks located in the vicinity of the lander craft. Preliminary results of chemical composition by weight of SiO2 50-55%, Al203 11-13%, K20 1-2%, Na20 2-5%, CaO 4-6%, MgO 3-7%, FeO 12-14%, S03 2-5%, and MnO <1%weregivenfortworocks.Paenthetically, the values for K and Mn were perhaps too high, and the analysis was based on X-ray data only. The appreciable amount of silica already found on Mars and empirical evidence to support the hypothesis that the planet once had water sufficient to rapidly cool magma imply the possibility of discovering natural glass of volcanic origin in subsequent missions.

Author

Aluminum Oxides; Amorphous Materials; Chemical Composition; Glass; Iron Oxides; Lunar Rocks; Magnesium Oxides; Planetary Geology; Silicon Dioxide; Mars Volcanoes; Water

19990026760 New Mexico Univ., Inst. of Meteoritics, Albuquerque, NM USA

Catalog of Martian Materials

Newsom, Horton E., New Mexico Univ., USA; Hagerty, J. J., New Mexico Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 14; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The long-term exploration of Mars will require the utilization of surface and near-surface materials for construction, radiation shielding, and life support. Eventually, such materials could be used as raw materials in manufacturing. While there is a resemblance between the surface of Mars, as revealed in Viking and Pathfinder images, and terrestrial desert environments, there are distinct differences that will affect the utilization of in situ resources. In general, the surface geological features are extremely old compared to Earth, dating back to the early evolution of the solar system. Therefore, materials created by processes such as impact cratering are important on Mars. Impact cratering probably created extensive sheets of impact melt bearing breccias on the surface and resulted in the formation of a thick regolith of broken rock fragments in the ancient terrains of Mars. Another key feature is the lack of rainfall over most of Mars' history. This resulted in the lack of extensive erosion. On Earth, extensive erosion of volcanic centers, for example, has exposed deep hydrothermal deposits that are mined for Cu, Mo, and W, but such deposits are not likely to be exposed at the surface on Mars. Similarly, deposits of quartz sand, used for glass making, are created by the erosion of granitic terrains on Earth, and are not likely to be found on Mars. The soil on Mars is also very different from wind-blown material on Earth. Virtually no organic material is present, and the material is enriched in volatile elements, such as S and Cl, and possi-

bly also toxic heavy metals, derived from volcanic gases and hydrothermal waters that poured onto the surface. The volatile elements have remained in the soil due to the absence of processes that recycle volatile elements back into the planet's crust. Hydrogen peroxide originally formed in the atmosphere is also mixed into the soil and regolith, and was probably responsible for the "oxidant" found in the soil by the Viking biology experiments. The surface may also contain material delivered to the surface, including solar-wind He-3, and chondritic material from meteorites and cosmic dust. One of the biggest problems is the probable lack of water any where near the surface, except in the the form of ice near the poles. A list summarizing some of the familiar and unfamiliar materials that may be encountered on the martian surface is presented.
Author
Chondrites; Glass; Granite; Hydrogen Peroxide; Ice; Mars Surface; Metals; Planetary Geology; Regolith; Soils; Polar Caps; Mars (Planet)

19990026761 Arizona Univ., Space Engineering Research Center, Tucson, AZ USA
New Technologies for Reliable, Low-Cost In Situ Resource Utilization
Ramohalli, Kumar, Arizona Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 14-15; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

New technologies can dramatically alter overall mission feasibility, architecture, window-of-opportunity, and science return. In the specific context of planetary exploration/development, several new technologies have been recently developed. It is significant that every one of these new technologies won a NASA NTR award in 1997-1998. In the area of low-cost space access and planetary transportation, hybrids are discussed. Whether we carry all of the fuel and oxidizer from Earth, or we make some or all of it in situ, mass advantages are shown through calculations. The hybrisol concept, where a solid fuel is cast over a state-of-the-art solid propellant, is introduced as a further advance in these ideas,. Thus, the motor operates as a controllable, high I(sub sp) rocket initially, and transitions to a high-thrust rocket after ascent, at which time the empty oxidizer tank is jettisoned. Again, calculations show significant advantages. In the area of efficient energy use for various mechanical actuations and robotic movements, muscle wires are introduced. Not only do we present detailed systems-level schemes, but we also present results from a hardware mechanism that has seen more than 18,000 cycles of operation. Recognizing that power is the real issue in planetary exploration/ development, the concept of LORPEX is introduced as a means of converting low-level energy accumulation into sudden bursts of power that can give factors of millions (in power magnification) in the process; this robot employs a low-power In Situ Resource Utilization (ISRU) unit to accumulate ISRU-generated fuel and oxidizer to be consumed at a rapid rate, chemically in an engine. Drilling, hopping, jumping, and ascent, or even return to Earth, are possible. Again, the hardware has been built and initial systems checkout demonstrated. Long-duration exploration and long-distance travel are made possible through aerobots, as is well known for planets with an atmosphere. However, power has again been a limiting factor. With our new concept of PV-enhanced aerobots, the aerobot surface is covered with ultra-lightweight photovoltaic cells that generate power. The power is used for buoyancy enhancement, communication, and science instruments In the area of fuel/oxidizer generation, a new concept is introduced that avoids the fragile solid oxide electrolyzers (SOXE) and Sabatier reactors (that need H). The new concept of MIMOCE is naturally suited for the local atmosphere, operates at a significantly lower temperature (less than 400? C), and has no troublesome seals or electrodes with bonding problems.
Author
High Thrust; Photovoltaic Cells; Robotics; Solid Propellants; Space Exploration; Transportation; Hybrid Propellants; Energy Conversion

19990026765 Oregon L-5 Society, Oregon Moonbase, Oregon City, OR USA
Utility of Lava Tubes on Other Worlds
Walden, Bryce E., Oregon L-5 Society, USA; Billings, T. L., Oregon L-5 Society, USA; York, Cheryl Lynn, Oregon L-5 Society, USA; Gillett, S. L., Oregon L-5 Society, USA; Herbert, M. V., Oregon L-5 Society, USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 16-17; In English; See also 19990026739
Contract(s)/Grant(s): NASw-4460; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

On Mars, as on Earth, lava tubes are found in the extensive lava fields associated with shield volcanism. Lunar lava-tube traces are located near mare-highland boundaries, giving access to a variety of minerals and other resources, including steep slopes, prominent heights for local area communications and observation, large-surface areas in shade, and abundant basalt plains suitable for landing sites, mass-drivers, surface transportation, regolith harvesting, and other uses. Methods for detecting lava tubes include

visual observations of collapse trenches and skylights, ground-penetrating radar, gravimetry, magnetometry, seismography, atmospheric effects, laser, lidar, infrared, and human or robotic exploration.
Derived from text
Basalt; Lava; Regolith; Volcanology; Mars Volcanoes; Calderas; Lunar Surface; Lunar Bases; Mars Bases

19990026766 Idaho Univ., Dept. of Metallurgical and Mining Engineering, Moscow, ID USA
Plasma-Based Steel Rod or Rebar Production From In Situ Materials
White, H., Idaho Univ., USA; Prisbrey, Keith, Idaho Univ., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 18; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The probability of lunar ice has redefined the importance of earlier research reporting Fe as a byproduct of O production from lunar regolith. That emphasis is now on Fe and other materials for in situ resources for construction. In pursuit of O from lunar ilmenite, we have tried (1) a resonating cavity microwave plasma reactor, (2) a nontransferred arc plasma torch feeding a cylindrical reactor, and (3) an inductively coupled plasma reactor feeding a quench chamber with relative success. Instead of using these or other O-focused strategies, and instead of using commercial submerged electric arc smelting of ilmenite to produce Fe, a compact, portable, light, plasma-based cyclone reactor could be adapted as another choice. Cyclone reactors have been under development for several decades, and P. R. Taylor and coworkers have extended their evolution and used them effectively on iron taconites as well as other materials. The advantages of the plasma reactor over other current steel making processes include continuous operation, higher through puts in small reactors, enhanced heat and mass transfer rates, higher temperatures, easy separation of liquids and gases, capture and recycle of plasma gases, and no feed agglomeration. The procedure for producing steel was to feed taconite and CO/CO2 mixtures into the cyclone reactor (Fig. 1), The results were excellent. The procedure and results for lunar ilmenite would be similar. Electrostatically concentrated ilmenite and magnetically concentrated Fe and associated agglutinates would be fed into the reactor along with reductant. Plasma reactors can be modified to produce Al, Ti, glass, ceramics, and advanced materials, and an already automated reactor system can be further automated for remote operation.
Author
Iron; Lunar Rocks; Smelting; Steels; Metallurgy; Foundries; Lunar Resources

19990026768 Rutgers Univ., Dept. of Mechanical and Aerospace Engineering, Piscataway, NJ USA
In Situ Resources for Lunar Base Applications
Benaroya, Haym, Rutgers Univ., USA; Workshop on Using In Situ Resources for Construction of Planetary Outposts; 1998, pp. 21-22; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Lunar resources have been cited either as an economic driver to justify a return to the Moon or as being useful in the creation and maintenance of a lunar civilization. Except for He3 as a fusion fuel, the former is unlikely.
Derived from text
Lunar Bases; Lunar Resources; Moon; Lunar Mining

19990026773 Lunar and Planetary Inst., Houston, TX USA
Opportunities for ISRU Applications in the Mars Reference Mission
Duke, Michael B., Lunar and Planetary Inst., USA; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 34-35; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of in-situ resources in the Mars Reference Mission is discussed in this presentation. The objectives of the presentation are to consider whether In Situ Resource Use (ISRU), other than propellants and life support consumables can be useful, and to outline the type of analysis that has to be performed to evaluate the ISRU use, and to suggest some areas for investigation. The presentation also discusses ways to reduce risk, and cost. Possible strategies are posed, including use of robotic systems. The use of robotic systems could reduce total mass required for the mission by producing required material over a long period of time. Several examples are discussed. (1) In the presentation the possible use of ISRU in making concrete for structures is discussed. Using robots to produce, mix, form, and cure the concrete, ISRU concrete may be able to compete with earth supply. (2) The use of robots to grade roads is also discussed. The use of ISRU is more complex than bringing things from Earth.
CASI
Cost Reduction; Robotics; Mars (Planet); Mars Bases; Space Habitats; Mars Environment; Extraterrestrial Resources

19990026776 Shimizu Corp., Space Systems Div., Japan

Considerations on the Technologies for Lunar Resource Utilization

Kanamori, Hiroshi, Shimizu Corp., Japan; Workshop on Using In Situ resources for Construction of Planetary Outposts; 1998, pp. 40-42; In English; See also 19990026739; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Many concepts in use of Lunar Resources are discussed in this presentation. The evolution and requirements a of lunar base from the survey mode to a fully autonomous base is discussed. The presentation also reviews candidates for lunar products through each phase of the evolution of the base. The presentation discusses the technologies to be studied for Lunar Resource Utilization. These include: (1) infrastructure, (2) preliminary processing and (3) secondary processing. The resources and processes in this scenario are (1) Gas Desorption, (2) Oxygen production, (3) non-processed regolith, (4) Cast Basalt and Glass, (5) Ceramics, (5) Cement, (6) Metals, and (6) Composites.

CASI

Autonomy; Lunar Bases; Lunar Resources; Lunar Excavation Equipment; Lunar Mining; Beneficiation; Desorption; Melting; Sintering

19990027824 NASA Ames Research Center, Moffett Field, CA USA

Martian Meteorology: Determination of Large Scale Weather Patterns from Surface Measurements ***Final Report, 22 Jul. 1996 - 21 Jul. 1998***

Murphy, James R., San Jose State Univ., USA; Haberle, Robert M., NASA Ames Research Center, USA; Bridger, Alison F. C., San Jose State Univ., USA; 19980; 5p; In English

Contract(s)/Grant(s): NCC2-5181; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We employed numerical modelling of the martian atmosphere, and our expertise in understanding martian atmospheric processes, to better understand the coupling between lower and upper atmosphere processes. One practical application of this work has been our involvement with the ongoing atmospheric aerobraking which the Mars Global Surveyor (MGS) spacecraft is currently undergoing at Mars. Dr. Murphy is currently a member of the Mars Global Surveyor (MGS) Aerobraking Atmospheric Advisory Group (AAG). He was asked to participate in this activity based upon his knowledge of martian atmospheric dynamical processes. Aerobraking is a process whereby a spacecraft, in an elliptical orbit, passes through the upper layers of the atmosphere (in this instance Mars). This passage through the atmosphere 'drags'upon the spacecraft, gradually reducing its orbital velocity. This has the effect, over time, of converting the elliptical orbit to a circular orbit, which is the desired mapping orbit for MGS. Carrying out aerobraking eliminates the need for carrying large amounts of fuel on the spacecraft to execute an engine burn to achieve the desired orbit. Eliminating the mass of the fuel reduces the cost of launch. Damage to one of MGS's solar panels shortly after launch has resulted in a less aggressive extended in time aerobraking phase which will not end until March, 1999. Phase I extended from Sept. 1997 through March 1998. During this time period, Dr. Murphy participated almost daily in the AAG meetings, and beginning in December 1997 lead the meeting several times per week. The leader of each of the daily AAG meetings took the results of that meeting (current state of the atmosphere, identification of any time trends or spatial patterns in upper atmosphere densities, etc.) forward to the Aerobraking Planning Group (APG) meeting, at which time the decision was made to not change MGS orbit, to lower the orbit to reach higher densities (greater 'drag'), or raise the orbit to avoid experiencing excessive, possibly damaging densities.

Author

Mars Atmosphere; Weather; Aerobraking; Atmospheric Density; Elliptical Orbits; Circular Orbits

19990028235 Lunar and Planetary Inst., Houston, TX USA

New Approach to Diagnosing Properties of Protoplanetary Disks

Stepinski, Tomasz F., Lunar and Planetary Inst., USA; Astrophysical Journal; Nov. 01, 1998; Volume 507, pp. 361-370; In English

Contract(s)/Grant(s): NASw-4574; NAGw-3719; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we suggest that subjecting the observationally derived properties of protoplanetary disks to the evolutionary interpretation yields new insights into the working of those disks, and offers valuable constraints on their models. We propose that the global properties of individual disks, such as their accretion rates and disk masses, sorted by the mass of the central star, can be indexed by the age of the star to simulate the evolution of a single disk. Using data from published surveys of T Tauri stars, we show that accretion rate data, and disk mass data for the lowest mass stars, form well-defined evolutionary tracks. The higher mass stars show a definitive negative correlation between accretion rates and star ages. We use the time-dependent alpha-disk model of the viscous protoplanetary disk to link the theory to observations. The data are consistent with the standard theoretical paradigm, but not with the layered accretion model. The best fits to the data are obtained for the standard models that start with disks that are about one-third of the mass of the central star and have their angular momenta, j, and alpha-coefficients linked by the relationship j varies as Solar mass(exp 3/2)alpha(exp 1/3). The proportionality constant in this relationship, when derived from

the accretion rate data, differs from the constant derived from the disk mass data. We argue that the accretion rate data are more reliable. Taking into account typical values of the specific angular momentum of disk-forming matter, we obtain alpha is greater than or equal to 10(exp -2). A complete time-dependent standard disk model, built on the parameters determined from the best-fit procedure, is presented. Such a model constitutes a good point of departure for various theoretical studies aimed at the issue of formation of planetary systems and the character of protoplanetary disks.
Author
Planetary Systems; Accretion Disks; Stellar Models; T Tauri Stars; Protoplanets; Planetary Evolution

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

19990028009 New Hampshire Univ., Space Science Center, Durham, NH USA
EGRET High Energy Capability and Multiwavelength Flare Studies and Solar Flare Proton Spectra ***Final Report, 15 Nov. 1996 - 15 Nov. 1998***
Chupp, Edward L., New Hampshire Univ., USA; 1998; 50p; In English
Contract(s)/Grant(s): NAG5-2420; NAG5-3518; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The accomplishments of the participation in the Compton Gamma Ray Observatory Guest investigator program is summarized in this report. The work involved the study of Energetic Gamma Ray Experiment Telescope (EGRET)/Total Absorption Shower Counter(TASC) flare data. The specific accomplishments were the use of the accelerator neutron measurements obtained at the University of New Hampshire to verify the TASC response function and to modify the TASC fitting program to include a high energy neutron contribution, and to determine a high energy neutron contribution to the emissions from the 1991 June 11, solar flare. The next step in the analysis of this event was doing fits to the TASC energy-loss spectra as a function of time. A significant hardening of the solar proton spectrum over time was found for the flare. Further data was obtained from the Yohkoh HXT time histories and images for the 1991 October 27 flare. The results to date demonstrate that the TASC spectral analysis contributes crucial information on the particle spectrum interacting at the Sun. The report includes a paper accepted for publication, a draft of a paper to be delivered at the 26th International Cosmic Ray Conference and an abstract of a paper to be presented at the Meeting of the American Physical Society.
CASI
Cosmic Rays; Neutron Emission; Solar Flares; Gamma Rays; Gamma Ray Astronomy

19990028195 New Hampshire Univ., Space Science Center, Durham, NH USA
Cormack Research Project: Glasgow University ***Final Report, 1 Sep. 1993 - 28 Feb. 1998***
Skinner, Susan, New Hampshire Univ., USA; Ryan, James M., New Hampshire Univ., USA; August 1998; 12p; In English
Contract(s)/Grant(s): NAG5-2350; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The aim of this project was to investigate and improve upon existing methods of analysing data from COMITEL on the Gamma Ray Observatory for neutrons emitted during solar flares. In particular, a strategy for placing confidence intervals on neutron energy distributions, due to uncertainties on the response matrix has been developed. We have also been able to demonstrate the superior performance of one of a range of possible statistical regularization strategies. A method of generating likely models of neutron energy distributions has also been developed as a tool to this end. The project involved solving an inverse problem with noise being added to the data in various ways. to achieve this pre-existing C code was used to run FORTRAN subroutines which performed statistical regularization on the data.
Author
Solar Flares; Neutrons; Emittance; Neutron Distribution; Energy Distribution

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.

19990027182 Department of Energy, Office of Energy Research, Washington, DC USA
Nuclear astrophysics and the Daresbury Recoil Separator at the Holifield Radioactive Ion Beam Facility
Smith, M. S., Department of Energy, USA; Dec. 31, 1997; 21p; In English; Origins of matter and evolution of galaxies 1997, USA
Report No.(s): DE98-003164; ORNL/CP-96139; CONF-9711115; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Daresbury Recoil Separator (DRS) has been installed for nuclear astrophysics research at Oak Ridge National Laboratory's Holifield Radioactive Ion Beam Facility. It will be used for direct measurements of capture reactions on radioactive ions which occur in stellar explosions such as novae, supernovae and X-ray bursts. These measurements will be made in inverse kinematics with radioactive heavy ion beams incident on hydrogen and helium targets, and the DRS will separate the capture reaction recoils from the intense flux of beam particles. Details of the new DRS experimental equipment and preliminary results from the first commissioning experiments with stable beams are described, along with the plans for the first measurements with radioactive beams. Other astrophysics research efforts at ORNL--in theoretical astrophysics, nuclear astrophysics data evaluation, heavy element nucleosynthesis, theoretical atomic astrophysics, and atomic astrophysics data--are also briefly described.
NTIS
Nuclear Astrophysics; Separators; Ion Beams; Radioactivity

19990027954 Department of Energy, Washington, DC USA
Highest energy phenomena in the universe
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One of the most enduring and frustrating mysteries in astrophysics is the nature of the cosmic gamma-ray burst (GRB). GRB's were first reported in the 1970's, and since then have been observed from over a dozen different satellites. Two recently launched satellites have revolutionized this field. One, the most sensitive, is known as the Compton Gamma-Ray Observatory (CGRO). This orbiting observatory carries an experiment known as the Burst and Transient Source Experiment (BATSE), which was intended to help elucidate the nature and origin of GRB's. The other is the Italian-Dutch satellite Beppo-SAX, which is substantially less sensitive than BATSE, but can provide greatly superior positional accuracy for the GRBs it detects. The purpose of this LDRD project was to maximize the combined return of these satellites and two ground- based programs (MACHO (Massive Compact Halo Objects) and LOTIS (Livermore Optical Transient Imaging System)), which LLNL largely controls. We have been successful in designing and implementing real-time response systems, and have successfully responded to GRBs with the MACHO Telescope System.
NTIS
Gamma Ray Observatory; Astrophysics; Gamma Ray Bursts; Cosmic Rays

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GENERAL

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With the many different technical talents, Marshall Space Flight Center (MSFC) continues to be an important force behind many scientific breakthroughs. The MSFC's annual report reviews the technology developments, research in space and microgravity sciences, studies in space system concepts, and technology transfer. The technology development programs include development in: (1) space propulsion and fluid management, (2) structures and dynamics, (3) materials and processes and (4) avionics and optics.
CASI
Aerospace Engineering; Technology Utilization; NASA Programs; Aerospace Technology Transfer

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