Scientific and Technical Aerospace Reports

STAR

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Volume 37
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National Aeronautics and Space Administration
Langley Research Center

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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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- Translations in report form;
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses.

Also included are two indexes, Subject Term and Personal Author. The Subject Term Index is generated from the *NASA Thesaurus* terms associated and listed with each document.

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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G. Mathematical and Computer Sciences
H. Physics
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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

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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

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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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VOLUME 37, MARCH 15, 1999

01
AERONAUTICS (GENERAL)

19990019378 NASA Langley Research Center, Hampton,VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplment 394
Feb. 19, 1999; 34p; In English
Report No.(s): NASA/SP-1999-7037/SUPPL394; NAS 1.21:7037/SUPPL394; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-1999-7037) 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. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes-subject and author are included after the abstract section.
CASI
Aerodynamics; Aeronautical Engineering; Bibliographies; Indexes (Documentation)

19990019602 Logistics Management Inst., McLean, VA USA
The Aviation System Analysis Capability Air Carrier Cost-Benefit Model ***Final Report***
Gaier, Eric M., Logistics Management Inst., USA; Edlich, Alexander, Logistics Management Inst., USA; Santmire, Tara S., Logistics Management Inst., USA; Wingrove, Earl R.., III, Logistics Management Inst., USA; Jan. 1999; 55p; In English
Contract(s)/Grant(s): NAS2-14361; RTOP 538-16-11-01
Report No.(s): NASA/CR-1999-208983; NS804S1; NAS 1.26:208983; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

To meet its objective of assisting the U.S. aviation industry with the technological challenges of the future, NASA must identify research areas that have the greatest potential for improving the operation of the air transportation system. Therefore, NASA is developing the ability to evaluate the potential impact of various advanced technologies. by thoroughly understanding the economic impact of advanced aviation technologies and by evaluating how the new technologies will be used in the integrated aviation system, NASA aims to balance its aeronautical research program and help speed the introduction of high-leverage technologies. to meet these objectives, NASA is building the Aviation System Analysis Capability (ASAC). NASA envisions ASAC primarily as a process for understanding and evaluating the impact of advanced aviation technologies on the U.S. economy. ASAC consists of a diverse collection of models and databases used by analysts and other individuals from the public and private sectors brought together to work on issues of common interest to organizations in the aviation community. ASAC also will be a resource available to the aviation community to analyze; inform; and assist scientists, engineers, analysts, and program managers in their daily work. The ASAC differs from previous NASA modeling efforts in that the economic behavior of buyers and sellers in the air transportation and aviation industries is central to its conception. Commercial air carriers, in particular, are an important stakeholder in this community. Therefore, to fully evaluate the implications of advanced aviation technologies, ASAC requires a flexible financial analysis tool that credibly links the technology of flight with the financial performance of commercial air carriers. by linking technical and financial information, NASA ensures that its technology programs will continue to benefit the user community. In addition, the analysis tool must be capable of being incorporated into the wide-ranging suite of economic and tech-

nical models that comprise ASAC. This report describes an Air Carrier Cost-Benefit Model (CBM) that meets these requirements. The ASAC CBM is distinguished from many of the aviation cost-benefit models by its exclusive focus on commercial air carriers. The model considers such benefit categories as time and fuel savings, utilization opportunities, reliability and capacity enhancements, and safety and security improvements. The model distinguishes between benefits that are predictable and those that occur randomly. by making such a distinction, the model captures the ability of air carriers to reoptimize scheduling and crew assignments for predictable benefits. In addition, the model incorporates a life-cycle cost module for new technology, which applies the costs of nonrecurring acquisitions, recurring maintenance and operation, and training to each aircraft equipment type independently.
Author
Commercial Aircraft; Cost Analysis; Models; Air Transportation; Operating Costs; Systems Analysis

19990019603 Logistics Management Inst., McLean, VA USA
Aviation System Analysis Capability Air Carrier Investment Model-Cargo ***Final Report***
Johnson, Jesse, Logistics Management Inst., USA; Santmire, Tara, Logistics Management Inst., USA; Jan. 1999; 41p; In English; Original contains color illustration
Contract(s)/Grant(s): NAS2-14361; RTOP 538-16-11-01
Report No.(s): NASA/CR-1999-208984; NS803S1; NAS 1.26:208984; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of the Aviation System Analysis Capability (ASAC) Air Cargo Investment Model-Cargo (ACIMC), is to examine the economic effects of technology investment on the air cargo market, particularly the market for new cargo aircraft. to do so, we have built an econometrically based model designed to operate like the ACIM. Two main drivers account for virtually all of the demand: the growth rate of the Gross Domestic Product (GDP) and changes in the fare yield (which is a proxy of the price charged or fare). These differences arise from a combination of the nature of air cargo demand and the peculiarities of the air cargo market. The net effect of these two factors are that sales of new cargo aircraft are much less sensitive to either increases in GDP or changes in the costs of labor, capital, fuel, materials, and energy associated with the production of new cargo aircraft than the sales of new passenger aircraft. This in conjunction with the relatively small size of the cargo aircraft market means technology improvements to the cargo aircraft will do relatively very little to spur increased sales of new cargo aircraft.
Author
Air Cargo; Air Transportation; Systems Analysis; Cargo Aircraft

19990019831 NASA Ames Research Center, Moffett Field, CA USA
HPCCP/CAS Workshop Proceedings 1998
Schulbach, Catherine, NASA Ames Research Center, USA; Mata, Ellen, Editor, Raytheon Co., USA; Schulbach, Catherine, Editor, NASA Ames Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999; 275p; In English; Sponsored by NASA Ames Research Center, USA; Also announced as 19990019832 through 19990019878
Contract(s)/Grant(s): RTOP 509-10-61
Report No.(s): NASA/CP-1999-208757; A-990762; NAS 1.55:208757; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This publication is a collection of extended abstracts of presentations given at the HPCCP/CAS (High Performance Computing and Communications Program/Computational Aerosciences Project) Workshop held on August 24-26, 1998, at NASA Ames Research Center, Moffett Field, California. The objective of the Workshop was to bring together the aerospace high performance computing community, consisting of airframe and propulsion companies, independent software vendors, university researchers, and government scientists and engineers. The Workshop was sponsored by the HPCCP Office at NASA Ames Research Center. The Workshop consisted of over 40 presentations, including an overview of NASA's High Performance Computing and Communications Program and the Computational Aerosciences Project; ten sessions of papers representative of the high performance computing research conducted within the Program by the aerospace industry, academia, NASA, and other government laboratories; two panel sessions; and a special presentation by Mr. James Bailey.
Author
Computer Programming; Computer Systems Design; Computer Systems Performance; Algorithms; Computer Programs; Parallel Computers; Multidisciplinary Research; Computer Aided Design; Mathematical Programming; Conferences; Aerospace Systems

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.

19990019285 Israel Inst. of Tech., Dept. of Aeronautical Engineering, Haifa, Israel
Numerical Calculation of Nonlinear Aerodynamics of Wing-Body Configurations
Rusak, Z., Israel Inst. of Tech., Israel; Wasserstrom, E., Israel Inst. of Tech., Israel; Seginer, A., Israel Inst. of Tech., Israel; AIAA Journal; Jul. 1983; Volume 21, No. 7, pp. 929-936; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A numerical method for the calculation of the nonlinear aerodynamic characteristics of wing-body configurations in steady low subsonic flow has been developed. The method is based on a combination of the linear source-panel method for the body and the nonlinear vortex-lattice method for the lifting surfaces and their separated wakes. Special emphasis is given to the understanding of the behavior and the computational accuracy of the numerical method. In order to demonstrate the capabilities of the present method, total and distributed loads are computed and compared with available experimental results. The computed examples cover simple configurations as well as more complicated geometries with greater relevance to modem missiles and aircraft. Details of the calculations clarify the significant nonlinear contribution of the body to the aerodynamic properties of the configuration. Good agreement was found between the computations and the experiments.
Author
Body-Wing Configurations; Steady Flow; Subsonic Flow; Aerodynamic Characteristics; Vortex Lattice Method; Panel Method (Fluid Dynamics); Nonlinearity

19990019318 Manchester Univ., School of Engineering, UK
Improved Flight Flutter Testing Excitation Techniques ***Final Report***
Desforges, M. J., Manchester Univ., UK; Cooper, J. E., Manchester Univ., UK; Sep. 28, 1998; 46p; In English
Contract(s)/Grant(s): F61775-98-WE012
Report No.(s): AD-A357902; DCRG/98/EOARD/2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking School of Engineering University of Manchester as follows: The contractor will investigate improvements in excitations signals used in aircraft flutter flight test data collection. It describes the work done during the period 1 April - 30 September 1998 for the EOARD contract F61775-98-WEO12 on Improved Flight Flutter Testing Excitation Techniques. Strategies.
DTIC
Flight Tests; Flutter; Data Acquisition

19990019363 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Navier-Stokes Analysis of the Flowfield Characteristics of an Ice Contaminated Aircraft Wing
Chung, J., Institute for Computer Applications in Science and Engineering, USA; Choo, Y., NASA Lewis Research Center, USA; Reehorst, A., NASA Lewis Research Center, USA; Potapczuk, M., NASA Lewis Research Center, USA; Slater, J., NASA Lewis Research Center, USA; January 1999; 22p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 548-20-23
Report No.(s): NASA/TM-1999-208897; NAS 1.15:208897; AIAA Paper 99-0375; ICOMP-99-03; E-11496; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An analytical study was performed as part of the NASA Lewis support of a National Transportation Safety Board (NTSB) aircraft accident investigation. The study was focused on the performance degradation associated with ice contamination on the wing of a commercial turbo-prop-powered aircraft. Based upon the results of an earlier numerical study conducted by the authors, a prominent ridged-ice formation on the subject aircraft wing was selected for detailed flow analysis using 2-dimensional (2-D), as well as, 3-dimensional (3-D) Navier-Stokes computations. This configuration was selected because it caused the largest lift decrease and drag increase among all the ice shapes investigated in the earlier study. A grid sensitivity test was performed to find out the influence of grid spacing on the lift, drag, and associated angle-of-attack for the maximum lift (C(sub lmax)). This study showed that grid resolution is important and a sensitivity analysis is an essential element of the process in order to assure that the final solution is independent of the grid. The 2-D results suggested that a severe stability and control difficulty could have occurred at a slightly higher angle-of-attack (AOA) than the one recorded by the Flight Data Recorder (FDR). This stability and control problem was thought to have resulted from a decreased differential lift on the wings with respect to the normal loading for the configuration. The analysis also indicated that this stability and control problem could have occurred whether or not natural ice

shedding took place. Numerical results using an assumed 3-D ice shape showed an increase of the angle at which this phenomena occurred of about 4 degrees. As it occurred with the 2-D case, the trailing edge separation was observed but started only when the AOA was very close to the angle at which the maximum lift occurred.
Author
Ice Formation; Wings; Navier-Stokes Equation; Contamination; Aircraft Icing; Computational Fluid Dynamics; Aerodynamic Characteristics

19990019475 NASA Lewis Research Center, Cleveland, OH USA
A Review of NASA Lewis' Development Plans for Computational Simulation of Aircraft Icing
Potapczuk, Mark G., NASA Lewis Research Center, USA; January 1999; 18p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 548-21-23
Report No.(s): NASA/TM-1999-208904; NAS 1.15:208904; E-11517; AIAA Paper 99-0243; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of computational methods in the simulation of flight in icing, conditions is an ongoing, research effort by the Icing Branch at the NASA Lewis Research Center. The development of accurate, robust, well-documented, well-maintained computational tools is a major function of the research activities of the Icing, Branch, in collaboration with its grantees and contractors. The goal of the Icing, Branch's efforts is to provide simulation methods that can be used to aid in design, testing, certification, and qualification efforts related to flight in icing conditions. This paper will detail the current research and plans for future efforts in the development of computational tools for simulation of ice accretion, ice protection systems, the effects of ice on aircraft performance characteristics, and the behavior of aircraft systems subjected to icing conditions.
Author
Aircraft Icing; Aircraft Performance; Deicing; Flight Conditions; Ice Formation; Ice Prevention

19990019704 Chicago State Univ., Dept. of Mathematics and Computer Science, Chicago, IL USA
Assessment of Turbulent Models for Single-Element Airfoil at High-Lift
Getachew, Dawit, Chicago State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 62; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The present study consists of: flow calculations around an AEROSPATIALE A-airfoil at high angles of attacks, and assessing different turbulence models by comparing numerically predicted turbulent flow characteristics over the airfoil against reference experimental values. The turbulence models investigated include: (i) the Spalart-Allmaras (SA) one equation mode (ii) the Mentr's k-Omega Shear Stress Transport (MSST) model and (ill) the k - 6 version of the Explicit Algebraic model of Gateski and Spezial with variable (p). To attain this goal, a series of computations, using CFL3Dv5 code of NASA Langley Research Center, have been performed for a M = 0.15, angles of attacks at 3.4, 10.1, 14.1 and 17.1 and Re = 3.13 x 10, as well as a low Reynolds number test case Re = 2 x 10(exp 6) and at incidence a = 13.3. For all the calculations performed in this investigation, the location of transition points on the suction and pressure sides are fixed at 12% and 30% of the chord, respectively, and we used the mandatory structured C-mesh consisting of 512 cells in the wrap-around directions and 128 cells in wall-normal direction. The wake was covered by 64 cells and 384 cells were located on the airfoil surface. The results of this investigation show that the performance of the two linear eddy viscosity models, namely SA and MSST, is the same for most of the test cases considered. Furthermore, for the low Reynolds number test case, these two models did perform better than the nonlinear eddy viscosity model (EASM), whereas for the high Reynolds number test case the EASM perform well. Since the grid independence study, to generate the fine mesh used in the present investigation, was performed using linear eddy viscosity models, it is difficult to draw, using the aforementioned results, any conclusion about the overall performance of EASM as compared to the other two linear eddy viscosity models.
Author
Turbulence Models; Turbulent Flow; Airfoils; Eddy Viscosity; Flow Characteristics; Shear Stress; Stress Analysis

19990019719 Old Dominion Univ., Dept. of Engineering Technology, Norfolk, VA USA
Hyper-X Research Vehicle Stage Separation: Mach 7 Time Accurate Viscous Computations
Mohieldin, Taj O., Old Dominion Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 79; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

With the present interest in aerospace planes, considerable effort is being devoted to the development of propulsion systems that would power these vehicles. Among the proposed engine systems, scramjet engine (supersonic combustion ramjet) has been expected to be applied as the propulsion system. NASA's hypersonic technology program Hyper-X, has been initiated to elevate scramjet powered hypersonic technology readiness (TRL's) from the wind tunnel to the real flight environment, the last stage preceding prototype development. The program is now concentrating on Mach 7 vehicle development, verification and validation and flight test risk reduction. The desired test condition for the hyper-X in free flight is a dynamic pressure of 1000 pounds per square foot. The research vehicle will be boosted to approximately 95,000 feet for Mach 7. Following drop from the B-52 and boost to the predetermined stage separation point, the hyper-X research vehicle will be ejected from the booster-stack and start the programmed flight test. The stage separation will resume with the ignition of the explodable rivets fastening the vehicle to the arm. Then the arm will swing down about the hinge connected to the Hyper-X Launch vehicle leaving the research vehicle free and air-borne at the desired flight speed. CFD computations and experimental data with the drop-jaw adaptor at several rotation angles predicted significant interference on the hyper-X research vehicle during stage separation. Several dynamic simulation of hyper-X stage separation have been presented using time accurate inviscid computations. However, an adequate prediction of this unsteady hypersonic flowfield should include viscous effects. The focus of this study is to perform dynamic simulations of hyper-X stage separation to assess viscous effects on the transient forces and moments and to compare with the inviscid results. The unstructured grid solver, Rampant, is used to perform the steady state and time accurate analysis. Results for MACH 7 steady state and time accurate inviscid and viscous computations with fixed 0.5 inch cavity openings are presented in this study.
Author

Hypersonic Speed; Hypersonics; Research Aircraft; Aerospace Planes; Launch Vehicles; Mach Number; Propulsion System Configurations; Propulsion System Performance

19990019869 NASA Ames Research Center, Moffett Field, CA USA

Aerodynamic Shape Optimization Using A Combined Distributed/Shared Memory Paradigm

Cheung, Samson, MRJ Technology Solutions, USA; Holst, Terry, NASA Ames Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 207-212; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Current parallel computational approaches involve distributed and shared memory paradigms. In the distributed memory paradigm, each processor has its own independent memory. Message passing typically uses a function library such as MPI or PVM. In the shared memory paradigm, such as that used on the SGI Origin 2000 machine, compiler directives are used to instruct the compiler to schedule multiple threads to perform calculations. In this paradigm, it must be assured that processors (threads) do not simultaneously access regions of memory in such away that errors would occur. This paper utilizes the latest version of the SGI MPI function library to combine the two parallelization paradigms to perform aerodynamic shape optimization of a generic wing/body.
Author

Distributed Memory; Interprocessor Communication; Optimization; Newton Methods; Parallel Processing (Computers); Aircraft Design

19990019870 National Academy of Sciences - National Research Council, Hampton, VA USA

High-Fidelity Analysis and Aerodynamic Optimization of a Supersonic Transport

Giunta, Anthony A., National Academy of Sciences - National Research Council, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 213-218; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A suite of modular government/commercial off-the-shelf (G/COTS) software packages has been created to perform high-fidelity aeroelastic analysis and aerodynamic optimization of aircraft configurations. While the current status of the software permits multidisciplinary analysis and single-disciplinary optimization, the goal of this research is to develop a high-fidelity multidisciplinary optimization (MDO) capability in which various MDO methods will be examined on realistic aircraft design problems. The existing MPI-based parallel computing capability in some elements of the G/COTS software is a key component in realizing the goal of high-fidelity MDO. In particular, the parallel computing capabilities allow the efficient calculation of sensitivity derivatives needed to perform gradient-based optimization. to demonstrate the utility of this modular G/COTS software approach, an aeroelastic analysis and aerodynamic optimization of a high-speed civil transport (HSCT) are examined.
Author

Aerodynamic Configurations; Applications Programs (Computers); Multidisciplinary Design Optimization; Aeroelasticity; Parallel Processing (Computers); Design Analysis

19990019871 NASA Langley Research Center, Hampton, VA USA

Parallel Computation of Sensitivity Derivatives with Application to Aerodynamic Optimization of a Wing

Biedron, Robert T., NASA Langley Research Center, USA; Samareh, Jamshid A., NASA Langley Research Center, USA; Green, Lawrence T., NASA Langley Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 219-224; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper focuses on the parallel computation of aerodynamic derivatives via automatic differentiation of the Euler/Navier-Stokes solver CFL3D. The comparison with derivatives obtained by finite differences is presented and the scaling of the time required to obtain the derivatives relative to the number of processors employed for the computation is shown. Finally, the derivative computations are coupled with an optimizer and surface/volume grid deformation tools to perform an optimization to reduce the drag of a three-dimensional wing.

Author

Parallel Processing (Computers); Applications Programs (Computers); Computation; Optimization; Wing Profiles; Differentiation; Parameterization

19990019872 NASA Langley Research Center, Hampton, VA USA

Demonstration of Automatically-Generated Adjoint Code for Use in Aerodynamic Shape Optimization

Green, Lawrence, NASA Langley Research Center, USA; Carle, Alan, Rice Univ., USA; Fagan, Mike, Rice Univ., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 225-229; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Gradient-based optimization requires accurate derivatives of the objective function and constraints. These gradients may have previously been obtained by manual differentiation of analysis codes, symbolic manipulators, finite-difference approximations, or existing automatic differentiation (AD) tools such as ADIFOR (Automatic Differentiation in FORTRAN). Each of these methods has certain deficiencies, particularly when applied to complex, coupled analyses with many design variables. Recently, a new AD tool called ADJIFOR (Automatic Adjoint Generation in FORTRAN), based upon ADIFOR, was developed and demonstrated. Whereas ADIFOR implements forward-mode (direct) differentiation throughout an analysis program to obtain exact derivatives via the chain rule of calculus, ADJIFOR implements the reverse-mode counterpart of the chain rule to obtain exact adjoint form derivatives from FORTRAN code. Automatically-generated adjoint versions of the widely-used CFL3D computational fluid dynamics (CFD) code and an algebraic wing grid generation code were obtained with just a few hours processing time using the ADJIFOR tool. The codes were verified for accuracy and were shown to compute the exact gradient of the wing lift-to-drag ratio, with respect to any number of shape parameters, in about the time required for 7 to 20 function evaluations. The codes have now been executed on various computers with typical memory and disk space for problems with up to 129 x 65 x 33 grid points, and for hundreds to thousands of independent variables. These adjoint codes are now used in a gradient-based aerodynamic shape optimization problem for a swept, tapered wing. For each design iteration, the optimization package constructs an approximate, linear optimization problem, based upon the current objective function, constraints, and gradient values. The optimizer subroutines are called within a design loop employing the approximate linear problem until an optimum shape is found, the design loop limit is reached, or no further design improvement is possible due to active design variable bounds and/or constraints. The resulting shape parameters are then used by the grid generation code to define a new wing surface and computational grid. The lift-to-drag ratio and its gradient are computed for the new design by the automatically-generated adjoint codes. Several optimization iterations may be required to find an optimum wing shape. Results from two sample cases will be discussed. The reader should note that this work primarily represents a demonstration of use of automatically- generated adjoint code within an aerodynamic shape optimization. As such, little significance is placed upon the actual optimization results, relative to the method for obtaining the results.

Derived from text

Applications Programs (Computers); Aerodynamic Configurations; Shape Functions; Optimization; Grid Generation (Mathematics); Differential Calculus; Aircraft Design; Computer Techniques

19990019873 Boeing Co., Long Beach, CA USA

Applications of Parallel Processing in Aerodynamic Analysis and Design

Sundaram, P., Boeing Co., USA; Hager, James O., Boeing Co., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 231-237; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The continuously growing size and computational complexity of CFD-based aerodynamic analysis problems demand larger and larger computational resources. In addition, quick turn-around time for design and synthesis are necessary to make high fidelity, CFD-based techniques practical. Typical full-configuration, Navier-Stokes analysis grids tend to have more than 10 million points, and the solutions to these problems require very large amounts of CPU time and memory. Also, CFD-based nonlinear shape

optimization of full aircraft configurations is required within a few weeks to meet the cost and schedule challenges of today's aerospace customer. Traditional sequential computers cannot deliver these large computing resources, and no new large sequential vector supercomputers are under development. Thus, parallel processing has emerged as the most efficient and cost-effective method to achieve the large computational resources required for these advanced CFD applications. This paper presents the recent progress made in the application of the CFL3Dhp parallel code for configuration analyses and aerodynamic shape optimization at Boeing-Phantom Works (BPW). CFL3Dhp is the coarse-grain parallel version of the CFL3D Euler/Navier-Stokes solver developed at NASA LARC. CFL3Dhp utilizes the MPI message-passing library to exchange information with other task processors as well as with the host. CFL3Dhp runs on most available parallel platforms and distributed environments. Several utilities have been developed at BPW to provide a user-friendly parallel environment.
Author
Parallel Processing (Computers); Aerodynamic Configurations; Aerodynamics; Aircraft Design; Applications Programs (Computers); Optimization; Design Analysis

19990020957 NASA Langley Research Center, Hampton,VA USA
Effects of Convoluted Divergent Flap Contouring on the Performance of a Fixed-Geometry Nonaxisymmetric Exhaust Nozzle
Asbury, Scott C., NASA Langley Research Center, USA; Hunter, Craig A., NASA Langley Research Center, USA; Feb. 1999; 75p; In English
Contract(s)/Grant(s): RTOP 538-14-12-01
Report No.(s): NASA/TP-1999-209093; L-17696; NAS 1.60:209093; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An investigation was conducted in the model preparation area of the Langley 16-Foot Transonic Tunnel to determine the effects of convoluted divergent-flap contouring on the internal performance of a fixed-geometry, nonaxisymmetric, convergent-divergent exhaust nozzle. Testing was conducted at static conditions using a sub-scale nozzle model with one baseline and four convoluted configurations. All tests were conducted with no external flow at nozzle pressure ratios from 1.25 to approximately 9.50. Results indicate that baseline nozzle performance was dominated by unstable, shock-induced, boundary-layer separation at overexpanded conditions. Convoluted configurations were found to significantly reduce, and in some cases totally alleviate separation at overexpanded conditions. This result was attributed to the ability of convoluted contouring to energize and improve the condition of the nozzle boundary layer. Separation alleviation offers potential for installed nozzle aeropropulsive (thrust-minus-drag) performance benefits by reducing drag at forward flight speeds, even though this may reduce nozzle thrust ratio as much as 6.4% at off-design conditions. At on-design conditions, nozzle thrust ratio for the convoluted configurations ranged from 1% to 2.9% below the baseline configuration; this was a result of increased skin friction and oblique shock losses inside the nozzle.
Author
Convergent-Divergent Nozzles; Boundary Layer Separation; Wind Tunnel Nozzles; Wind Tunnel Tests; Nozzle Flow; Oblique Shock Waves; Flow Visualization

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.

19990019320 Joint Chiefs of Staff, Washington, DC USA
Joint Tactics, Techniques, and Procedures for Shipboard Helicopter Operations
Dec. 10, 1997; 214p; In English
Report No.(s): AD-A358011; JOINT-PUB-3-04.1; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This publication provides operating and aviation ordnance procedures required to plan and conduct shipboard helicopter operations and places emphasis on single-ship, single- helicopter independent operations. The publication is written to reflect: routine operations for the deployment of joint force helicopters on board US Navy (USN) and US Coast Guard (USCG) ships. This is generally the result of careful presail planning, but does not preclude crisis response, surge requirements, or warfighting execution. This publication describes shipboard helicopter operational procedures for both embarked and transient aircraft and aviation

detachments. Some of the terminology, regulations, and routine I encountered aboard ship reflect naval traditions and contribute to efficient and safe operations.
DTIC
Helicopters; Military Operations; Navy; Tactics; Ships; Procedures

19990019485 NASA Lewis Research Center, Cleveland, OH USA
NASA/FAA Tailplane Icing Program Overview
Ratvasky, Thomas P., NASA Lewis Research Center, USA; VanZante, Judith Foss, DYNACS Engineering Co., Inc., USA; Riley, James T., Federal Aviation Administration, USA; January 1999; 16p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-98008; RTOP 548-20-23
Report No.(s): NASA/TM-1999-208901; NAS 1.15:208901; E-11502; AIAA Paper 99-0370; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effects of tailplane icing were investigated in a four-year NASA/FAA Tailplane Icing, Program (TIP). This research program was developed to improve the understanding, of iced tailplane aeroperformance and aircraft aerodynamics, and to develop design and training aides to help reduce the number of incidents and accidents caused by tailplane icing. to do this, the TIP was constructed with elements that included icing, wind tunnel testing, dry-air aerodynamic wind tunnel testing, flight tests, and analytical code development. This paper provides an overview of the entire program demonstrating the interconnectivity of the program elements and reports on current accomplishments.
Author
Aircraft Icing; Horizontal Tail Surfaces; Flight Tests

19990019696 Pittsburgh State Univ., Dept. of Engineering Technology, KS USA
Engineering Study for Reactivation of a Six Degrees of Freedom Platform for Aeronautical Safety Investigations
Buchanan, Randy K., Pittsburgh State Univ., USA; Lookadoo, James A., Pittsburgh State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 52; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The Systems Integration Branch of the Flight Electronics Technology Division at NASA/Langley Research Center possesses a hydraulically operated six degrees of freedom (Stewart) platform that had previously supported microgravity robotics investigations. New directions for NASA's Aeronautical enterprise are driving new initiatives throughout Langley. Future branch operations may incorporate a variety of aeronautical safety investigations. This expectation generated the need to reengineer the platform as a test bed for new experiments. Suitability issues extend beyond the inherent physical and performance parameters of the platform. These operational characteristics were found to be adequate for most of the new testing regimens envisioned. The problem investigated also had constraints in economics and maintainability characteristics. In the leaner budget environment, the platform must not prove too costly to operate or to upgrade. Finally, a wider customer base of users beyond the Systems Integration Branch is anticipated. The facility must incorporate a researcher-friendly interface for these potential new users. Meeting all of the constraints for the problem indicated a solution saving 0 of the current actuator and sensor elements on the platform. Additionally, most of the existing control hardware and control software elements were identified as replaceable with newer and more robust solutions. Meeting the economic guidelines suggested a Pentium grade of PC with appropriate 1/0 enhancements as the optimal controls environment for a refurbished platform. This machine would host any necessary kinematics calculations, control algorithms, experiment stimulus generation and resident safety monitoring software elements. Additionally, network capability would allow the platform control PC to support either local or remote computing facilities operating as research interfaces. These ancillary machines would also host the instrumentation systems supporting the experiments mounted on the platform. The final recommendation actually contains a set of potential but workable solutions for implementation. In this fashion, a wider set of experiments and customers may be accommodated.
Author
Degrees of Freedom; Robotics; Kinematics; Computer Programs; Systems Integration; Computers; Economics

19990020984 Federal Aviation Administration, Washington, DC USA
Notices to Airmen Domestic/International, December 3, 1998
1998; 192p; In English
Report No.(s): PB99-118978; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Table of Contents: Airway Notams; Airports, Facilities, and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum En Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.
NTIS
National Airspace System; Air Navigation

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.

19990019289 NASA Ames Research Center, Moffett Field, CA USA
Civil Helicopter Flight Operations using Differential GPS
Edwards, Frederick G., NASA Ames Research Center, USA; Loomis, Peter V. W., TAU Corp., USA; Navigation: Journal of the Institute of Navigation; 1985; Volume 32, No. 3, pp. 233-253; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

NASA Ames Research Center conducted a nonreal-time, Differential Global Positioning System (DGPS) flight-test experiment using two coarse-acquisition (C/A) code GPS receivers. The data were recorded concurrently at a fixed site and on board the NASA SH-3G test helicopter. The aircraft conducted several simulated mission operations, including terminal approach, while being tracked by radar and laser systems. After the flights, data recorded by the two GPS receivers and the trackers were analyzed to determine whether differential corrections could improve the navigation performance of the airborne GPS receiver. An airborne navigation error history was obtained by subtracting the reference ”true’ trajectory (derived from the tracking data) from the airborne GPS navigation solution. At the same time, differential GPS corrections were obtained by subtracting the ground-station GPS navigation solution from the true (surveyed) location of the ground receiver. Filtering was used to separate receiver-unique errors in the GPS data from the locally common (spatially correlated) GPS errors. The result’s show high correlation between airborne navigation errors and the differential corrections. The airborne navigation solution is shown to be much improved after the addition of the differential corrections. Efforts are continuing to develop a real-time differential data link between the ground station and the aircraft.
Author
Global Positioning System; Helicopters; Flight Operations; Flight Tests; Real Time Operation; Air Navigation

19990019756 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Interferometric GPS/Micro-Mechanical Gyro Attitude Determination System: A Study Into the Integration Issues
Giustino, Antonio; Oct. 14, 1998; 126p; In English
Report No.(s): AD-A356190; AFIT-98-090; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The near future will see a proliferation of small low cost communication and science satellites with modest (0.1-0.5 deg) pointing requirements which will use attitude determination Systems (ADS’s) of low power, weight, size, and cost. This project proposes to synthesize two in-house navigation systems as an alternative for the traditional LEO/MEO spacecraft ADS suite. This system consists of the Draper Micro-Mechanical (MM) gyroscopes aided by an interferometric GPS (IGPS) receiver. The two systems are integrated in a highly-coupled design through an extended Kalman filter (EKF).
DTIC
Satellite Attitude Control; Communication Satellites; Global Positioning System; Interferometry; Navigation; 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.

19990019135 NASA Marshall Space Flight Center, Huntsville, AL USA
X-34 Program Status
London, John R., III, NASA Marshall Space Flight Center, USA; Creech, Stephen D., NASA Marshall Space Flight Center, USA; 1998; 7p; In English, 28-30 Oct. 1998, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): IAF-98-V-4-04; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) initiated the current X-34 program in 1996 as part of the U.S. space agency's effort to dramatically reduce the cost of access to space. The X-34 is the first in a series of "Pathfinder" vehicles designed to conduct flight testing of key launch vehicle technologies at low cost. The X-34 program has moved rapidly from the drawing board to hardware build-up, with the first flight scheduled for 1999. The development of the X-34 has been accomplished by a unique blend of industry and government organizations and personnel working closely together. The program will provide rocket powered winged vehicles that can fly sub-orbital missions in support of advanced reusable launch vehicle technology development. In addition, the X-34 vehicles will represent a hypersonic test bed for advanced experiments in the aeronautical sciences.
Author
X-34 Reusable Launch Vehicle; NASA Programs; Flight Tests; Cost Reduction

19990019287 NASA Ames Research Center, Moffett Field, CA USA
Frequency-Domain Identification of XV-15 Tilt-Rotor Aircraft Dynamics in Hovering Flight
Tischler, Mark B., Army Research and Technology Labs., USA; Leung, Joseph G. M., NASA Ames Research Center, USA; Dugan, Daniel C., NASA Ames Research Center, USA; Journal of the American Helicopter Society; Apr. 1985, pp. 38-48; In English; 2nd; Flight Testing, Nov. 1983, Las Vegas, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Frequency-domain methods are used to identify the open-loop dynamics of the XV-15 tilt-rotor aircraft from flight tests. Piloting and data analysis techniques are presented to determine frequency response plots and equivalent transfer function models. The open-loop pitch and roll dynamics for the hover flight condition exhibit unstable low-frequency oscillations, whereas the dynamics in the remaining degrees of freedom are lightly damped and generally decoupled. Comparisons of XV-15 flight-test and simulator data are more favorable for high-frequency inputs (omega greater than 1.0 rad/sec) than low-frequency inputs. Time-domain comparisons of the extracted transfer functions with step response flight data are very favorable, even for large amplitude motions. The results presented in this paper demonstrate the utility of the frequency-domain techniques for dynamics identification and simulator fidelity studies.
Author
XV-15 Aircraft; Frequency Response; Hovering; Tilt Rotor Aircraft; Rotor Dynamics; Flight Tests

19990019457 California Univ., Dept. of Mechanical and Aerospace Engineering, Los Angeles, CA USA
A Fundamental Study of Active Vibration Control in Rotorcraft Using the ACSR Approach ***Final Report, 15 Oct. 1992 - 14 Apr. 1997***
Friedmann, Peretz P.; Dec. 20, 1997; 12p; In English
Contract(s)/Grant(s): DAAH04-93-G-0004
Report No.(s): AD-A358026; ARO-29641.1-EG; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final report describing the objectives and accomplishments of the research conducted under the above referenced grant. The general purpose of this grant has been to study a novel approach to active vibration control in helicopter fuselages known as the Active Control of Structural Response (ACSR) approach. In this approach vibrations in the helicopter fuselage are reduced by introducing harmonically varying forces by actuators located between the rotor and the fuselage such that the sum of the response of the airframe, due to rotor loads and external excitation, is reduced to a minimum. The primary objectives of this research were: (1) development of a coupled rotor/flexible fuselage model capable of simulating the vibrations in the fuselage and their control using the ACSR system, (2) modeling of the closed loop vibration reduction using two different control algorithms, a simple algorithm denoted the BACSR-algorithm, and a more refined algorithm based upon the internal model principle, denoted as the IMP-algorithm, and (3) conduct trend studies, to demonstrate vibration reduction throughout the flight envelope of the helicopter. All the objectives stated were achieved in the course of the research. Reduction of vibration levels below 0.04g

was demonstrated throughout the flight envelope, with relatively modest control effort, and low control power requirements. This research also provided a fundamental understanding of the approach that was not available from the experimental and empirical studies conducted before.
DTIC
Vibration Damping; Fuselages; Active Control; Feedback Control; Helicopters; Rotors; Structural Vibration

19990019643 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Study of Fretting Fatigue in Aircraft Components
Birch, Paul R.; Oct. 14, 1998; 153p; In English
Report No.(s): AD-A356297; AFIT-98-088; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This thesis presents theoretical computational, and experimental approaches to the problem of fretting fatigue in materials systems relevant to aircraft components. The basic contact mechanics for fretting fatigue in a sphere-plane contact geometry are reviewed. Various elastic criteria for predicting fretting failure are discussed; selected fretting maps created from one of these the modified Crossland criterion are presented. Fail/no-fail predictions based on these maps have verified trends observed in experimental work performed on Al 7075-T6 specimens. A three-dimensional finite-element model of sphere-plane fretting contact is reviewed. This model has been used to model elastic and elastoplastic fretting contact. The evolution of tangential loads coincident with plastic flow has been simulated, as well as the accumulation of equivalent plastic strains for these fretting conditions. This information may be used to predict the life of components subject to fretting contact high cycle fatigue (HCF) via a Coffin-Manson type relation. Design and construction of an apparatus for performing quantitative fretting experiments are described, and results of early tests performed on 7075-T6 aluminum alloys are presented. These experiments validate the proper operation of the experimental apparatus. Finally, basic principles of fracture mechanics and the limitations of applying traditional linear elastic fracture mechanics (LEFM) to fretting fatigue are discussed. The new crack analogue concept of Giannakopoulos et al. is reviewed as a means of uniting LEFM and fretting contact mechanics to achieve a life prediction scheme for components subject to HCF that is superior to the modified Goodman diagram approach currently employed by the US Air Force.
DTIC
Fretting; Finite Element Method; Fracture Mechanics; Fatigue (Materials); Aircraft Structures; Coffin-Manson Law; Structural Failure

19990019708 University of South Florida, Dept. of Civil and Environmental Engineering, Tampa, FL USA
Update of the Starship Fuselage Finite Element Model Using Modal Data
Hassiotis, Sophia, University of South Florida, USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 67; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

An accurate analytical model of the Beechcraft Starship fuselage is needed to design the acoustic response in the main cabin of the aircraft. The initial dynamic response produced by a finite element model did not agree with measured data. This is due to the complexity of the aircraft. In this project, numerous parameters were identified and updated to achieve agreement between the analytical and measured response. The Starship is a new 10-passenger aircraft with a unique all-composite construction. The composite consists of a honeycomb which is sandwiched on either side by four graphite epoxy plies. Aluminum stiffeners, reinforcements placed on the floor and around windows, and an unknown distribution of the mass added to the overall complexity of the structure. An initial MSC/NASTRAN finite element model produced errors in the natural frequencies in excess of 40% of those measured in laboratory tests. In addition, the weight of the aircraft given by the model was 449 lbs less than measured. First, the model was updated to correct the amount and distribution of mass. Examination of core samples indicated that two additional composite plies needed to be included in the main cabin area. IN addition, weight was added to compensate for paint, rivets, epoxy, and concentrated masses. Finally, the thickness of each ply was increased to account for numerical error in measurement. The updates added the necessary weight. Parameters which defined the structural stiffness were modified to produce better agreement between model and measured frequencies. Namely, the elastic constants he composite were changed to more accurately reflect the values found in the literature. The mass and stiffness updates produced a model which predicted the natural frequencies measured in the laboratory.
Author
Graphite-Epoxy Composites; Honeycomb Structures; Passenger Aircraft; Mathematical Models; Finite Element Method; Elastic Properties; Epoxy Resins; Dynamic Response

19990019857 NASA Langley Research Center, Hampton, VA USA

Engineering Overview of a Multidisciplinary HSCT Design Framework Using Medium-Fidelity Analysis Codes

Weston, R. P., NASA Langley Research Center, USA; Green, L. L., NASA Langley Research Center, USA; Salas, A. O., NASA Langley Research Center, USA; Samareh, J. A., NASA Langley Research Center, USA; Townsend, J. C., NASA Langley Research Center, USA; Walsh, J. L., NASA Langley Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 133-134; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

An objective of the HPCC Program at NASA Langley has been to promote the use of advanced computing techniques to more rapidly solve the problem of multidisciplinary optimization of a supersonic transport configuration. As a result, a software system has been designed and is being implemented to integrate a set of existing discipline analysis codes, some of them CPU-intensive, into a distributed computational framework for the design of a High Speed Civil Transport (HSCT) configuration. The proposed paper will describe the engineering aspects of integrating these analysis codes and additional interface codes into an automated design system. The objective of the design problem is to optimize the aircraft weight for given mission conditions, range, and payload requirements, subject to aerodynamic, structural, and performance constraints. The design variables include both thicknesses of structural elements and geometric parameters that define the external aircraft shape. An optimization model has been adopted that uses the multidisciplinary analysis results and the derivatives of the solution with respect to the design variables to formulate a linearized model that provides input to the CONMIN optimization code, which outputs new values for the design variables. The analysis process begins by deriving the updated geometries and grids from the baseline geometries and grids using the new values for the design variables. This free-form deformation approach provides internal FEM (finite element method) grids that are consistent with aerodynamic surface grids. The next step involves using the derived FEM and section properties in a weights process to calculate detailed weights and the center of gravity location for specified flight conditions. The weights process computes the as-built weight, weight distribution, and weight sensitivities for given aircraft configurations at various mass cases. Currently, two mass cases are considered: cruise and gross take-off weight (GTOW). Weights information is obtained from correlations of data from three sources: 1) as-built initial structural and non-structural weights from an existing database, 2) theoretical FEM structural weights and sensitivities from Genesis, and 3) empirical as-built weight increments, non-structural weights, and weight sensitivities from FLOPS. For the aeroelastic analysis, a variable-fidelity aerodynamic analysis has been adopted. This approach uses infrequent CPU-intensive non-linear CFD to calculate a non-linear correction relative to a linear aero calculation for the same aerodynamic surface at an angle of attack that results in the same configuration lift. For efficiency, this nonlinear correction is applied after each subsequent linear aero solution during the iterations between the aerodynamic and structural analyses. Convergence is achieved when the vehicle shape being used for the aerodynamic calculations is consistent with the structural deformations caused by the aerodynamic loads. to make the structural analyses more efficient, a linearized structural deformation model has been adopted, in which a single stiffness matrix can be used to solve for the deformations under all the load conditions. Using the converged aerodynamic loads, a final set of structural analyses are performed to determine the stress distributions and the buckling conditions for constraint calculation. Performance constraints are obtained by running FLOPS using drag polars that are computed using results from non-linear corrections to the linear aero code plus several codes to provide drag increments due to skin friction, wave drag, and other miscellaneous drag contributions. The status of the integration effort will be presented in the proposed paper, and results will be provided that illustrate the degree of accuracy in the linearizations that have been employed. Author

Aircraft Design; Multidisciplinary Design Optimization; Design Analysis; Iterative Solution; Applications Programs (Computers); Software Engineering; Finite Element Method

19990019864 Computer Sciences Corp., Hampton, VA USA

An Object Oriented Framework for HSCT Design

Sistla, Raj, Computer Sciences Corp., USA; Dovi, Augustine R., Computer Sciences Corp., USA; Su, Philip, Computer Sciences Corp., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 171-176; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Aircraft design is inherently iterative in nature and multidisciplinary in composition. The process is complicated by the fact that the focus and approach of each discipline can be quite distinct, and multiple invocations of the discipline programs are required to arrive at a feasible design. The usual result is a design procedure that is largely inflexible and computationally taxing. An earlier effort within the Framework for Interdisciplinary Design and Optimization (FIDO) project used Parallel Virtual Machine (PVM) to handle communications between discipline codes executing in a ”host/slave” mode. This framework was sensitive to the host operating system and changing the analytical connectivity or switching discipline codes required major programming intervention. The goal of the current framework is to provide a prooramming environment for automating the distribution of a complex computing task over a networked, heterogeneous system of computers. These computers may include: engineering workstations,

vector supercomputers, and parallel-processing computers. They work on their individual parts of the design, in parallel whenever possible, and have access to centralized data. Each computational task is assigned to the most appropriate computer type. The present framework provides a means for automating the overall design process. It provides communication and control between components, which include the diverse discipline computations in a design problem and the system services facilitating the design. Derived from text

Multidisciplinary Design Optimization; Aircraft Design; Computer Techniques; Programming Environments; Object-Oriented Programming; Computer Networks; Design Analysis

19990021055 Isothermal Community Coll., Spindale, NC USA

Harnessing the Brute: The Development of Propulsion Controlled Aircraft at NASA Dryden

Tucker, Tom, Isothermal Community Coll., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

PCA, Performance Control Aircraft, is a backup flight control system for use when an airplane has lost all its hydraulics and normal flight controls. PCA is an autopilot system which modulates the thrust of the engines to provide lateral and longitudinal direction and enables the pilots to land the airplane. NASA Dryden has developed this technology in flight, ground simulator, and analytic studies which started as early as 1989. NASA Dryden has combined efforts with NASA Ames, McDonnell Aerospace St. Louis, Douglass Aircraft Long Beach, Honeywell, Pratt & Whitney, the US Air Force, and the US Navy to develop PCA to the point where it is feasible to bring a commercial airliner not just to a survivable crash landing but to a normal landing. The purpose of my project was to develop a history of an invention which evolved by group problem-solving. My focus was not on validations arrived at -- these are already documented in technical reports -- but on the inventive process. I have previously published work about individual inventors and their processes, one of these studies concerning Philo Farnsworth's Image Dissector, the crucial invention for all-electronic television. The Image Dissector history concerns the classic lone inventor scenario. But PCA is the history of often reconfigured teams developing an invention in our modern environment governed by complex commercial and regulatory units, a story of, as one engineer put it, "how you push a good idea through the system."

Author

Automatic Pilots; Electronic Equipment; Flight Control; Flight Simulators

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.

19990019125 Smiths Industries Aerospace and Defense Systems, Inc., Grand Rapids Div., Grand Rapids, MI USA

Navy F/A-18 Crash Survivable Flight Incident Recorder (CSFIR)

Nov. 23, 1998; 30p; In English

Contract(s)/Grant(s): N00019-98-F-0016

Report No.(s): AD-A357658; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On 17-18 November 1998 Representatives from the Navy, Boeing and Smiths Industries met at the Naval Air Weapons Development Center, China Lake, CA. The objective of this meeting was to provide an update on this program including the Program Overview, Task Description, Deliverable Items, Schedule, Status of the Interface Control Document, Software Design, System Test Plans, Software Requirement Specification Review. In addition to the briefing material, the following items were discussed: 1. Since the proposed F/A-18 CSFIR installation does not include a download connector, the existing AN/AUQ-76A will not work without incorporating a different interface cabling scheme. Bill Parillo requested SI provide informal schematics for such an interface cable for the following two configurations: (SI action item #7) * The AN/AUQ-76A interfaces to the CSFIR on the aircraft. * The AN/AUQ-76A interfaces to the CSFIR off the aircraft and on the bench. 2. Bill Parillo asked China Lake how long they would need the CSFIR VADR

DTIC

Computer Programs; Interfaces; Flight Recorders; Automatic Control; Crashes

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.

19990019165 NASA Langley Research Center, Hampton, VA USA

Static Performance of a Wing-Mounted Thrust Reverser Concept

Asbury, Scott C., NASA Langley Research Center, USA; Yetter, Jeffrey A., NASA Langley Research Center, USA; 1998; 19p; In English; 34th; Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 98-3256; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An experimental investigation was conducted in the Jet-Exit Test Facility at NASA Langley Research Center to study the static aerodynamic performance of a wing-mounted thrust reverser concept applicable to subsonic transport aircraft. This innovative engine powered thrust reverser system is designed to utilize wing-mounted flow deflectors to produce aircraft deceleration forces. Testing was conducted using a 7.9%-scale exhaust system model with a fan-to-core bypass ratio of approximately 9.0, a supercritical left-hand wing section attached via a pylon, and wing-mounted flow deflectors attached to the wing section. Geometric variations of key design parameters investigated for the wing-mounted thrust reverser concept included flow deflector angle and chord length, deflector edge fences, and the yaw mount angle of the deflector system (normal to the engine centerline or parallel to the wing trailing edge). All tests were conducted with no external flow and high pressure air was used to simulate core and fan engine exhaust flows. Test results indicate that the wing-mounted thrust reverser concept can achieve overall thrust reverser effectiveness levels competitive with (parallel mount), or better than (normal mount) a conventional cascade thrust reverser system. by removing the thrust reverser system from the nacelle, the wing-mounted concept offers the nacelle designer more options for improving nacelle aerodynamics and propulsion-airframe integration, simplifying nacelle structural designs, reducing nacelle weight, and improving engine maintenance access.

Author

Experimentation; Aerodynamic Characteristics; Subsonic Speed; Structural Design; Scale Models; Transport Aircraft; Supercritical Wings; Thrust Reversal

19990019324 NASA Lewis Research Center, Cleveland,OH USA

Study of Boundary Layer Development in a Two-Stage Low-Pressure Turbine

Dorney, Daniel J., Virginia Commonwealth Univ., USA; Ashpis, David E., NASA Lewis Research Center, USA; Halstead, David E., General Electric Co., USA; Wisler, David C., General Electric Co., USA; Feb. 1999; 28p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC3-645; RTOP 523-26-33

Report No.(s): NASA/TM-1999-208913; E-11544; AIAA Paper 99-0742; NAS 1.15:208913; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that unsteady blade row interactions and separation can have a significant impact on the efficiency of low-pressure turbine stages. Measured turbine efficiencies at takeoff can be as much as two points higher than those at cruise conditions. Several recent studies have revealed that Reynolds number effects may contribute to the lower efficiencies at cruise conditions. In the current study numerical simulations have been performed to study the boundary layer development in a two-stage low-pressure turbine, and to evaluate the transition models available for low Reynolds number flows in turbomachinery. The results of the simulations have been compared with experimental data, including airfoil loadings and integral boundary layer quantities. The predicted unsteady results display similar trends to the experimental data, but significantly overestimate the amplitude of the unsteadiness. The time-averaged results show close agreement with the experimental data.

Author

Jet Engines; Two Stage Turbines; Computerized Simulation; Baldwin-Lomax Turbulence Model; Boundary Layer Transition; Transition Flow; Flow Visualization; Boundary Layer Separation; Separated Flow; Rotor Blades (Turbomachinery)

19990019479 NASA Lewis Research Center, Cleveland, OH USA

Analysis of Inlet-Compressor Acoustic Interactions Using Coupled CFD Codes

Suresh, A., DYNACS Engineering Co., Inc., USA; Townsend, S. E., DYNACS Engineering Co., Inc., USA; Cole, G. L., NASA Lewis Research Center, USA; Slater, J. W., NASA Lewis Research Center, USA; Chima, R., NASA Lewis Research Center, USA; December 1998; 14p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS3-98008; RTOP 509-10-11

Report No.(s): NASA/TM-1998-208839; NAS 1.15:208839; AIAA Paper 98-0749; E-11451; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A problem that arises in the numerical simulation of supersonic inlets is the lack of a suitable boundary condition at the engine face. In this paper, a coupled approach, in which the inlet computation is coupled dynamically to a turbomachinery computation, is proposed as a means to overcome this problem. The specific application chosen for validation of this approach is the collapsing bump experiment performed at the University of Cincinnati. The computed results are found to be in reasonable agreement with experimental results. The coupled simulation results could also be used to aid development of a simplified boundary condition. Author

Computational Fluid Dynamics; Turbomachinery; Supersonic Inlets; Unsteady Aerodynamics

19990019480 NASA Lewis Research Center, Cleveland, OH USA

Engine Technology Challenges for the High-Speed Civil Transport Plane

Plencner, Robert M., NASA Lewis Research Center, USA; Misra, Ajay, NASA Lewis Research Center, USA; Graber, Edwin J., Jr., NASA Lewis Research Center, USA; Shaw, Robert J., NASA Lewis Research Center, USA; Seng, Gary T., NASA Lewis Research Center, USA; December 1998; 20p; In English; 20th; Advanced Measurement and Ground Testing Technology, 15-18 Jun. 1998, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 537-05-23

Report No.(s): NASA/TM-1998-208405; E-11238; NAS 1.15:208405; AIAA Paper 98-2505; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ongoing NASA-funded and privately funded studies continue to indicate that an opportunity exists for a second generation supersonic commercial airliner, or High-Speed Civil Transport (HSCT), to become a key part of the 21 st century international air transportation system. Long distance air travel is projected to be the fastest growing segment of the air transportation market by the turn of the century with increases at about 5 percent per annum over the next two decades. This projection suggests that by the year 2015, more than 600,000 passengers per day will be traveling long distances, predominantly over water. These routes would provide the greatest potential for an HSCT to become a significant part of the international air transportation system. The potential market for an HSCT is currently projected to be anywhere from 500-1500 aircraft over the 2005-2030 time period. Such an aircraft fleet size would represent a considerable share of the potential long-range aircraft market. However, this projected HSCT fleet can become a reality only if technologies are developed which will allow an HSCT design that is (1) environmentally compatible and (2) economically viable. Simply stated, the HSCT will be a technology driven airplane. Without significant advances in airframe and propulsion technologies over the levels currently available, there will be no second generation supersonic airliner! This paper will briefly describe the propulsion technology challenges which must be met prior to any product launch decision being made by industry and the progress toward meeting these challenges through NASAs High-Speed Research (HSR) Program, a partnership between NASA and Boeing, General Electric and Pratt & Whitney.

Author

Supersonic Transports; Air Transportation; Propulsion; Airframes

19990019847 NASA Lewis Research Center, Cleveland, OH USA

3D Multistage Simulation of Each Component of the GE90 Turbofan Engine

Turner, Mark, General Electric Co., USA; Topp, Dave, General Electric Co., USA; Veres, Joe, NASA Lewis Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 87; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

A 3D multistage simulation of each component of the GE90 Turbofan engine has been made. This includes 49 blade rows. A coupled simulation of all blade rows will be made very soon. The simulation is running using two levels of parallelism. The first level is on a blade row basis with information shared using files. The second level is using a grid domain decomposition with information shared using MPI. Timings will be shown for running on the SP2, an SGI Origin and a distributed system of HP workstations. On the HP workstations, the CHIMP version of MPI is used, with queuing supplied by LSF (Load Sharing Facility). A script-based control system is used to ensure reliability. An MPEG movie illustrating the flow simulation of the engine has been

created using PV3, a parallel visualization library created by Bob Haimes of MIT. PVM is used to create a virtual machine from 10 HP workstations and display on an SGI workstation. A representative component simulation will be compared to rig data to demonstrate its usefulness in turbomachinery design and analysis.
Author
Turbofan Engines; Engine Design; Engine Parts; Computerized Simulation; Parallel Processing (Computers); Distributed Processing

19990019848 ASE Technologies, Inc., Cincinnati, OH USA
Application of Multi-Stage Viscous Flow CFD Methods for Advanced Gas Turbine Engine Design and Development
Subramanian, S., ASE Technologies, Inc., USA; Vitt, Paul, ASE Technologies, Inc., USA; Cherry, David, General Electric Co., USA; Turner, Mark, General Electric Co., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 89-90; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

The primary objective of the research is to develop, apply and demonstrate the capability and accuracy of 3-D multi-stage CFD methods as efficient design tools on high-performance computer platforms, for the development of advanced gas turbine engines. Propulsion systems that are planned and that are currently in development for next generation civilian and military aircraft applications under NASA's Advanced Subsonic Technology (AST), DoD's Integrated High Performance Turbine Engine Technology (IHPTET) programs will be required to operate under complex flow conditions, imposed by strict performance expectations and goals. Some of the expectations and goals include higher thrust, lower emission levels, higher pressure ratios, smaller size, lower weight, fewer stages, lower fuel consumption and higher efficiency. These goals necessitate blades with high turning angles, stages with small axial gaps between blade rows, and non-axisymmetric flowpath. It becomes important to use design methods that treat the stator and rotor airfoils as a complete system for providing information regarding the influence of one blade row on the other for overall engine performance. The particular aspect of this very complex problem that is presently of interest to NASA and to US Aircraft Engine companies, and the focal point of this research is the prediction and understanding of the 3-D multi-stage interaction effects in advanced gas turbine engines. More importantly, to use the information for design optimization and performance improvements in next generation engines to power US commercial and military aircraft. Using the HPCCP computational resources, several 3-D multi-stage aerodynamic analyses were performed for high pressure and low pressure turbine designs under flight and rig conditions. Results are presented here for a Boeing 777 class, high and low pressure turbine engine stage configuration at take-off conditions. The analysis included cooling flow addition details and effects of seal leaks through both turbine stages to realistically represent the actual engine operation. The turbine geometry consisted of 18 blade rows, that were solved simultaneously due to fully subsonic flow conditions. Using the parallel version of the average passage code and with a total of 9.4 million grid points, results were obtained using typically 16 to 60 processors. Load balancing the processors between blade rows provided good parallel efficiency. The overall agreement of the rig analysis with experimental data was very good, providing confidence in the average passage solution approach. The HPCCP computational resource was an excellent testbed for these real world simulations, and very good parallel performance efficiencies were achieved for these complex flow analyses.
Author
Computational Fluid Dynamics; Gas Turbine Engines; Engine Design; Propulsion System Configurations; Propulsion System Performance; Optimization; Viscous Flow; Parallel Processing (Computers)

19990019858 Allison Engine Co., Indianapolis, IN USA
Turbine Engine HP/LP Spool Analysis
Hall, Edward J., Allison Engine Co., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 137-142; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The primary objective of this task is to develop and demonstrate the capability to analyze the aerodynamics in the complete high pressure (HP) and low pressure (LP) subsystems of both the NASA/General Electric (GE) Energy Efficient Engine (EEE) and the Allison AE3007 engine using three-dimensional Navier-Stokes numerical models. The analysis will evaluate the impact of steady aerodynamic interaction effects between the components of the HP and LP subsystems. The computational models shall be developed from the geometric components contained in the HP and LP subsystems including: engine nacelle, inlet, fan blades, bifurcated bypass and core inlet, bypass vanes, core inlet guide vanes, booster stage, core compressor blades, high pressure turbine blades, low pressure turbine blades, mixer, and exhaust nozzle. Predictions will be obtained using the ADPAC aerodynamic analysis code. The analysis shall be performed and optimized for workstation cluster computing platforms using parallel processing techniques. The concept of "zooming" in the analysis shall be demonstrated by substituting a lower order cycle model of the HP

or LP subsystems using results from the National Cycle Program (NCP). Ultimately, the analysis will include the effects of operation at angle of attack by modeling a complete rotation of the fan wheel.
Author
Gas Turbine Engines; Three Dimensional Models; Parallel Processing (Computers); Navier-Stokes Equation; Mathematical Models; Engine Design; Aerodynamic Characteristics; Computerized Simulation

19990019865 NASA Lewis Research Center, Cleveland, OH USA
National Cycle Program (NCP) Common Analysis Tool for Aeropropulsion
Follen, G., NASA Lewis Research Center, USA; Naiman, C., NASA Lewis Research Center, USA; Evans, A., NASA Lewis Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 177-181; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Through the NASA/Industry Cooperative Effort (NICE) agreement, NASA Lewis and industry partners are developing a new engine simulation, called the National Cycle Program (NCP), which is the initial framework of NPSS. NCP is the first phase toward achieving the goal of NPSS. This new software supports the aerothermodynamic system simulation process for the full life cycle of an engine. The National Cycle Program (NCP) was written following the Object Oriented Paradigm (C++, CORBA). The software development process used was also based on the Object Oriented paradigm. Software reviews, configuration management, test plans, requirements, design were all apart of the process used in developing NCP. Due to the many contributors to NCP, the stated software process was mandatory for building a common tool intended for use by so many organizations. The U.S. aircraft and airframe companies recognize NCP as the future industry standard for propulsion system modeling.
Derived from text
Computerized Simulation; Engine Design; Programming Environments; Applications Programs (Computers); Computer Techniques

19990021018 Syracuse Univ., Dept. of Mechanical, Aerospace, and Manufacturing Engineering, NY USA
A Computer Investigation of a Lobed-Mixer Fuel-Injection Strut in a Scramjet Engine Model ***Final Report, Jun. 1994 - Jun. 1997***
Campuzano, Mario Felipe, Syracuse Univ., USA; Dang, Thong Q., Syracuse Univ., USA; May 1997; 98p; In English; Original contains color illustrations
Contract(s)/Grant(s): NGT-70380; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

A method of enhancing fuel/air mixing using streamwise vorticity for scramjet applications is presented. The generation of large-scale streamwise vortices is achieved by the incorporation of a lobed-mixer device into the fuel-injection struts of a proposed NASA scramjet engine. Conceptually, the lobed-mixer strut design is a three-dimensional lifting surface with a sinusoidal spanwise lift distribution. In the flow passage between the strut leading- and trailing-edges, the presence of a spanwise pressure gradient generates secondary flows. In the region behind the strut, which is a lifting surface, the shed vorticity system consists of periodic large-scale counter-rotating streamwise vortices. to evaluate this hypermixer concept, CFD calculations were carried out at supersonic combustor inlet Mach numbers ranging from 2 to 3 for cold flows. This concept is first analyzed for a 3D cascade of struts in inviscid flows. Results from this preliminary work reveal that significant secondary flows are generated in and behind the strut regions, while the additional shock losses associated with the lobed strut is small. Results confirm that the mechanism of generating streamwise vorticity is an inviscid phenomenon; the shed vorticity (i.e. streamwise vorticity) behind the strut is proportional to the pressure loading along the strut (Kutta-Joukowsky theorem). The next stage of this investigation considers the effects of viscosity on the generation of streamwise vorticity (or secondary flow). The geometry considered is a single lobed strut with ”slip” side walls. Here, the NASA Reynolds-Averaged Navier-Stokes LARCK code (Langley Algorithm for Research in Chemical Kinetics) was used. Relative to the inviscid-flow results, in the absence of flow separation, viscous effects introduce blockage into the flow passage, causing a small reduction in pressure loading and hence a slight reduction in secondary flow. In the presence of flow separation, the strut pressure loading can be significantly reduced, resulting in a large reduction in secondary flow. Next, the effect of Mach number on the strength of the streamwise vorticity is investigated. For the configuration studied, the pressure loading along the strut (hence the magnitude of secondary flow) was found to be a strong function of the strength and angle of the leading-edge shocks, which depends on the inflow Mach number. Finally, preliminary experimental verification of this hypermixer concept was carried out. Flow visualizations confirm the presence of strong large-scale streamwise vortices downstream of the strut.
Author
Supersonic Combustion Ramjet Engines; Fuel Injection; Flow Visualization; Secondary Flow; Supersonic Inlets; Trailing Edges; Vorticity; Reynolds Averaging; Pressure Gradients; Leading Edges

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.

19990019364 NASA Dryden Flight Research Center, Edwards, CA USA
Flight-Determined, Subsonic, Lateral-Directional Stability and Control Derivatives of the Thrust-Vectoring F-18 High Angle of Attack Research Vehicle (HARV), and Comparisons to the Basic F-18 and Predicted Derivatives
Iliff, Kenneth W., NASA Dryden Flight Research Center, USA; Wang, Kon-Sheng Charles, Sparta, Inc., USA; January 1999; 90p; In English
Contract(s)/Grant(s): RTOP 529-50-04-00-RR
Report No.(s): NASA/TP-1999-206573; NAS 1.60:206573; H-2252; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The subsonic, lateral-directional, stability and control derivatives of the thrust-vectoring F-1 8 High Angle of Attack Research Vehicle (HARV) are extracted from flight data using a maximum likelihood parameter identification technique. State noise is accounted for in the identification formulation and is used to model the uncommanded forcing functions caused by unsteady aerodynamics. Preprogrammed maneuvers provided independent control surface inputs, eliminating problems of identifiability related to correlations between the aircraft controls and states. The HARV derivatives are plotted as functions of angles of attack between 10deg and 70deg and compared to flight estimates from the basic F-18 aircraft and to predictions from ground and wind tunnel tests. Unlike maneuvers of the basic F-18 aircraft, the HARV maneuvers were very precise and repeatable, resulting in tightly clustered estimates with small uncertainty levels. Significant differences were found between flight and prediction; however, some of these differences may be attributed to differences in the range of sideslip or input amplitude over which a given derivative was evaluated, and to differences between the HARV external configuration and that of the basic F-18 aircraft, upon which most of the prediction was based. Some HARV derivative fairings have been adjusted using basic F-18 derivatives (with low uncertainties) to help account for differences in variable ranges and the lack of HARV maneuvers at certain angles of attack.
Author
F-18 Aircraft; Angle of Attack; Maximum Likelihood Estimates; Directional Stability; Control Surfaces; Aircraft Control

19990019379 NASA Langley Research Center, Hampton, VA USA
Estimation of Aircraft Nonlinear Unsteady Parameters From Wind Tunnel Data
Klein, Vladislav, Joint Inst. for Advancement of Flight Sciences, USA; Murphy, Patrick C., NASA Langley Research Center, USA; December 1998; 43p; In English
Contract(s)/Grant(s): RTOP 522-33-11-05
Report No.(s): NASA/TM-1998-208969; NAS 1.15:208969; L-17805; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerodynamic equations were formulated for an aircraft in one-degree-of-freedom large amplitude motion about each of its body axes. The model formulation based on indicial functions separated the resulting aerodynamic forces and moments into static terms, purely rotary terms and unsteady terms. Model identification from experimental data combined stepwise regression and maximum likelihood estimation in a two-stage optimization algorithm that can identify the unsteady term and rotary term if necessary. The identification scheme was applied to oscillatory data in two examples. The model identified from experimental data fit the data well, however, some parameters were estimated with limited accuracy. The resulting model was a good predictor for oscillatory and ramp input data.
Author
Wind Tunnel Tests; Unsteady Aerodynamics; Aerodynamic Forces; Mathematical Models; Aircraft Stability; Flight Stability Tests

19990019404 Florida Univ., Dept. of Electrical and Computer Engineering, Gainesville, FL USA
Application of Robust Control and Gain Scheduling to Missile Autopilot Design ***Final Report, 1 Aug. 1994 - 31 Jan. 1996***
Bullock, T. E.; Fields, S. L.; Sep. 01, 1998; 116p; In English
Contract(s)/Grant(s): DAAH04-94-G-0276
Report No.(s): AD-A357847; ARO-32865.1-MA; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The problem of gain scheduling LPV systems is studied and applied to missile autopilot design. Necessary and sufficient conditions for determining the Quadratic stabilizing of LPV systems are given. A stabilizing LPV controller is found if one exists. The necessary and sufficient conditions are realistically computable with reduced dimension and with only the elements of the Lyapunov matrix P as the unknown variables. The quadratic Stability results are then extended to the more general case of General

Lyapunov stability. The derivation is the same as for Quadratic stability, except there is an additional term that is a function of the derivative of the Lyapunov function. An algorithm is presented that will solve these new conditions. Finally two methods for finding minimal/near minimal realizations for 2-D systems is presented. The first method requires extracting any greatest common divisors out of a nominimal realization and then returning the realization back to state-space form. This method does not extend to N-D systems. However the second method, the System Equivalent Based method, can be extended to N-D systems. This method begins with the LPV system description being converted to Rosenbreock's system matrix form. Then the system matrix form is systematically manipulated until it is in state-space form.
Author
Scheduling; Automatic Pilots; Aircraft Design; Matrices (Mathematics); Robustness (Mathematics)

19990019435 NASA Dryden Flight Research Center, Edwards, CA USA
Flight Test of an Adaptive Configuration Optimization System for Transport Aircraft
Gilyard, Glenn B., NASA Dryden Flight Research Center, USA; Georgie, Jennifer, NASA Dryden Flight Research Center, USA; Barnicki, Joseph S., NASA Dryden Flight Research Center, USA; January 1999; 14p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 522-16-14-00-39
Report No.(s): NASA/TM-1999-206569; NAS 1.15:206569; H-2284; AIAA Paper 99-0831; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A NASA Dryden Flight Research Center program explores the practical application of real-time adaptive configuration optimization for enhanced transport performance on an L-1011 aircraft. This approach is based on calculation of incremental drag from forced-response, symmetric, outboard aileron maneuvers. In real-time operation, the symmetric outboard aileron deflection is directly optimized, and the horizontal stabilator and angle of attack are indirectly optimized. A flight experiment has been conducted from an onboard research engineering test station, and flight research results are presented herein. The optimization system has demonstrated the capability of determining the minimum drag configuration of the aircraft in real time. The drag-minimization algorithm is capable of identifying drag to approximately a one-drag-count level. Optimizing the symmetric outboard aileron position realizes a drag reduction of 2-3 drag counts (approximately 1 percent). Algorithm analysis of maneuvers indicate that two-sided raised-cosine maneuvers improve definition of the symmetric outboard aileron drag effect, thereby improving analysis results and consistency. Ramp maneuvers provide a more even distribution of data collection as a function of excitation deflection than raised-cosine maneuvers provide. A commercial operational system would require airdata calculations and normal output of current inertial navigation systems; engine pressure ratio measurements would be optional.
Author
Adaptive Control; Aircraft Performance; Cambered Wings; Transport Aircraft; Flight Tests; Data Acquisition; Angle of Attack; Aerodynamic Drag

19990019462 Utah Univ., Dept. of Mechanical Engineering, Salt Lake City, UT USA
Output Tracking with Nonhyperbolic and Near Nonhyperbolic Internal Dynamics: Helicopter Hover Control
Devasia, Santosh, Utah Univ., USA; Journal of Guidance, Control, and Dynamics; May 1997; Volume 20, No. 3, pp. 573-580; In English
Contract(s)/Grant(s): NAG2-1042; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A technique to achieve output tracking for nonminimum phase linear systems with nonhyperbolic and near nonhyperbolic internal dynamics is presented. This approach integrates stable inversion techniques, which achieve exact tracking, with approximation techniques, which modify the internal dynamics, to achieve desirable performance. Such modification of the internal dynamics is used: (1) to remove nonhyperbolicity, which is an obstruction to applying stable inversion techniques; and (2) to reduce large preactuation times needed to apply stable inversion for near nonhyperbolic cases. The method is applied to an example helicopter hover control problem with near nonhyperbolic internal dynamics for illustrating the tradeoff between exact tracking and reduction of preactuation time.
Author
Helicopter Control; Hovering; Stability; Linear Systems

19990019659 Virginia Polytechnic Inst. and State Univ., Dept. of Mechanical Engineering, Blacksburg, VA USA
Variable Store Flutter Suppression (AASERT) ***Final Report, 15 Jun. 1995 - 14 Jun 1998***
Inman, Daniel J.; Sep. 09, 1998; 25p; In English
Contract(s)/Grant(s): F49620-95-1-0426
Report No.(s): AD-A356048; AFRL-SR-BL-TR-98-0686; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives for this three year program where (a) to design and develop mechanics models for a novel ”large stroke” piezoceramic actuator, and (b) examine the usefulness of this actuator for solving the store induced flutter problem. In particular our goal has been to formulate predictive models that would be useful in the design and commercialization of such actuators.
DTIC
Actuators; Flutter; Piezoelectric Ceramics; Acoustic Attenuation; Vibration Damping

19990019716 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Autoparametric Control of Helicopter Ground Resonance
Kunz, Donald L., Old Dominion Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 76; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

This research focused on using autoparametric absorbers and saturation control to suppress helicopter ground resonance. In virtually every helicopter, ground resonance instabilities are eliminated by incorporating lag dampers in the rotor design to dissipate the energy transferred to the lag motion of the blades when the regressing cyclic lag and rigid-body fuselage modes coalesce. In addition to the blade dampers, it is frequently necessary to incorporate dampers in the landing gear of the aircraft, in order to obtain sufficient energy dissipation. The benefit of replacing the blade-mounted lag dampers with autoparametric absorbers would be to significantly reduce the weight and drag penalty associated with the dampers. In this investigation, the equations of motion used to model ground resonance were based on the classical equations derived by Coleman and Feingold. Only the minimum number of degrees of freedom were retained, including fuselage longitudinal translation, rotor cosine cyclic lag and rotor sine cyclic lag motions. Three absorber equations were then appended to the ground resonance equations, one for each degree of freedom; and they were coupled to the fuselage equation with quadratic nonlinear terms. The design of the absorbers required an analytical solution of these six, simultaneous, nonlinear, ordinary differential equations. The method of multiple scales was used to obtain the solution. Obtaining a solution for the equations, and therefore a design for the absorbers, presented difficulties not previously encountered in applications of this type of absorber. First, because of the Coriolis coupling between the rotor lag degrees of freedom, there is no set of principal coordinates that will result in a set of uncoupled natural modes for the system. Second, because of the comparatively large number of equations needed to model ground resonance and the absorbers, the solutions of the equations became very complex and cumbersome. The solutions of the first-order equations were obtained quite easily, since the rotor equations were not coupled to the three, independent absorber equations. However, the analytical solutions to the rotor/fuselage equations were extremely complex. The solution of the second-order equations presented some difficulties that have yet to be resolved. The fundamental question is how to represent the natural rotor/fuselage modes in the absorber equations. It would be easier to make the coupling implicit by introducing three modal variables, but this approach might not lead to an adequate consideration of the coupling in the second-order solution. The alternative leads to a very complex set of equations. In short, additional work will be required before an adequate design for the absorbers can be obtained.
Author
Helicopters; Uncoupled Modes; Nonlinear Equations; Landing Gear; Ground Resonance; Fuselages; Energy Dissipation; Degrees of Freedom

19990019832 Rensselaer Polytechnic Inst., Troy, NY USA
Adaptive Computation of Rotor-Blades in Hover
Dindar, Mustafa, Rensselaer Polytechnic Inst., USA; Kenwright, David, MRJ Technology Solutions, USA; Jansen, Ken, Rensselaer Polytechnic Inst., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 3-8; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

An adaptive refinement procedure is developed for computing vortical flows encountered in rotor aerodynamics. For this purpose, an error indicator based on interpolation error estimate is formulated and coded into an adaptive finite element framework. It is shown that the error indicator based on interpolation error estimate is effective in resolving the global features of the flow-field. Furthermore, for efficiency and problem size considerations, once the interpolation errors are reduced to acceptable levels, the adaptive refinement is done only in regions affected by the vortical flows. to do this a novel vortex core detection technique is used to capture vortex tubes. The combination of interpolation error estimate and vortex core detection technique proved to be very effective in computing vortical flow-field of rotor blades. Using this two-level adaptive refinement procedure the UH-60A BlackHawk rotor is analyzed in hover flow conditions.
Author
Error Detection Codes; Rotor Aerodynamics; Iterative Solution; Vortices; Systematic Errors; Interpolation; Finite Element Method; Computational Grids; Flow Distribution

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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).

19990019705 Rochester Inst. of Tech., Dept. of Mechanical Engineering, NY USA
Implementation of TWNTN4A at the 0.3 Meter Transonic Cryogenic Tunnel
Ghosh, Amitabha, Rochester Inst. of Tech., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 63; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

TWNTN4A is a nonlinear, transonic, small disturbance code for correcting wall interference effects in 2-D wind tunnels. Incorporated into this potential flow solver is the capability to account for the important effects of the boundary layer growths on the wind tunnel sidewalls. The original TWINTAN code was developed about 20 years ago for post-test use; however, improved computer technology now allows on-line implementation. The object of this research is to implement the code in the test cycle and enhance capabilities of the 0.3 m. Transonic Cryogenic Tunnel (TCT) at NASA-Langley. TWNTN4A has three calculation cycles - tunnel calculations, free-air calculations and perturbation flow calculations. The tunnel calculations are an inverse design procedure to generate an effective inviscid body using the tunnel wall pressure measurements as boundary conditions with the free stream velocity and Mach number the same as the experimental test case. The effective inviscid body shape which produces the same blockage effect (drag coefficients) then undergoes the second cycle of calculation. In this cycle the flow of free-air is calculated around the equivalent shape while the angle of attack is corrected to satisfy the Kutta condition for lift corresponding to the tunnel flow. During the convergence process, the far field velocity and Mach number are upgraded using an optimization algorithm which tries to match the free-airflow pressure distribution around the airfoil. When the second cycle is complete the correction quantities for angle of attack and Mach number are available. However to determine further the effect of the model and wall effects, a third cycle is run which solves the free- air flow with the singularity distribution obtained in the first cycle and the corrected free- stream conditions obtained from the second. Wall effects are the difference between the total perturbation from the first cycle and model perturbations from the second. The focus of this work was to convert a research code into a production code, streamline the process where possible, prepare on-line documentation, upgrade input and output capabilities and deliver a single code for different operating systems. The program which used to take several hours for convergence in the old system now runs under 10 seconds in the DEC Alpha system available at TCT. Thus, TWNTN4A will be available for real-time data correction for future tests. Additionally, new TECPLOT plotting capabilities which are readily available on multiple systems have been added. New and extensive documentation adds comments on program variables and input requirements. Future directions of this research will include comparison of several testing runs with Navier-Stokes calculations. A major interest in this research is to determine the exact effect of free-stream flow angularity. Since wind tunnel test sections are finite in size the effects on flow angularity may not be fully correctable. Shock wave boundary layer interaction is another phenomenon which will limit the capabilities of TWNTN4A. Testing with different size models must be conducted to assess program limitations.
Author
Cryogenics; Wind Tunnel Tests; Transonic Wind Tunnels; Shock Wave Interaction; Navier-Stokes Equation; Kutta-Joukowski Condition; Aerodynamic Interference; Aerodynamic Coefficients; Airfoils

19990019709 Christopher Newport Univ., Dept. of Physics, Computer Science and Engineering, Newport News, VA USA
TIGER MANE: Thermally-Induced Gradient Effects Research, Model Analysis and Nontransferability Evaluation
Hereford, James, Christopher Newport Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 68; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

When wind tunnel measurements are made at non-ambient temperatures (e.g., at the National Transonic Facility), temperature differences on the measurement balance cause a strain that affects the measured load on the model. The strain from the thermal gradient affects all six measurements but its greatest impact is on the axial force (drag) measurement. (Current NTF balances have uncorrected thermal effects of approximately 1% of the full scale component load.) Correction of the thermal gradient effects requires a timely and expensive conditioning process. The goals of this program are to (a) understand the physics of the thermally-induced strain and its subsequent impact on load measurements and (b) develop a robust thermal gradient compensation algorithm. The net effect will be more accurate and precise data, more efficient use of the N'IT, and an overall cost savings to NASA. One part of the TIGER program is a Model Assessment and Nontransferability Evaluation (MANE). The goal of MANE is to determine the model for how the temperature gradients affect the strain measurements. In addition, it is important to understand why a model that works well for lab data does not work well when an aircraft model is on the balance (transferability evaluation). The first step

was to evaluate a wide assortment of mathematical models to determine how combine the (nine) temperature measurements into a prediction of the output of the axial force. Several models were considered: linear, sin, exponential, natural log, 2d order models and several autoregressive moving average (ARMA) models which take into account past data samples. The ARMA models worked great but are impractical to implement in real-life wind tunnel applications because they would also cancel out a constant applied force. Hence, after considering 14 different models and almost 11,000,000 test cases, we determined a linear combination of temperature sensors gives the best approximation of axial force output. Data analysis from a standard balance with nine temperature sensors does not lead directly to an applicable thermal gradient compensation algorithm. Thus, physical affects of then-nal gradients were considered. From the physical affects, two possible compensation techniques have been determined. The first technique, the front-back technique, determines the impact on the axial force output of a thermal gradient from the front of the balance to the back. (A similar analysis shows that left to right thermal gradients will have no affect on axial force output). The resulting front-back thermal gradient equation gives a clear technique to correct for the gradient once certain key temperatures are known. The second technique, the thermomechanical technique, looks at how thermal gradients will affect the flex beams on the balance. For the simple gradients considered, there is a large difference between how the flex beams deflect when subjected to thermal gradients versus when they are subjected to an applied force. Monitoring the flex beams, therefore, could lead to a thermal gradient compensation technique. to verify these techniques, data from a special research balance must be obtained.
Author
Thermodynamics; Temperature Sensors; Temperature Measurement; Temperature Gradients; Temperature Effects; Drag Measurement; Autoregressive Moving Average; Aircraft Models

19990019723 Christopher Newport Univ., Dept. of Physics, Computer Science and Engineering, Newport News, VA USA
Interface Properties of MEMS Sensors on Airfoil
Selim, Raouf, Christopher Newport Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 83; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

One of the primary goals of wind tunnel groups at NASA Langley Research Center is to reduce wind tunnel cycle time and cost while improving data quality collected during the tests. The objective of the Advanced Model Instrumentation Technology (AMIT) program is to develop a prototype in-model instrumentation system that can be retrofitted into existing models or integrated in new models at the time of their design. The program has three major components: 1) Micro Electro Mechanical Systems (MEMS) sensors (shear stress, pressure, temperature and Angle of attack). 2) In-model electronics (Data acquisition systems and signal conditioning). 3) Data transfer capabilities (Fiber optic or telemetry). MEMS sensors are micron-to-millimeter scale devices with moving parts or containing fluids, fabricated using semiconductor technologies and often directly connected or integrated with ICs. MEMS Sensor Design covers three areas: 1) Layout and process of the sensor itself. 2) Circuitry for interfacing the system with the sensor. 3) The package that will fit the MEMS sensor into an application. The purpose of this study is to characterize the mechanical interface of MEMS sensors mounted on the surface of the model and test the packaging design under simulated conditions (normal stress, vibration, etc ...). The study included two types of MEMS sensors, namely pressure sensors and shear stress sensors. A measurement system was developed for characterizing the sensors under normal strain and at different temperatures. Each sensor was mounted on a specially designed cantilever beam that has a maximum strain of 1000 micro in/in. The output voltage of the MEMS pressure sensor was measured as a function of applied static pressure and the strain on the beam (at different temperatures). The resistance of four different resistors on the shear stress sensor was measured as a function of the strain on the beam (also at different temperatures). The resistance of four different resistors on the shear stress sensor was measured as a function of the strain on the beam (also at different temperatures). Results of the experiment show that change in the output voltage of the pressure sensor due to strain is less than 80 microvolt and is less than 0.1% of FSO. One can conclude that the strain on the beam has minimal effect on the output of the pressure sensor. Resistance values of the shear stress sensor' resistors increase with the increase in strain. More measurements need to be done to further characterize the relationship between shear stress sensor output and strain on the airfoil. Future studies also may include the effect of pressure and temperature on shear stress sensors.
Author
Airfoils; Angle of Attack; Cantilever Beams; Data Acquisition; Fabrication; Fiber Optics; Microelectromechanical Systems; Millimeter Waves

19990019726 Hampton Univ., School of Business, VA USA
Paving the Way for the Wind Tunnel Enterprise at NASA Langley Research Center
Siegfeldt, Denise V., Hampton Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 86; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The Wind Tunnel Enterprise (WTE) at Langley Research Center (LaRC) is a virtual organization comprised of nine Divisions: Aero- and Gas-Dynamics, Facilities & Systems Support, Experimental Testing Technology, Facility Systems Engineering, Information Systems and Services, Fabrication, Fluid Mechanics and Acoustics, and Structures. Wind tunnel facilities within the WTE include the National Transonic Facility and the 0.3M Cryogenic Tunnel. The WTE was envisioned as an organization that would apply business-like principles to its operations and the way in which customers are handled. Strategic planning for the WTE was based upon the cooperative efforts of customers, stakeholders, and producers/ operators of LaRC's wind tunnels. Due to intense global competition, external customers of the wind tunnels had voiced concern that the test cycle time was too long, which delayed the time for new products to reach the market. They were also concerned about the quality of data that they were receiving. Concerns of internal customers were also taken into consideration. WTE's mission is to "provide reliable, accurate research information to the aeronautical community in a timely manner. to accomplish this requires a focus on increasing productivity, cost-effective operations, technical support that adds value, and the development of new facility capability and test techniques." There are many technical, operational, cultural and management goals for the WTE. These goals are designed to enable the WTE to have a positive influence on the bottom-line; namely, increased productivity, data quality, customer satisfaction and employee satisfaction, and decreased cost and cycle time. A major component of the WTE is the proposed Wind Tunnel University (WTU). WTU was the focus of this project and is linked to the VTM cultural goals. The project involved creating a framework for the identification of core competencies (i.e., Tunnel Operations and Wind Tunnel Information Technology) and associated skills through involvement of the WTE Curriculum Committee and interviews with LARC administrators, researchers and technicians. A Gap Analysis Survey was designed to examine gaps that exist between the skills of WTE employees today verses those that are needed. The survey was fine-tuned through use of an electronic meeting with researchers and technicians who are subject matter experts. The survey will be administered through a Web site designed to assure anonymity to individual respondents. Future skill requirements due to cutting edge technologies and those on the horizon will also be identified. Results will provide a snapshot view of the state of the WTE today in terms of employee skills and will suggest the types of training needed. Experts' description's of the skills will be used to develop a course catalog for WTE training at LARC. Metrics will be created to measure the success of each training program. The VITU will serve as a national model for wind tunnel training and is projected to serve outside customers and govenunent agencies in the future.
Author
Wind Tunnels; Systems Engineering; Information Systems; Fluid Mechanics; Gas Dynamics

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19990019286 NASA Ames Research Center, Moffett Field, CA USA
Pioneer to Venus: The Multiprobe and Orbiter Missions
Craig, Roger A., NASA Ames Research Center, USA; Colin, Lawrence, NASA Ames Research Center, USA; Fimmel, Richard O., NASA Ames Research Center, USA; Journal of the British Interplanetary Society; 1984; Volume 37, pp. 453-466; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In December 1978 the two spacecraft of the Pioneer Venus mission arrived at Venus. One of these consisted of four entry probes and a carrier, the Bus. The four entry probes, designed to make in situ measurements of the atmosphere, were deployed to different places on the planet. The Bus returned data from measurements made in the exosphere, upper atmosphere and ionosphere. The other spacecraft, the Orbiter, was placed in orbit around Venus to radar map the surface, explore gravity features, study the clouds and the atmosphere and its interaction with the solar wind, and examine the magnetic and electrical fields. The four probes and the Bus completed their mission successfully in two and a half hours. The Orbiter continues to return enormous quantities of scientific data concerning all aspects of the environment of Venus. This paper outlines the history of the development of the Pioneer Venus Program, discusses its scientific achievements and contrasts them with the important questions about Venus. This paper also presents the expectations for the remainder of the mission, including the exciting observations of Comet Halley.
Author
Pioneer Venus Spacecraft; Space Missions; Venus (Planet); Space Probes; Upper Atmosphere; Exosphere

19990019642 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Satellite Attitude Dynamics Simulation and Control

Pierre, Daniel C.; May 04, 1998; 76p; In English

Report No.(s): AD-A356311; AFIT-98-026; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Satellite Attitude Dynamics Simulation and Control System (SADSaC) project has two main objectives. The first is to provide a visual demonstration of satellite attitude dynamics. The second purpose is to be used as a learning tool by providing actuator hardware for student analysis and design. SAD SaC is a 22" cube attached to a bearing on a 3, pole that allows for near-frictionless rotation about the vertical axis. Attitude control will be done using a dual actuator system of a reaction wheel and gas jet thrusters. Tachometers and an absolute optical encoder will provide sensing capabilities of satellite position and satellite and reaction wheel velocities. This paper describes in detail the procedures used during design from conception to operation, as well as the modeling and system tests that were necessary to ensure proper operation. Documentation of engineering drawings, mathematical models and component parts ensure easy duplication of SADSaC should the need for more than one arise.

DTIC

Satellite Attitude Control; Space Environment Simulation; Dynamic Control

19990019655 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Risk Assessment of Space Debris Hazards for Global Positioning Spacecraft

Ashley, David M.; Oct. 26, 1998; 37p; In English

Report No.(s): AD-A356208; AFIT-98-031; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An important concern of USSPACECOM has been developing a policy to reduce orbital debris, including ensuring proper spacecraft end-of-life disposal to minimize the number of spacecraft left on mission orbit beyond their useful lifetimes. This paper provides insight to the pertinent issues related to space debris and spacecraft disposal in addition to a detailed analysis of debris hazards for the Global Positioning System (GPS) family of spacecraft as outlined by M. E. Sorge. Results of the analysis show that inactive GPS satellites pose the most significant hazard to the GPS constellation of all space debris of large size, thus reaffirming recent U.S. space policy mandating deorbiting for all GPS satellites deemed non-mission capable. Additional analysis is recommended to explore collision probabilities for medium sized debris, since this category is also capable of disabling GPS satellites.

DTIC

Space Debris; Global Positioning System; Risk; Spacecraft Breakup

19990019722 James Madison Univ., Harrisonburg, VA USA

The Idea Nobody Wanted

OConnor, Thomas, James Madison Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 82; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

My ASEE fellowship involved producing, writing and hosting a 27-minute video documentary called The Idea Nobody Wanted. The show is intended to document one of Langley's major contributions to NASA in honor of the agency's 40th anniversary this October. The Idea Nobody Wanted centers on the concept called Lunar Orbit Rendezvous, which was developed at the NASA Langley Research Center. This controversial idea turned out to be key in putting a man on the moon in 1969. The documentary tells the story of the scientists at Langley, headed by Dr. John Houbolt, whose courage and unwavering convictions played a major role in one of the most important historic events of the 20th century. Auburn University historian Dr. James Hansen states, "Thousands of factors contributed the ultimate success of the Apollo lunar landing missions, but no single factor was more essential than the concept of LOR." George Low, the engineer who oversaw the development of the Apollo program said: "It is my opinion to this day, that had the Lunar Orbit Rendezvous mode not been chosen, Apollo would not have succeeded." Low went on to say that John Houbolt's work in fighting for the LOR concept "was a major contribution to the success of Apollo and, therefore, to the nation." The documentary is completed and will be initially shown at Langley, then forwarded to NASA headquarters in time for the anniversary celebration. The show also will be submitted to the Discovery Channel for a national broadcast. Should it be accepted, it will air next year in honor of the 30th anniversary of the first manned lunar landing in 1969.

Author

Orbital Rendezvous; Lunar Orbits; Lunar Landing; Apollo Project

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ASTRODYNAMICS

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

19990019835 NASA Ames Research Center, Moffett Field, CA USA
Virtual Petaflop Simulation: Parallel Potential Solvers and New Integrators for Gravitational Systems
Lake, George, NASA Ames Research Center, USA; Quinn, Thomas, Washington Univ., USA; Richardson, Derek C., Washington Univ., USA; Stadel, Joachim, Washington Univ., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 21-28; In English; Also announced as 19990019831; Sponsored in part by IRP and ATP.; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

”The orbit of any one planet depends on the combined motion of all the planets, not to mention the actions of all these on each other. to consider simultaneously all these causes of motion and to define these motions by exact laws allowing of convenient calculation exceeds, unless I am mistaken, the forces of the entire human intellect” -Isaac Newton 1687. Epochal surveys are throwing down the gauntlet for cosmological simulation. We describe three keys to meeting the challenge of N-body simulation: adaptive potential solvers, adaptive integrators and volume renormalization. With these techniques and a dedicated Teraflop facility, simulation can stay even with observation of the Universe. We also describe some problems in the formation and stability of planetary systems. Here, the challenge is to perform accurate integrations that retain Hamiltonian properties for 10(exp 13) timesteps.
Author
Cosmology; Many Body Problem; Computerized Simulation; Celestial Mechanics; Run Time (Computers); Parallel Processing (Computers); Normalizing (Statistics); Renormalization Group Methods; Integrators

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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.

19990019501 NASA, Washington, DC USA
SOHO Mission Interruption Joint NASA/ESA Investigation Board *Final Report*
Aug. 31, 1998; 24p; In English
Report No.(s): AD-A354771; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Contact with the SOlar Heliospheric Observatory (SOHO) spacecraft was lost in the early morning hours of June 25, 1998, Eastern Daylight Time (EDT), during a planned period of calibrations, maneuvers, and spacecraft reconfigurations. Prior to this the SOHO operations team had concluded two years of extremely successful science operations. A joint European Space Agency (ESA)/National Aeronautics and Space Administration (NASA) engineering team has been planning and executing recovery efforts since loss of contact with some success to date. ESA and NASA management established the SOHO Mission Interruption Joint Investigation Board to determine the actual or probable cause(s) of the SOHO spacecraft mishap. The Board has concluded that there were no anomalies on-board the SOHO spacecraft but that a number of ground errors led to the major loss of attitude experienced by the spacecraft. The Board finds that the loss of the SOHO spacecraft was a direct result of operational errors, a failure to adequately monitor spacecraft status, and an erroneous decision which disabled part of the on-board autonomous failure detection. Further, following the occurrence of the emergency situation, the Board finds that insufficient time was taken by the operations team to fully assess the spacecraft status prior to initiating recovery operations. The Board discovered that a number of factors contributed to the circumstances that allowed the direct causes to occur. The Board strongly recommends that the two Agencies proceed immediately with a comprehensive review of SOHO operations addressing issues in the ground procedures, procedure implementation, management structure and process, and ground systems. This review process should be completed and process improvements initiated prior to the resumption of SOHO normal operations.
Derived from text
SOHO Mission; Interruption; Emergencies; Solar Observatories; Heliosphere; Losses; NASA Programs

19990019897 NASA Langley Research Center, Hampton, VA USA

The Road from the NASA Access-to-Space Study to a Reusable Launch Vehicle

Powell, Richard W., NASA Langley Research Center, USA; Lockwood, Mary Kae, NASA Langley Research Center, USA; Cook, Stephen A., NASA Marshall Space Flight Center, USA; 1998; 20p; In English; 49th; International Astronautical Congress, 28 Sep. - 2 Oct. 1998, Melbourne, Australia

Report No.(s): IAF-98-V.4.02; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

NASA has established a goal of providing low-cost reliable access to space. While this goal has been around for many years, it received a major impetus when the U.S Congress mandated the Access-to-Space study in 1993. This study concluded that a rocket powered single-stage-to-orbit vehicle offered the best opportunity for low-cost reliable space transportation by the first decade of the new millennium. This required a focused technology development program before such a vehicle could be built. NASA recognized that no commercial entity would commit to the development of a single-stage-to-orbit vehicle without the U.S. Government's participation. to this end, NASA entered into a cooperative agreement with industry to mature the required technologies. This effort includes the development of an experimental subscale-vehicle known as the X-33, an extensive ground-based program to provide the required additional technology development, and conceptual through preliminary design of an operational reusable launch vehicle. Following this effort, a decision will be made whether or not to proceed with the detailed design and fabrication of an operational vehicle.

Author

Reusable Launch Vehicles; Single Stage to Orbit Vehicles; Space Transportation

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

19990019478 TriQuint Semiconductor, Inc., MMIC Research and Development Lab., Dallas, TX USA

K-Band Power Enbedded Transmission Line (ETL) MMIC Amplifiers for Satellite Communication Applications *Final Report*

Tserng, Hua-Quen, TriQuint Semiconductor, Inc., USA; Ketterson, Andrew, TriQuint Semiconductor, Inc., USA; Saunier, Paul, TriQuint Semiconductor, Inc., USA; McCarty, Larry, Raytheon Systems Co., USA; Davis, Steve, Raytheon Systems Co., USA; November 1998; 6p; In English; Radio Frequency Integrated Circuit (RFIC), 13-15 Jun. 1999, Anaheim, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): NCC3-497; RTOP 632-50-5B

Report No.(s): NASA/CR-1998-208681; E-11420; NAS 1.26:208681; No Copyright; Avail: CASI; A02, Hardcopy; A01, icrofiche

The design, fabrication, and performance of K-band high-efficiency, linear power pHEMT amplifiers implemented in Embedded Transmission Line (ETL) MMIC configuration with unthinned GaAs substrate and topside grounding are reported. A three-stage amplifier achieved a power-added efficiency of 40.5% with 264 mW output at 20.2 GHz. The linear gain is 28.5 dB with 1-dB gain compression output power of 200 mW and 31% power-added efficiency. The carrier-to-third-order intermodulation ratio is approx. 20 dBc at the 1-dB compression point. A RF functional yield of more than 90% has been achieved.

Author

Satellite Communication; Superhigh Frequencies; Linear Amplifiers; Integrated Circuits; Extremely High Frequencies

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.

19990019365 NASA Johnson Space Center, Houston, TX USA
Mir Mission Chronicle, *Nov. 1994 - Aug. 1996*
McDonald, Sue, NASA Johnson Space Center, USA; December 1998; 74p; In English
Report No.(s): NASA/TP-1998-207890; NAS 1.60:207890; S-844; No Copyright; Avail: CASI; A04, Hardcopy; A01,

Dockings, module additions, configuration changes, crew changes, and major mission events are tracked for Mir missions 17 through 21 (November 1994 through August 1996). The international aspects of these missions are presented, comprising joint missions with ESA and NASA, including three U.S. Space Shuttle dockings. New Mir modules described are Spektr, the Docking Module, and Priroda.
Author
Space Stations; Mir Space Station; Spacecraft Docking; Spacecraft Configurations; Space Missions

19990019644 Naval Postgraduate School, Dept. of Electrical and Computer Engineering, Monterey, CA USA
The Military Applications of MEO and ICO Commercial Satellite Systems *Final Report*
Kakavas, I.; Ha, T. T.; Garcia, V.; Sep. 15, 1998; 139p; In English
Report No.(s): AD-A356294; NPS-EC-098-014; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

At the dawn of the 21st century several low and medium earth orbit commercial satellite constellations will be operational and they will be able to provide high bandwidth global communications in voice, data, and multimedia services for mobile consumers and also ”users in the move.” This research evolves as a continuation of previous studies (on Iridium, Globalstar, Teledesic, and Odyssey), and considers the ICO as well as the Teledesic and GBS systems in an effort to provide a comprehensive model architecture. This model accommodates narrowband, wideband, and broadcast requirements, respectively, of the U.S. MILSATCOM in addition to the communication needs of a model UN peacekeeping mission. The application of these systems to U.S. MILSATCOM coincides perfectly with the U.S. defense doctrine of a CONUS-based military with the capability of rapid global power projection to respond to crises throughout the global arena. Instead of investing heavily in new satellite systems, the U.S. military services can use the forthcoming commercial LEO and MEO systems to meet the information requirements of tactical commanders.
DTIC
Satellite Communication; Artificial Satellites; User Requirements

19990019896 NASA Langley Research Center, Hampton, VA USA
The Mars Surveyor 2001 Lander: A First Step Toward Precision Landing
Braun, Robert D., NASA Langley Research Center, USA; Powell, Richard W., NASA Langley Research Center, USA; Cheatwood, F. McNeil, NASA Langley Research Center, USA; Spencer, David A., Jet Propulsion Lab., California Inst. of Tech., USA; Mase, Robert A., Jet Propulsion Lab., California Inst. of Tech., USA; 1998; 18p; In English; 49th; International Astronautical Congress, 28 Sep. - 2 Oct. 1998, Melbourne, Australia; Original contains color illustrations
Report No.(s): IAF-98-Q.3.03; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

As the robotic exploration of Mars continues, science objectives have driven mission and flight system development towards the use of precision landing technology such that small surface features, such as craters, can be investigated. In addition, the surface rendezvous elements of human exploration missions will require landing accuracy that is greatly improved over that achievable with ballistic flight. With improved approach navigation and hypersonic maneuvering technologies, the MSP’01 Lander is taking the first significant step toward precision landing on Mars. This advance requires both the ability to generate lift during the atmospheric flight and an on-board guidance algorithm to direct a three-axis control system. Many configuration options were examined to generate the required lift, with an afterbody-mounted deployable flap emerging as the lightest-weight solution. Five candidate guidance algorithms have been developed and submitted to the MSP’01 Project for evaluation. Through high-fidelity simulation, each of these algorithms has demonstrated the ability to greatly improve upon the landed accuracy provided by ballistic flight. As a result, the science community should expect to be within 10 km of the specified landing target. In fact, depending on the selected aeroshell L/D, a 5-km precision landing goal is achievable with greater than 90% confidence.
Derived from text
Mars Landing; Robotics; Systems Engineering; Mission Planning; Navigation; Hypersonics

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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.

19990019321 NASA Lewis Research Center, Cleveland,OH USA

Thermal Environmental Testing of NSTAR Engineering Model Ion Thrusters

Rawlin, Vincent K., NASA Lewis Research Center, USA; Patterson, Michael J., NASA Lewis Research Center, USA; Becker, Raymond A., Jet Propulsion Lab., California Inst. of Tech., USA; Jan. 1999; 13p; In English; 25th; Electric Propulsion, 24-28 Aug. 1997, Cleveland, OH, USA; Sponsored by Electric Rocket Propulsion Society, USA

Contract(s)/Grant(s): RTOP 242-70-01

Report No.(s): NASA/TM-1999-206304; E-11001; NAS 1.15:206304; IEPC-97-051; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA's New Millenium program will fly a xenon ion propulsion system on the Deep Space 1 Mission. Tests were conducted under NASA's Solar Electric Propulsion Technology Applications Readiness (NSTAR) Program with 3 different engineering model ion thrusters to determine thruster thermal characteristics over the NSTAR operating range in a variety of thermal environments. A liquid nitrogen-cooled shroud was used to cold-soak the thruster to -120 C. Initial tests were performed prior to a mature spacecraft design. Those results and the final, severe, requirements mandated by the spacecraft led to several changes to the basic thermal design. These changes were incorporated into a final design and tested over a wide range of environmental conditions. Author

Solar Electric Propulsion; Thermal Environments; Ion Propulsion; Environmental Engineering; Xenon; Solar Thermal Propulsion; Ion Engines; Thrustors

19990019393 NASA Lewis Research Center, Cleveland, OH USA

Low-Power Ion Thruster Development Status

Patterson, Michael J., NASA Lewis Research Center, USA; January 1999; 17p; In English; 34th; Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 022-00-00

Report No.(s): NASA/TM-1999-208822; NAS 1.15:208822; E-11428; AIAA Paper 98-3347; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An effort is on-going to examine scaling relationships and design criteria for ion propulsion systems, and to address the need for a light weight, low power, high specific impulse propulsion option for small spacecraft. An element of this activity is the development of a low-power (sub-0.5 kW) ion thruster. This development effort has led to the fabrication and preliminary performance assessment of an 8 cm prototype xenon ion thruster operating over an input power envelope of 0.1-0.3 kW. Efficiencies for the thruster vary from 0.31 at 1750 seconds specific impulse at 0.1 kW, to about 0.48 at 2700 seconds specific impulse and 0.3 kW input power. Discharge losses for the thruster over this power range varied from about 320-380 W/A down to about 220-250 W/A. Ion optics performance compare favorably to that obtained with 30 cm ion optics, when scaled for the difference in beam area. The neutralizer, fabricated using 3 mm hollow cathode technology, operated at keeper currents of about 0.2-0.3 A, at a xenon flow rate of about 0.06 mg/s, over the 0.1-0.3 kW thruster input power envelope.

Author

Ion Propulsion; Engine Design; Design Analysis; Ion Engines; Fabrication; Scale Models; Xenon

19990019398 NASA Lewis Research Center, Cleveland,OH USA

800 Hours of Operational Experience from a 2 kW(sub e) Solar Dynamic System

Shaltens, Richard K., NASA Lewis Research Center, USA; Mason, Lee S., NASA Lewis Research Center, USA; Jan. 1999; 11p; In English; Space Technology and Applications International Forum, Jan. 31 - Feb. 4 1999, Albuquerque, NM, USA; Sponsored by Boeing Co., USA

Contract(s)/Grant(s): RTOP 632-1A-1D

Report No.(s): NASA/TM-1999-208840; E-11452; NAS 1.15:208840; No Copyright; Avail: CASI; A03, Hardcopy; A01,

From December 1994 to September 1998, testing with a 2 kW(sub e) Solar Dynamic power system resulted in 33 individual tests, 886 hours of solar heating, and 783 hours of power generation. Power generation ranged from 400 watts to over 2 kW(sub e), and SD system efficiencies have been measured up to 17 per cent, during simulated low-Earth orbit operation. Further, the turbo-alternator-compressors successfully completed 100 start/stops on foil bearings. Operation was conducted in a large thermal/vacuum facility with a simulated Sun at the NASA Lewis Research Center. The Solar Dynamic system featured a closed Brayton conversion unit integrated with a solar heat receiver, which included thermal energy storage for continuous power output through a typical low-Earth orbit. Two power conversion units and three alternator configurations were used during testing. This paper will review the test program, provide operational and performance data, and review a number of technology issues.

Author

Solar Generators; Brayton Cycle; Electric Generators; Heat Storage; Performance Tests

19990019657 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Design and Analysis of a Pressurized Composite Fuel Tank

Martin, Andrew L.; Mar. 25, 1998; 72p; In English

Report No.(s): AD-A356203; AFIT-98-014; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An investigation works towards obtaining a lightweight, cost-effective pressurized fuel tank for a hybrid sounding rocket with a capacity of 20 kg of either Nitrous Oxide or Hydrogen Peroxide. Trade studies result in analyzing a graphite epoxy prepreg composite tank with unidirectional lamina designed for a burst pressure of 2000 psi. The analysis resulted in a pressure vessel in the shape of a cylinder with spherical ends. The tank's diameter is 8 inches and the total length is 5 feet. The analysis further determined the fuel tank's layered construction of 6 plies oriented 0 degrees and 90 degrees each, with 10 plies oriented at 45 degrees. This gave a total of 22 plies for a thickness of 0.11 inches with a tank factor of 18785 and a mass of 3.7 kg. Hand lay-up manufacturing techniques are discussed for composite fuel tanks as well as mold and tooling comparisons.

DTIC

Pressure Vessels; Fuel Tanks; Composite Structures; Hydrogen Peroxide; Graphite-Epoxy Composites; Nitrous Oxides; Sandwich Structures; Laminates; Manufacturing

19990020975 NASA Lewis Research Center, Cleveland, OH USA

A Spherical Torus Nuclear Fusion Reactor Space Propulsion Vehicle Concept for Fast Interplanetary Travel

Williams, Craig H., NASA Lewis Research Center, USA; Borowski, Stanley K., NASA Lewis Research Center, USA; Dudzinski, Leonard A., NASA Lewis Research Center, USA; Juhasz, Albert J., NASA Lewis Research Center, USA; December 1998; 36p; In English; 34th; Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 242-74-74

Report No.(s): NASA/TM-1998-208831; NAS 1.15:208831; E-11442; AIAA Paper 98-3591; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A conceptual vehicle design enabling fast outer solar system travel was produced predicated on a small aspect ratio spherical torus nuclear fusion reactor. Initial requirements were for a human mission to Saturn with a greater than 5% payload mass fraction and a one way trip time of less than one year. Analysis revealed that the vehicle could deliver a 108 mt crew habitat payload to Saturn rendezvous in 235 days, with an initial mass in low Earth orbit of 2,941 mt. Engineering conceptual design, analysis, and assessment was performed on all ma or systems including payload, central truss, nuclear reactor (including divertor and fuel injector), power conversion (including turbine, compressor, alternator, radiator, recuperator, and conditioning), magnetic nozzle, neutral beam injector, tankage, start/re-start reactor and battery, refrigeration, communications, reaction control, and in-space operations. Detailed assessment was done on reactor operations, including plasma characteristics, power balance, power utilization, and component design.

Author

Nuclear Fusion; Toruses; Design Analysis; Nuclear Reactors; Propulsion; Payloads; Spacecrews

19990019283 NASA Ames Research Center, Moffett Field, CA USA

Solubilization and Resolution of the Membrane-Bound Nitrite Reductase from Paracoccus Halodenitrificans into Nitrite and Nitric Oxide Reductases

Grant, Michael A., Santa Clara Univ., USA; Cronin, Sonja E., NASA Ames Research Center, USA; Hochstein, Lawrence I., NASA Ames Research Center, USA; Archives of Microbiology; 1984; Volume 140, pp. 183-186; In English

Contract(s)/Grant(s): NCA2-OR-685-203; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Membranes prepared from Paracoccus halodenitrificans reduced nitrite or nitric oxide to nitrous oxide. Extraction of these membranes with the detergent CHAPSO [3-(3-Chlolamidoporopyldimethylammonio)-1-(2- hydroxy-1-propanesulfonate)], followed by ammonium sulfate fractionation of the solubilized proteins, resulted in the separation of nitrite and nitric oxide reductase activities. The fraction containing nitrite reductase activity spectrally resembled a cd-type cytochrome. Several cytochromes were detected in the nitric oxide reductase fraction. Which, if any, of these cytochromes is associated with the reduction of nitric oxide is not clear at this time.

Author

Nitrites; Nitrous Oxides; Nitric Oxide; Reduction; Membranes; Solubility; Cytochromes; Ammonium Sulfates

19990019410 Department of the Navy, Washington, DC USA

UV-Curable and Non-Volatile Pigmented Coatings

Howell, Barbara F., Inventor; Poole, Karen M., Inventor; May 05, 1998; 6p; In English; Supersedes US-Patent-Appl-SN-397014

Patent Info.: Filed 28 Feb. 95,; US-Patent-Appl-SN-397,014; US-Patent-5,747,115

Report No.(s): AD-D019128; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method is described for forming a pigmented coating on a poorly prepared, cold metal surface that cures in less than one minute by exposure to ultraviolet radiation from a xenon lamp and emits extremely low levels of volatile organic compounds so that application can be done safely in a confined space.

DTIC

Ultraviolet Radiation; Curing; Pigments; Cold Surfaces; Coating; Organic Compounds; Metal Surfaces

19990019554 NASA Marshall Space Flight Center, Huntsville, AL USA

The Feasibility of Bulk Crystallization as an Industrial Purification and Production Technique for Proteins

Judge, Russell A., Alabama Univ., USA; Forsythe, Elizabeth L., Universities Space Research Association, USA; Johns, Michael R., Queensland Univ., Australia; Pusey, Marc L., NASA Marshall Space Flight Center, USA; White, Edward T., Queensland Univ., Australia; 1998; 1p; In English; 7th; Crystallization of Biological Macromolecules, 3 May 1998, Granada, Spain; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Bulk crystallization in stirred vessels is used industrially for the recovery and purification of many inorganic and organic materials. Although much has been written on the crystallization of proteins for X-ray diffraction analysis, very little has been reported on the application of bulk crystallization in stirred vessels. In this study, a 1-liter, seeded, stirred, batch crystallizer was used with ovalbumin as a model protein to test the feasibility of this crystallization method as a recovery and purification process for proteins. Results were obtained for ovalbumin solubility, nucleation thresholds, crystal breakage and crystal growth kinetics in bulk solution under a range of operating conditions of pH and ammonium sulphate concentration (Judge et al., 1996). Experiments were also performed to determine the degree of purification that can be achieved by the crystallization of ovalbumin from a mixture of proteins. The effect of the presence of these proteins upon the ovalbumin crystal growth kinetics was also investigated (Judge et al., 1995). All of these aspects are essential for the design of bulk crystallization processes which have not previously been reported for proteins. Results from a second study that investigated the effect of structurally different proteins on the solubility, crystal growth rates and crystal purity of chicken egg white lysozyme are also presented (Judge et al., 1997). In this case face growth rates were measured using lysozyme purified by liquid chromatography and the effect of the addition of specific protein impurities were observed on the (110) and (101) crystal faces. In these two studies the results are presented to show the feasibility and purifying ability of crystallization as a production process for proteins.

Author

Crystallization; Purification; Proteins; Organic Materials; Ammonium Sulfates

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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.

19990019178 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
The Effect of Physical Aging on the Viscoelastic Response of Cross-Ply Laminates to In-Plane Compression
Huang, Nan-Nong, National Taiwan Ocean Univ., Taiwan, Province of China; Chen, Hsin-Jung, National Koahsiung Inst. of Marine Technology, Taiwan, Province of China; Lee, Chien-Fa, National Taiwan Ocean Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 159-170; In English
Contract(s)/Grant(s): NSC85-2212-E-019-004; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The viscoelastic behaviors of simply-supported, cross-ply laminates with a physical aging phenomenon are examined. The laminates considered are under uniaxial in-plane compression and have various amplitudes of initial imperfection. Laminae exhibit different aging shift rates for the creep responses to the axial and shear loadings. The effective time theory is employed to construct the stress-strain relations. The stress function is obtained by solving the compatibility equation by the use of the Laplace transform and a numerical integration scheme. Deflections are calculated from the moment equation by the Galerkin method in conjunction with the numerical integration. Numerical results of creep deflections, edge shortenings and stress resultants for graphite-reinforced thermoplastic and glass-reinforced thermosetting laminates are presented. The effects of physical aging, preloading aging time, and the amplitude of imperfection on the creep responses are illustrated in the numerical examples.
Author
Laminates; Ply Orientation; Stress Functions; Stress-Strain Relationships; Viscoelasticity; Method of Moments; Measure and Integration

19990019254 California Inst. of Tech., Pasadena, CA USA
Bulk Metallic Glass Matrix Composites *Final Report*
Johnson, William L.; Goddard, William A., III; Aug. 1998; 16p; In English
Contract(s)/Grant(s): DAAH04-95-1-0233
Report No.(s): AD-A357938; ARO-34564.7-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Bulk metallic glass (BMG) forming alloys were used to synthesis metal matrix composites with the BMG as the matrix. The second phase in the composite is a refractory ceramic material (e.g. tungsten-carbide) or a heavy ductile metal (e.g. tungsten and tantalum). Composites containing up to 80% reinforcement were fabricated and characterized with respect to mechanical properties. Dynamic deformation behavior of BMG/tungsten composites was studied at ballistic impact velocities. The 13 BMG/tungsten composite has potentially useful properties as a kinetic energy penetrator.
DTIC
Metallic Glasses; Metal Matrix Composites

19990019399 NASA Marshall Space Flight Center, Huntsville, AL USA
Unlined Reuseable Filament Wound Composite Cryogenic Tank Testing
Murphy, A. W., NASA Marshall Space Flight Center, USA; Lake, R. E., NASA Marshall Space Flight Center, USA; Wilkerson, C., NASA Marshall Space Flight Center, USA; January 1999; 12p; In English
Report No.(s): NASA/TM-1999-209039; NAS 1.15:209039; M-909; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An unlined reusable filament wound composite cryogenic tank was tested at the Marshall Space Flight Center using LH2 cryogen and pressurization to 320 psig. The tank was fabricated by Phillips Laboratory and Wilson Composite Group, Inc., using an EnTec five-axis filament winder and sand mandrels. The material used was IM7/977-2 (graphite/epoxy).
Author
Liquid Hydrogen; Storage Tanks; Cryogenic Fluid Storage; Filament Winding; Graphite-Epoxy Composites

19990019442 Department of the Navy, Washington, DC USA
Method and Apparatus for Casting Thin-Walled Honeycomb Structures
Ayers, Jack D., Inventor; Jun. 23, 1998; 10p; In English; Supersedes US-Patent-Appl-SN-745169, AD-D018381.
Patent Info.: Filed 7 Nov. 96,; US-Patent-Appl-SN-745,169; US-Patent-5,769,153
Report No.(s): AD-D019081; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The present invention is a process for making a honeycomb structure of a selected material, having the steps: (a) disposing molten material in a melt container disposed over a mold, where the melt container has an opening for releasing molten material into the mold, where the mold is shaped for molding the honeycomb structure; (b) moving the melt container relative to the mold, where the molten material flows out of the opening into the mold; and (c) removing the mold from the material. Another aspect of the invention is an apparatus for making a honeycomb structure of a selected material, including: (a) a mold shaped for molding the honeycomb structure; (b) a melt container, disposed over the mold, having an opening for releasing molten material into the mold; and (c) a conveyor, for moving the melt container relative to the mold as the melt container releases the molten material into the mold.
DTIC
Casting; Honeycomb Structures; Thin Walls

19990019454 Virginia Polytechnic Inst. and State Univ., Dept. of Chemical Engineering, Blacksburg, VA USA
The Processing of In Situ Composites and Microcomposites Based on Thermotropic Liquid Crystalline Polymers and Thermoplastics ***Final Report, Jan. 1994 - Dec. 1997***
Baird, Donald G.; May 28, 1998; 19p; In English
Contract(s)/Grant(s): DAAH04-94-G-0282
Report No.(s): AD-A358062; ARO-32620.5-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The purpose of this work was to determine how to obtain the maximum reinforcement from thermotropic liquid crystalline polymers (TLCPs) when blended with other thermoplastics to produce light weight, wholly thermoplastic composites. Towards this goal, the research first focused on the spinning of thermoplastic/TLCP composite strands and fibers using a novel dual extrusion technique developed in our laboratory. It was found that the high degree of extensional deformation achieved in spinning and the ability to utilize the supercooling behavior of the TLCPs allowed a wide variety of thermoplastic/TLCP composite systems to be produced with properties matching or exceeding theoretical expectations. The strands and fibers generated in the spinning step were then subjected to a variety of post-processing techniques. This was done to expand the processing options available while retaining the high mechanical properties of the pregenerated TLCP fibrils. These post-processing techniques included: (1) manufacturing and consolidating woven thermoplastic/TLCP composite preforms, (2) injection molding of pregenerated microcomposites, and (3) rapid prototyping. Each of these techniques was shown to produce composites with higher mechanical properties than those of the neat matrix resins.
DTIC
Composite Materials; Polymers; Thermoplastic Resins; Liquid Crystals; Woven Composites; Manufacturing; Injection Molding

19990019458 New York Univ., Courant Inst. of Mathematical Sciences, New York, NY USA
Mathematical Problems in Micromechanics and Composite Materials ***Final Report, 1 Mar. 1995 - 30 Jun. 1998***
Kohn, Robert V.; Avellaneda, Marco; Aug. 12, 1998; 14p; In English
Contract(s)/Grant(s): DAAH04-95-1-0100
Report No.(s): AD-A358023; ARO-33529.25-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This project's scientific focus was at the frontier where mathematics meets materials science. Physically, it was concerned with issues such as the effective behavior of composites and the formation of microstructure due to coherent phase transformation. Mathematically, it brought to bear a variety of tools including homogenization, the calculus of variations, and nonlinear partial differential equations. Specific accomplishments include: (a) improved understanding of how symmetry and texture determine the recoverable strain of a shape-memory polycrystal; (b) fresh insight concerning twinning and hysteresis in shape-memory materials; (c) progress on fundamental aspects of crystal and polycrystal plasticity; (d) a new approach to pattern formation in certain magnetic materials; and (e) improved models of heterogeneous materials including piezoceramic composites and polymer dispersed liquid crystals.
DTIC
Composite Materials; Micromechanics; Nonlinear Equations; Microstructure; Liquid Crystals; Phase Transformations

19990019477 Massachusetts Inst. of Tech., Cambridge, MA USA
Long Term Degradation of Polyimide Composites
Patekar, Kaustubh A., Massachusetts Inst. of Tech., USA; McManus, Hugh L., Massachusetts Inst. of Tech., USA; December 1998; 12p; In English; 8th; Composite Materials, 24-25 Sep. 1998, Baltimore, MD, USA; Sponsored by American Composite Society, USA
Contract(s)/Grant(s): NAG3-2054; RTOP 523-21-13
Report No.(s): NASA/CR-1998-208675; E-11405; NAS 1.26:208675; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The durability of polymer matrix composites exposed to harsh environments is a major concern. Surface degradation and damage are observed in polyimide composites used in air at 125-300 C. It is believed that diffusion of oxygen into the material and oxidative chemical reactions are responsible. Previous work has characterized and modeled diffusion behavior, and thermogravimetric analyses (TGAS) have been carried out in nitrogen, air, and oxygen to provide quantitative information on thermal and oxidative reactions. However, the model developed using these data did not successfully extrapolate TGA data down to conditions seen in service. A test program that focuses on lower temperatures and makes use of isothermal tests was undertaken to achieve a better understanding of the degradation reactions under use conditions. A new, low-cost technique was developed to collect chemical degradation data for isothermal tests lasting over 200 hours in the temperature range 125-300 C. Results indicate complex behavior not captured by the previous model, including the presence of weight-adding reactions. Weight gain reactions dominated in the 125-225 C temperature range, while weight loss reactions dominated beyond 225 C. The data obtained from isothermal tests and earlier TGAs is used to develop an advanced model of the material behavior.
Author
Polyimides; Polymer Matrix Composites; Thermogravimetry; Chemical Properties; Degradation; Durability; Thermal Stability

19990019698 Hampton Univ., Dept. of Computer Science, VA USA
Extension of a Bond Fluctuation Model for LaRC PETI-5
Daley, Lawrence R., Hampton Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 55; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

One objective of the computational materials program at NASA is to use advanced computational tools to design optimum polymeric matrix composites by developing mathematical models that describe the polymer synthesis process. The bond fluctuation model puts polymer segments on a lattice, and allows randomly chosen segments to jump to nearby lattice sites after assuring that the new site is unoccupied, and that criteria for new bond lengths and angles and, in the case of polymerization and cross-linking, reactivity are met. Such a model was implemented for phenylethynyl-terminated polyimide (PETI-5) in a computer program written in compiled BASIC. The program's strongest feature is the use of segment descriptors which describe a given segment's functionality, lattice coordinates, and to which other segments it is bonded. The present work extends the model to incorporate: (1) reaction of anhydrides and amines to form the polyimide, rather than simply modeling a fixed chain length; (2) differentiating among segments as to their chemical type; (3) incorporating a Boltzmann distribution of bond energies as a function of temperature; (4) attempting to restrict bond angles to favor larger angles, i.e., stiffer polymer chains. Reaction of anhydrides and amines to form the polyimide was accomplished by setting a particular element of the segment descriptor to indicate whether the segment is a diamine, a dianhydride, or an ethynyl anhydride. Then the criteria for allowing segment (monomer) reaction with adjacent segments (monomers) included chemical type. In this way, a distribution of chain lengths was obtained. Incorporating a Boltzmann distribution of bond energies was done by calculating bond angles before and after a proposed random segment move based on lattice coordinates of the affected segments, allowing the move if the new bond energy would be lower (larger bond angle), and giving a proposed higher energy (smaller bond angle) a certain probability of occurrence depending on temperature. Refinements of the model to show increasing average square end-to-end distances at decreasing temperatures are currently in progress. Future work will incorporate a Boltzmann distribution of energies into the imidization and cross-linking reactions, and determine the effect of distribution of chain lengths vs. uniform chain length on end-to-end distance.
Author
Boltzmann Distribution; Polymer Matrix Composites; Mathematical Models; Computer Programs; Anhydrides

19990019713 Mississippi State Univ., Mississippi State, MS USA
Modeling the Dynamic Crush Behavior of Composite/Foam Sandwich Structures
Johnson, David P., Mississippi State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 72; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The dynamic failure response of two composite/foam sandwich structures was investigated. The two structures were a plate in 3-point bending , and a cylinder crushed under axial loads. Both structures were fabricated with fiberglass/epoxy skins and rigid, closed-cell polyurethane foam cores. The objective of the work was to determine how well these structures could be modeled using a 3-d, non-linear, dynamic finite element analysis package. Particular attention was paid to available models for describing the mechanical response of structural foams. Specimens were fabricated and tested to determine their load/deformation behavior. These response curves were compared to those generated by the finite element analysis. It was found that while the finite element

analysis cannot accurately predict the peak loads in the structures, the sustained crushing load was predicted reasonably well. Suggestions were made for more accurately predicting the peak loads in the future.
Author
Glass Fiber Reinforced Plastics; Composite Structures; Dynamic Characteristics; Deformation; Crushing; Epoxy Matrix Composites; Finite Element Method; Polyurethane Foam; Sandwich Structures

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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.

19990019177 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Reaction of Carbon Disulfide and o-Phenylene Diamine Catalyzed by Quaternary Ammonium Salt in the Presence of Potassium Hydroxide
Liu, Biing-Lang, National Tsing Hua Univ., Taiwan, Province of China; Wang, Maw-Ling, National Tsing Hua Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 171-180; In English
Contract(s)/Grant(s): NSC83-0402-E-007-004; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The synthesis of 2-mercaptobenzimidazole (MBI) from the reaction of carbon disulfide and o-phenylene diamine (C6H4(NH2)2), catalyzed by tetrabutylammonium bromide (TBAB or QBr) in the presence of potassium hydroxide, was carried out in a homogeneous solution using protic or aprotic solvent. Water in a small amount was added to dissolve the KOH. The role of KOH in the reaction was investigated by conducting several independent experiments, which included a timed reaction of CS2 and KOH, and further reaction of C6H4(NH2)2 in the presence or absence of TBAB catalyst in various sequential orders. A homogeneous reaction mechanism was proposed which supports the kinetic reaction model. The reactions were situated in protic and aprotic solvent and are described by zero-order and pseudo-first-order rate laws, respectively. The effect of the amount of KOH on the conversion of C6H4(NH2)2 was also studied. The reaction was greatly accelerated both in the presence of TBAB catalyst and KOH. Satisfactory explanations were provided for the enhanced catalytic reaction of CS2 and C6H4(NH2)2 by TBAB compared with KOH. The reaction rates in these processes are also discussed in detail.
Author
Ammonium Compounds; Carbon Disulfide; Potassium Hydroxides; Reaction Kinetics; Catalysis; Diamines; Phenyls; Amino Radical; Bromides

19990019362 Department of the Navy, Washington, DC USA
Lactic Acid Treatment of InP Materials
Ikossi-Anastasiou, Kiki, Inventor; Binari, Steve C., Inventor; Boos, J. B., Inventor; Kelner, Galina, Inventor; Jun. 30, 1998; 8p; In English; Supersedes US-Patent-Appl-SN-646537
Patent Info.: Filed 8 May 96,; US-Patent-Appl-SN-646,537; US-Patent-5,772,907
Report No.(s): AD-D019133; No Copyright; Avail: US Patent and Trademark Office, Microfiche
The use of lactic acid or its derivative in compositions to etch or polish materials containing indium phosphide results in treated surfaces that have reduced surface roughness compared to the surfaces treated with compositions devoid of lactic acid or its derivative is discussed. Indium phosphide surfaces treated with compositions containing lactic acid can have treated surfaces that are smooth or mirror-like, meaning that surface irregularities thereon are less than about 50 A.
DTIC
Indium Phosphides; Lactic Acid; Composite Materials; Surface Defects; Surface Finishing; Etching

19990019406 North Carolina State Univ., Dept. of Civil Engineering, Raleigh, NC USA
Interaction of Shock Waves with Materials Having Engineered Microstructures *Final Report*
Horie, Y.; May 25, 1998; 9p; In English
Contract(s)/Grant(s): DAAH04-94-G-0033
Report No.(s): AD-A358017; ARO-30210.1-EG; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Two computational techniques have been developed to model heterogeneous and non-equilibrium phenomena in reactive inorganic mixtures under high pressure shock wave loading. The first, known by its acronym VIR, is based on a continuum mixture theory and focused on modeling the interaction between chemical reaction and hydrodynamic flow. The second is a new computa-

tional tool called DM2 and is based on a discrete element approach. The second is primarily concerned with modeling of complex interactions of thermal, mechanical, and chemical processes at the particle level on the order of micrometers. Significant findings from numerical experiments by use of these techniques include: (1) a demonstration of condensed phase detonation, (2) a mechanistic description of shock-induced chemical reactions at the particle level, (3) a model demonstration of thermal explosion in shear bands, and (4) a confirmation of new deformation and failure response of metals under high-pressure shock compression.
DTIC
Shock Waves; Chemical Reactions; Computational Chemistry; Computer Programs; Powder (Particles); Deformation

19990019445 Department of the Navy, Washington, DC USA
Photoactivatable O-Nitrobenzyl Polyethylene Glycol-Silane for the Production of Patterened Biomolecular Arrays
Conrad, David W., Inventor; Golightley, Sara K., Inventor; Bart, John C., Inventor; Jun. 30, 1998; 9p; In English; Supersedes US-Patent-Appl-SN-797325, AD-D018383.
Patent Info.: Filed 10 Feb. 97,; US-Patent-Appl-SN-797,325; US-Patent-5,773,308
Report No.(s): AD-D019077; No Copyright; Avail: US Patent and Trademark Office, Microfiche

O-nitrobenzyl analogs that include a photoremovable protecting group that resists the nonspecific adsorption of biomolecules and a linking group for attaching the o-nitrobenzyl analog to a substrate are disclosed. Also disclosed are methods for using o-nitrobenzyl analogs for creating patterned arrays of anti-ligands on a substrate so that a plurality of bioassays can be conducted simultaneously. In particular, the compounds disclosed are o-nitrobenzyl-polyethylene glycol-silanes, wherein the silane group serves to attach the compound to a substrate, the polyethylene glycol group resists the nonspecific adsorption of biomolecules. The o-nitrobenzyl group provides a photoactivatable functionality that allows the polyethylene glycol group to be selectively removed upon exposure to UV radiation and be replaced by an anti-ligand.
DTIC
Nitrobenzenes; Bioassay; Polyethylenes; Biochemistry

19990019447 Drexel Univ., Dept. of Mechanical Engineering and Mechanics, Philadelphia, PA USA
High Pressure Preignition Chemistry of Hydrocarbons and Hydrocarbon Mixtures ***Final Report, 1 Jan. 1993 - 31 Jan. 1998***
Cernansky, N. P.; Miller, D. L.; Jul. 20, 1998; 21p; In English
Contract(s)/Grant(s): DAAH04-93-G-0042
Report No.(s): AD-A358087; ARO-30782.26-EG; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A research program to study the oxidation and ignition characteristics of hydrocarbon fuels and their mixtures has been conducted at Drexel University. The research program entailed mechanistic studies examining the oxidation chemistry of single-component hydrocarbons and ignition studies examining the overall ignition of pure single component fuels and fuel blends. Gas chromatography, gas chromatography/mass spectrometry, and gas chromatography/Fourier Transform Infrared Spectrometry (FTIR) analyses were used to determine the stable reaction intermediates and products associated with the preignition oxidation of these fuels. Development and application of spectroscopic diagnostics to permit in situ measurement of selected table and radical species also was successful. Associated in-house and collaborative modeling efforts were directed towards developing detailed and reduced chemical mechanisms that were used to model and predict relevant ignition and emission characteristics. We have investigated the oxidation of pure hydrocarbons and hydrocarbon blends in our various combustion systems, with emphasis on the effects of elevated pressure using our pressurized flow reactor (PFR) facility. Detailed experimental data were generated from the PFR for use in associated kinetic modeling work. We continued to develop and extend both detailed and reduced chemical kinetic models. Also, we collaborated with other laboratories to develop the situ measurement capabilities using degenerate four wave mixing (DFWM) and cavity ringdown laser absorption spectroscopy (CRLAS).
DTIC
Ignition; Hydrocarbon Fuels; Reaction Kinetics; Combustion; Spectroscopic Analysis; Oxidation

19990019450 Missouri Univ., Dept. of Physics, Columbia, MO USA
High Pressure Spectroscopic Studies of AlGaAs, GaAs, and II-VI and Other Semiconductors and Heterostructures ***Final Report, 1992 - 1998***
Chandrasekhar, M.; Jul. 12, 1998; 28p; In English
Contract(s)/Grant(s): DAAL03-92-G-0381
Report No.(s): AD-A358069; ARO-29682.20-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We summarize our work over the last five years on high pressure studies using optical techniques such as photoluminescence, photoreflectance and Raman scattering of GaAs/AlAs superlattices, polycrystalline and amorphous powder samples of pheny-

lene-type polymers and oligomers, ordered and disordered GaInP2, and ZnCdSe heterostructures. In order to modulate interatomic electronic interactions in the conventional semiconductors and to study both intrachain and interchain interactions in the conjugated polymers,these investigations were performed at hydrostatic pressures up to 70 kbar and in a temperature range of 20 to 300 K. We report characteristic changes of the emission spectrum which depend on both the molecular environment as well as the intramolecular bond configuration.
DTIC
Spectroscopic Analysis; Aluminum Gallium Arsenides; Phenyls; Heterojunction Devices; Gallium Arsenides; Amorphous Materials; Atomic Interactions; Spectroscopy; Photoluminescence

19990019452 Kansas State Univ., Dept. of Chemistry, Manhattan, KS USA
Nanoscale Metal Oxide Particles as New Materials for the Destructive Adsorption of Toxic Chemicals ***Final Report, 1993 - 1996***
Klabunde, Kenneth J.; May 1998; 15p; In English
Contract(s)/Grant(s): DAAH04-94-G-0328
Report No.(s): AD-A358066; ARO-31049.25-CH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Our interest has been in exploring and exploiting the enhanced surface chemical reactivates and huge surface areas of nanoparticles. This has led to the development of metal oxide nanoparticles as solid reagents that adsorb and simultaneously destroy toxic substances. The capacities of these destructive absorbents are high, and generally the toxic substance is ”mineralized” by extraction of the heteroatom (P, Cl, Br, N, S) and conversion to a innocuous metal salt; volatile organics are released as relatively non-toxic hydrocarbons or carbon oxides which could be used as a fuel source.
DTIC
Toxic Hazards; Adsorption; Composite Materials; Destruction; Absorbents; Metal Oxides; Chemical Reactions

19990019453 Rensselaer Polytechnic Inst., Dept. of Chemical Engineering, Troy, NY USA
Kinetics of Individual Combustion Reactions Over Wide Temperature Ranges, For Army Models ***Final Report, 1 Mar. 1995 - 28 Feb. 1998***
Fontijn, Arthur; May 1998; 9p; In English
Contract(s)/Grant(s): DAAH04-95-1-0098
Report No.(s): AD-A358064; ARO-33094.2-CH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The kinetics of reactions important for models of nitrate ester and nitramine propellant combustion, as well as a reaction of a potential halon replacement fire retardant, has been studied. The experiments, on isolated elementary reactions, have been made in a high-temperature reactor to yield rate coefficients k(T) in realistic temperature ranges. All k(T) given are in cu cm/ molecule/ sec. The N + CO2 right arrow NO + CO reaction has given an upper limit value of 5 x 10(exp -16) at 1140 K and lower values at lower temperatures. This suggests that the reverse reaction is unimportant in dark zones. This is the first investigation of an N-atom reaction at high temperatures by a photolytic technique. As a check on the method, the N + O2 right arrow NO + O reaction was studied. It yielded k(400-1220 K) = 2.0 x 10(exp -18) T2.15 exp(-2557 K/T), which in the region of temperature overlap (less than 910 K), is indistinguishable from the literature recommendation. The reaction O + N2O has two channels NO + NO and O2 + N2. From the measurements, with subsequent modeling, k(1370-3850 K) = 1.7 x 10(exp -10) exp(-14100 K/T) and k(1076-3340 K) = 6.1x10(exp -12) exp(-8000 K/T), were obtained for the respective channels. The latter is much larger than reviews suggest and will have a major impact on dark zone models. The ongoing work on O + CF3H has yielded the recommendation k(630-1330 K) = 3.3x10(exp -9) exp(-10663 K/T).
DTIC
Reaction Kinetics; Propellant Combustion; Nitramine Propellants; Nitrate Esters; Photolysis; Replacing

19990019493 Tokai Univ., School of Science, Tokyo, Japan
Determination of Nitro-Substituted Nitrogen Containing Cyclic Compounds by HPLC and Its Application to Analysis of the Combustion Gas of Heavy Oil
Kitahara, Takio, Tokai Univ., Japan; Takano, Jiro, Tokai Univ., Japan; Yasuoka, Takashi, Tokai Univ., Japan; Mitsuzawa, Shunmei, Tokai Univ., Japan; Proceedings of the School of Science of Tokai University; Mar. 1994; ISSN 0563-6795; Volume 29, pp. 91-100; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
An analytical method for Nitro substituted nitrogen containing cyclic compounds (NNCCs) by HPLC was systematically investigated for combustion gases from heavy oil. HPLC conditions for the determinations of NNCCs were studied with standard NNCCs, and the following conditions were found to be optimum for the analysis of NNCCs in the combustion gases of heavy oil; stationary phase: Shim pack ODS 11 (4.6 mm i.d. x 250 mm), mobile phase: acetonitrile water, flow rate: 0.7 ml/minute,

column temperature: 40 C, detector: Photo diode array UV VIS detector (190 approx. 900 nm). NNCCs containing soot is the combustion gases from 100 ml of heavy oil were collected on a glass filter of low volume sampler. After the NNCCs in the collection glass filter was supersonically extracted with methanol. The extract was concentrated to 2 ml under reduced pressure at 20 C.
Author
Nitrogen; Combustion Products; Oils; Gases; Numerical Analysis; Substitutes

19990019494 Tokai Univ., School of Science, Tokyo, Japan
Visualization of Electrode Reaction During Electrolysis of Aqueus Salt Solution
Matsuyama, Yukinori, Tokai Univ., Japan; Yasuoka, Takashi, Tokai Univ., Japan; Mitsuzawa, Shunmei, Tokai Univ., Japan; Proceedings of the School of Science of Tokai University; Mar. 1994; ISSN 0563-6795; Volume 29, pp. 101-108; In Japanese; Original contains color illustrations; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

During the electrolysis of aqueous electrolyte solution, electrode reaction often changes the pH around the electrodes. In the present experiment, anode and cathode solutions are separated by a salt bridge and color change of solutions by electrolysis is observed by the addition of pH indicator. Faraday's constant is estimated and reaction mechanism is presumed from the change of pH.
Author
Electrodes; Electrolysis; Visual Control; Salts

19990019553 NASA Marshall Space Flight Center, Huntsville, AL USA
The Effect of Solution Conditions on the Nucleation Kinetics of Tetragonal Lysozyme Crystals
Judge, Russell A., Alabama Univ., USA; Baird, James K., Alabama Univ., USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 7th; Crystallization of Biological Macromolecules, 3 May 1998, Granada, Spain; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An understanding of protein crystal nucleation rates and the effect of solution conditions upon them, is fundamental to the preparation of protein crystals of the desired size and shape for X-ray diffraction analysis. The ability to predict the effect of supersaturation, temperature, pH and precipitant concentration on the number and size of crystals formed is of great benefit in the pursuit of protein structure analysis. In this study we experimentally examine the effect of supersaturation, temperature, pH and sodium chloride concentration on the nucleation rate of tetragonal chicken egg white lysozyme crystals. In order to do this batch crystallization plates were prepared at given solution concentrations and incubated at three different temperatures over the period of one week. The number of crystals per well with their size and dimensions were recorded and correlated against solution conditions. Duplicate experiments indicate the reproducibility of the technique. Although it is well known that crystal numbers increase with increasing supersaturation, large changes in crystal number were also correlated against solution conditions of temperature, pH and salt concentration over the same supersaturation ranges. Analysis of these results enhance our understanding of the effect of solution conditions such as the dramatic effect that small changes in charge and ionic strength can have on the number of tetragonal lysozyme crystals that form and grow in solution.
Author
Proteins; Crystallization; X Ray Diffraction; Nucleation; Lysozyme; Sodium Chlorides

19990019664 Fractal Systems, Inc., Tampa, FL USA
Polymer Electrolyte Through Enzyme Catalysis for High Performance Lithium-Ion Batteries ***Final Report, 16 Apr - 16 Oct. 1998***
Aldissi, M.; Oct. 16, 1998; 29p; In English
Contract(s)/Grant(s): DAAN02-98-P-8454
Report No.(s): AD-A356039; A002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project was initiated with the idea of using alternative means for the synthesis of polymer electrolytes with high yield, efficiency and ease of the processes used. Enzyme catalysis meets these criteria, and was used for this purpose by incorporating amorphous segments of poly (ethylene glycol), PEG, onto a monomer which can be easily polymerized via enzyme catalysis. The goal was to lock the PEG segments onto a polymer backbone such that chemical and electrochemical stability is achieved. to accomplish this task, we have substituted the basic monomer with PEG segments of various molecular weights. We have successfully polymerized such systems in aqueous media and characterized them. Characterization of the polymers synthesized in this effort yielded very encouraging results as far as ionic conductivity goes, approaching an unprecedented room-temperature value of 0.001 S/cm. The various characterization efforts have indicated that although the glass transition temperature (Tg)is low, the melt and decomposition temperatures are high enough for use of such materials in lithium ion batteries in a wide temperature range.

The low Tg is due to the high mobility of the PEG component, and the good thermal stability is due to the carrier polymer obtained via enzyme catalysis. However, we went beyond this point and prepared a proprietary formulation, which takes advantage of the collective properties of the different components, and where the PEG segments become much longer through this process, without compromising their much-needed amorphous character. A fully solid state system with high fluidity of the PEG segments has resulted. We have also experimented with novel ionic gels based on our polymers without the incorporation of solvents as is usually the case in other efforts which employ propylene carbonate and the likes. Such materials are highly porous, with a strong ionic character, and would be developed further in the Phase II program.
DTIC
Synthesis (Chemistry); Electrolytes; Electric Batteries; Polymerization; Amorphous Materials; Metal Ions; Lithium; Monomers; Propylene

19990019699 Hampton Univ., Dept. of Chemistry, VA USA
Tristimulus Colorimetry Measurements of Thermochromic Temperature Sensitive Paints
Darby, Willie L., Hampton Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 56; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The measurement of heat transfer is a very important research tool used in the study of thermal properties of the surfaces of various materials. to this end, liquid crystal techniques, infrared imaging and thermographic phosphors have been used. Recently considerable attention has been given to temperature sensitive paints. The temperature sensitivity of the paints currently in use is based on fluorescence. The development of temperature sensing paints based on thermochromic transition metal complexes would add a new source of TSP's. The transition temperature (the temperature at which the color change occurs) is dependent on the transition metal used and the ligands and counterions attached to it. The thermochromism has been attributed to temperature- dependent changes in the stereochemistry of the complex and depends on the nature of the central metal ion and the ligand. Colorimetry is defined as the science of the quantitative measurement of color. Color can be described by three characteristics: hue, value, and chroma. Tristimulus colorimetry is a method used to measure changes in the three color characteristics, therefore it can be used to detect slight changes in "color". There are several methods used to arrange colors in some orderly fashion. These arrangements are called color spaces. The color space used in this project was the CIELab. The temperature dependent color changes of the complexes, bis(N,N'- diethylethylenediamine)copper perchlorate, [Cu(dieten)(sub 2)](ClO4)(sub 2), bis(N,N'- diethylethylenediamine)nickel perchlorate,[Ni(dieten)21-(ClO4)(sub 2) and bis(N,N'- diethylethylenediamine)nickel bromide, (Ni(dieten)(sub 2)]Br2 were measured. "Paints" were prepared by mixing the above complexes with an appropriate polymer. The tristimulus values of these 'paints" were measured using a MacBeth "Color Eye" 580 Colorimeter. The temperature was varied using a copper topped hot plate fitted Aith a West 2810 Temperature Controller. It was determined that there is a correlation between the tristimulus values and temperature. Therefore, colorimetry can be used to evaluate temperatures of thermochromic paints.
Author
Stereochemistry; Transition Temperature; Transition Metals; Thermodynamic Properties; Paints; Metal Plates; Liquid Crystals; Heat Measurement; Complex Compounds; Colorimetry

19990019700 Old Dominion Univ., Dept. of Electrical and Computer Engineering, Norfolk, VA USA
Line Narrowing Parameter Measurement by Modulation Spectroscopy *Final Report*
Dharamsi, Amin N., Old Dominion Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 57-58; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Accurate Characterization of Oxygen A-Band Line Parameters by Wavelength Modulation Spectroscopy with tunable diode lasers is an ongoing research at Old Dominion University, under sponsorship from NASA Langley research Center. The work proposed here will be undertaken under the guidance of Dr. William Chu and Dr. Lamont Poole of the Aerosol Research Branch at NASA Langley-Research Center in Hampton, Virginia. The research was started about two years ago and utilizes wavelength modulation absorption spectroscopy with higher harmonic detection, a technique that we developed at Old Dominion University, to obtain the absorption line characteristics of the Oxygen A-band rovibronic lines. Accurate characterization of this absorption band is needed for processing of data that will be obtained in experiments such as the NASA Stratospheric Aerosol and Gas Experiment III (SAGE III) as part of the US Mission to Planet Earth. The research work for Summer Fellowship undertook a measurement of the Dicke line-narrowing parameters of the Oxygen A-Band lines by using wavelength modulation spectroscopy. Our previous theoretical results had indicated that such a measurement could be done sensitively and in a convenient fashion by using this type of spectroscopy. In particular, theoretical results had indicated that the signal magnitude would depend on pressure in

a manner that was very sensitive to the narrowing parameter. One of the major tasks undertaken during the summer of 1998 was to establish experimentally that these theoretical predictions were correct. This was done successfully and the results of the work are being prepared for publication. Experimental Results were obtained in which the magnitude of the signal was measured as a function of pressure, for various harmonic detection orders (N = 1, 2, 3, 4, 5). A comparison with theoretical results was made, and it was shown that the agreement between theory and experiment was very good. More importantly, however, it was shown that the measurement was yielded a very sensitive technique for obtaining the narrowing parameter that describes the deviation of Oxygen A-band lines from the Voigt profile. In particular, it was seen that the best fits were obtained consistently when the narrowing parameter value used was 0.022 1/cm, 1/Atm, Previous work, upon which the current work was based has resulted in several accurate measurements of properties of particular lines of the Oxygen A band. For example, this work has resulted in the measurement of the collision cross sections of several lines including the RQ(13,14) and the RR(15,15) lines. A major achievement of achievement of the work was also the demonstration that the technique we have developed can accurately probe the structure of the absorption lineshape function. In particular, the method we have developed is very well suited for experimentally probing the characteristics of lines in their wings. This work was accepted for publication in the Journal of Applied Physics, and is scheduled to appear in the December 15, 1998 issue.
Author
Absorption Spectroscopy; Tunable Lasers; Semiconductor Lasers; Particle Collisions; Line Spectra

19990019802 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA
Laminar Soot Processes (LSP) Experiment
Faeth, Gerard M., Michigan Univ., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 9-21; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The structure and soot properties of nonbuoyant soot-containing laminar diffusion flames were studied at microgravity within an orbiting space shuttle. Test conditions included hydrocarbon-fueled laminar jet diffusion flames burning in still air at pressures of 35-130 kPa. Measurements included luminous flame shape, soot volume fraction distributions, soot structure, soot temperature distributions, gas temperature distributions beyond the flame tip, and flame radiation. Present flames were larger and emitted soot more readily than comparable flames observed during ground-based microgravity experiments due to closer approach to steady conditions and reduced gravitational disturbances. The observations established new methods for predicting luminous flame shapes, new imaging methods for measuring soot concentrations when soot volume fractions are small (less than 1 ppm), and new information about the laminar-smoke-point properties of nonbuoyant flames. The results also support the validity of laminar flamelet concepts for soot properties in nonbuoyant diffusion flames that could substantially simplify modeling of practical nonbuoyant flames.
Author
Laminar Flow; Jet Flow; Soot; Smoke; Microgravity; Gas Temperature; Flame Propagation; Diffusion Flames; Concentration (Composition); Combustion

19990019803 NASA Lewis Research Center, Cleveland, OH USA
Structure of Flame Balls at Low Lewis-Number (SOFBALL): Preliminary Results From the STS-83 and STS-94 Space Flight Experiments
Ronney, Paul D., University of Southern California, USA; Wu, Ming-Shin, University of Southern California, USA; Pearlman, Howard G., University of Southern California, USA; Weiland, Karen J., NASA Lewis Research Center, USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 24-35; In English; Also announced as 19990019800
Contract(s)/Grant(s): NAG3-1242; NAG3-1523; NAG3-2124; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Results from the Structure of Flame Balls At Low Lewis-number (SOFBALL) space flight experiment conducted on the MSL-1 Space Shuttle missions are reported. Several new insights were obtained, including: much lower buoyancy-induced drift speed than anticipated pre-flight; repulsion of adjacent flame balls due to their mutual interaction; remarkable sensitivity of flame balls to small accelerations resulting from Orbiter attitude control maneuvers; and very similar net heat release for all flame balls in all mixtures tested. Comparison of experimental results to computational predictions reveals limitations in current models of H2-02 chemistry for very lean mixtures. It is discussed how the results of these space experiments may provide an improved understanding of the interactions of the two most important phenomena in combusting materials, namely chemical reaction and transport processes, in the unequivocally simplest possible configuration.
Author
Spaceborne Experiments; Lewis Numbers; Heat Transfer; Flames; Chemical Reactions; Buoyancy; Space Manufacturing

19990019804 Northwestern Univ., Dept. of Material Science and Engineering, Evanston, IL USA

Coarsening in Solid-Liquid Mixtures (CSLM)

Voorhees, Peter W., Northwestern Univ., USA; Alkemper, J., Northwestern Univ., USA; Snyder, V., Northwestern Univ., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 37-43; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The CSLM experiment examines the dynamics of particle-coarsening in a two-phase mixture. The evolution of the average particle size and particle size distribution of dispersed Sn-particles in a Pb-Sn liquid was measured with respect to time. Samples were heat treated at 185 C where a mixture of liquid Pb-Sn and Sn-rich solid exist with varying volume fractions of solid. Initially, the solid was present in the form of small, dispersed particles with average sizes of ca. 10 microns. Presented here are the results of the samples from the MSL-1 mission which have been analyzed at this time. Initially we concentrated our analysis on samples with 10% solid volume fraction, only a few samples with other volume fractions have been analyzed. It is found that the kinetics of the process follow the theoretical predictions within the uncertainties of the materials parameters. We also found an increasing coarsening rate with increasing volume fraction which is in agreement with existing theories. A full evaluation of the existing theories based on the results of the CSLM experiments is not possible at this point.

Author

Spaceborne Experiments; Particle Size Distribution; Concentration (Composition); Space Shuttle Missions; Space Transportation System

19990019805 NASA Lewis Research Center, Cleveland, OH USA

Droplet Combustion Experiment (DCE)

Haggard, John B., Jr., NASA Lewis Research Center, USA; Nayagan, Vedha, NASA Lewis Research Center, USA; Dryer, Frederick L., Princeton Univ., USA; Williams, Forman A., California Univ., San Diego, USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 45-57; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The first space-based experiments were performed on the combustion of free, individual liquid fuel droplets in oxidizing atmospheres. The fuel was heptane, with initial droplet diameters ranging about from 1 mm to 4 mm. The atmospheres were mixtures of helium and oxygen, at pressures of 1.00, 0.50 and 0.25 bar, with oxygen mole fractions between 20% and 40%, as well as normal Spacelab cabin air. The temperatures of the atmospheres and of the initial liquid fuel were nominally 300 K. A total of 44 droplets were burned successfully on the two flights, 8 on the shortened STS-83 mission and 36 on STS-94. The results spanned the full range of heptane droplet combustion behavior, from radiative flame extinction at larger droplet diameters in the more dilute atmospheres to diffusive extinction in the less dilute atmospheres, with the droplet disappearing prior to flame extinction at the highest oxygen concentrations. Quasisteady histories of droplet diameters were observed along with unsteady histories of flame diameters. New and detailed information was obtained on burning rates, flame characteristics and soot behavior. The results have motivated new computational and theoretical investigations of droplet combustion, improving knowledge of the chemical kinetics, fluid mechanics and heat and mass transfer processes involved in burning liquid fuels.

Author

Spacelab; Soot; Reaction Kinetics; Mass Transfer; Liquid Fuels; Heptanes; Gas Pressure; Gas Mixtures; Fluid Mechanics; Flames; Drops (Liquids); Combustion; Burning Rate

19990019814 NASA Lewis Research Center, Cleveland, OH USA

Fiber Supported Droplet Combustion-2 (FSDC-2)

Colantonio, Renato, NASA Lewis Research Center, USA; Dietrich, Daniel, NASA Lewis Research Center, USA; Haggard, John B., Jr., NASA Lewis Research Center, USA; Nayagan, Vedha, NASA Lewis Research Center, USA; Dryer, Frederick L., Princeton Univ., USA; Shaw, Benjamin D., California Univ., USA; Williams, Forman A., California Univ., San Diego, USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 141-155; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Experimental results for the burning characteristics of fiber supported, liquid droplets in ambient Shuttle cabin air (21% oxygen, 1 bar pressure) were obtained from the Glove Box Facility aboard the STS-94/MSL-1 mission using the Fiber Supported Droplet Combustion - 2 (FSDC-2) apparatus. The combustion of individual droplets of methanol/water mixtures, ethanol, ethanol/water azeotrope, n-heptane, n-decane, and n-heptane/n-hexadecane mixtures were studied in quiescent air. The effects of low velocity, laminar gas phase forced convection on the combustion of individual droplets of n-heptane and n-decane were investigated and interactions of two droplet-arrays of n-heptane and n-decane droplets were also studied with and without gas phase convective flow. Initial diameters ranging from about 2mm to over 6mm were burned on 80-100 micron silicon fibers. In addition to phenomenological observations, quantitative data were obtained in the form of backlit images of the burning droplets, overall flame

images, and radiometric combustion emission measurements as a function of the burning time in each experiment. In all, 124 of the 129 attempted experiments (or about twice the number of experiments originally planned for the STS-94/MSL-1 mission) were conducted successfully. The experimental results contribute new observations on the combustion properties of pure alkanes, binary alkane mixtures, and simple alcohols for droplet sizes not studied previously, including measurements on individual droplets and two-droplet arrays, inclusive of the effects of forced gas phase convection. New phenomena characterized experimentally for the first time include radiative extinction of droplet burning for alkanes and the ”twin effect” which occurs as a result of interactions during the combustion of two-droplet arrays. Numerical modeling of isolated droplet combustion phenomenon has been conducted for methanol/water mixtures, n-heptane, and n-heptane/n-hexadecane mixtures, and results compare quantitatively with those found experimentally for methanol/water mixtures. Initial computational results qualitatively predict experimental results obtained for isolated n-heptane and n-heptane/n-hexadecane droplet combustion, although the effects of sooting are not yet included in the modeling work. Numerical modeling of ethanol and ethanol/water droplet burning is under development. Considerable data remain to be fully analyzed and will provide a large database for comparisons with further numerical and analytical modeling and development of future free droplet experiments aboard space platforms.
Author
Combustion Chemistry; Combustion Physics; Combustion Products; Convective Flow; Forced Convection; Space Transportation System; Soot; Reaction Kinetics

19990019818 NASA Lewis Research Center, Cleveland, OH USA
The Dynamics of Disorder-Order Transition in Hard Sphere Colloidal Dispersions
Chaikin, Paul M., Princeton Univ., USA; Zhu, Jixiang, Princeton Univ., USA; Cheng, Zhengdong, Princeton Univ., USA; Phan, See-Eng, Princeton Univ., USA; Russel, William B., Princeton Univ., USA; Lant, Christian T., NASA Lewis Research Center, USA; Doherty, Michael P., NASA Lewis Research Center, USA; Meyer, William V., NASA Lewis Research Center, USA; Rogers, Richard, NASA Lewis Research Center, USA; Cannell, D. S., California Univ., USA; Ottewill, R. H., Bristol Univ., UK; Microgravity Science Laboratory (MSL-1); November 1998, pp. 186-195; In English; Also announced as 19990019800
Contract(s)/Grant(s): NAG3-1762; NGT3-52301; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Physics of Hard Spheres Experiment (PHaSE) seeks a complete understanding of the entropically driven disorder-order transition in hard sphere colloidal dispersions. The light scattering instrument designed for flight collects Bragg and low angle light scattering in the forward direction via a CCD camera and performs conventional static and dynamic light scattering at 10-160 deg. through fiber optic cables. Here we report on the kinetics of nucleation and growth extracted from time-resolved Bragg images and measurements of the elastic modulus of crystalline phases obtained by monitoring resonant responses to sinusoidal forcing through dynamic light scattering. Preliminary analysis of the former indicates a significant difference from measurements on the ground, while the latter confirms nicely laboratory experiments with the same instrument and predictions from computer simulations.
Author
Computerized Simulation; Crystallinity; Fiber Optics; Kinetics; Light Scattering; Modulus of Elasticity

19990019837 Stanford Univ., Center for Integrated Turbulence Simulations, Stanford, CA USA
Toward the Large Eddy Simulation of Gas Turbine Spray Combustion Processes
Oefelein, Joseph C., Stanford Univ., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 33-34; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

As part of the Department of Energy Accelerated Strategic Computing Initiative (ASCI), an effort is currently underway to develop improved numerical methods and subgrid-scale models suitable for performing highly resolved large-eddy-simulations of multiphase combustion processes in gas turbine combustors. The objective is to provide simulation methodologies that will enable a new paradigm for the design of advanced systems in which turbulent multiphase combustion plays a controlling role. Key components of the program include the development of general theories and models, model validation, and the concurrent development of high performance parallel algorithms which support the implementation of massively parallel large-scale simulations. Beginning in the point-particle ideal limit, a hierarchy of three fundamental systems are being investigated in swirling coannular dump combustor configurations. These are: 1) particle-laden systems; 2) binary fuel-air systems; and 3) reacting multicomponent systems. The focus of respective investigations are: 1) momentum coupling and subgrid-scale modulation effects; 2) mass and energy coupling and subgrid-scale scalar mixing; and 3) multiphase combustion models. Here, an overview of the objectives, approach, current status, and future directions will be given with emphasis placed on model development, accuracy, and parallel implementation.
Author
Exhaust Flow Simulation; Large Eddy Simulation; Parallel Processing (Computers); Mathematical Models

19990019866 NASA Lewis Research Center, Cleveland, OH USA

NCC: A Multidisciplinary Design/Analysis Tool for Combustion Systems

Liu, Nan-Suey, NASA Lewis Research Center, USA; Quealy, Angela, DYNACS Engineering Co., Inc., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 183-188; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A multi-disciplinary design/analysis tool for combustion systems is critical for optimizing the low-emission, high-performance combustor design process. Based on discussions between NASA Lewis Research Center and the jet engine companies, an industry-government team was formed in early 1995 to develop the National Combustion Code (NCC), which is an integrated system of computer codes for the design and analysis of combustion systems. NCC has advanced features that address the need to meet designer's requirements such as "assured accuracy", "fast turnaround", and "acceptable cost". The NCC development team is comprised of Allison Engine Company (Allison), CFD Research Corporation (CFDRC), GE Aircraft Engines (GEAE), NASA Lewis Research Center (LeRC), and Pratt & Whitney (P&W). This development team operates under the guidance of the NCC steering committee. The "unstructured mesh" capability and "parallel computing" are fundamental features of NCC from its inception. The NCC system is composed of a set of "elements" which includes grid generator, main flow solver, turbulence module, turbulence and chemistry interaction module, chemistry module, spray module, radiation heat transfer module, data visualization module, and a post-processor for evaluating engine performance parameters. Each element may have contributions from several team members. Such a multi-source multi-element system needs to be integrated in a way that facilitates inter-module data communication, flexibility in module selection, and ease of integration.

Derived from text

Multidisciplinary Design Optimization; Combustion Chambers; Applications Programs (Computers); Computerized Simulation; Parallel Programming

19990020828 NASA Lewis Research Center, Cleveland, OH USA

Second Flight of the Zeno Experiment on USMP-3

Gammon, Robert W., Maryland Univ., USA; Shaumeyer, J. N., Maryland Univ., USA; Briggs, Matthew E., Maryland Univ., USA; Boukari, Hacene, Maryland Univ., USA; Gent, David, Maryland Univ., USA; Wilkinson, R. Allen, NASA Lewis Research Center, USA; Third USA Microgravity Payload: One Year Report; November 1998, pp. 15-37; In English; Also announced as 19990020826

Contract(s)/Grant(s): NAG3-25370; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The second flight of the Zeno experiment in the USMP-3 flight has shown successful control of density perturbations near the window surfaces. These density changes were demonstrated to be arising from the rate of temperature change in the sample cell during the flight. These effects could be controlled by using decreasing ramp rates as Tc was approached. The cell window interference was carefully recorded to provide data about the phase of the interference close to the critical point and the effective window reflectivity. Correlograms were recorded from 500 mili K down to 2 mili K at 24 temperatures, 383 correlograms in all. The efforts to get closer were prevented by a long (greater than two week time constant) decay of a 1.3% density error caused by local heating from the 17 micro W laser beam. The phase boundary was located with unprecedented precision of +/- 2O micro K. The complete experiment sequence was done with ground commanding and uploaded script files, bypassing the original autonomous-mode program sequence.

Author

Interferometers; Temperature Effects; Xenon; Critical Point; Density (Mass/Volume); Spaceborne Experiments

19990020831 NASA Lewis Research Center, Cleveland, OH USA

Forced Flow Flame Spreading Test: Preliminary Findings From the USMP-3 Shuttle Mission

Sacksteder, Kurt R., NASA Lewis Research Center, USA; Greenberg, Paul S., NASA Lewis Research Center, USA; Pettegrew, Richard D., National Center for Microgravity Research on Fluids and Combusiton, USA; Tien, James S., Case Western Reserve Univ., USA; Ferkul, Paul V., National Center for Microgravity Research on Fluids and Combusiton, USA; Shih, Hsin-Yi, Case Western Reserve Univ., USA; Third USA Microgravity Payload: One Year Report; November 1998, pp. 83-96; In English; Also announced as 19990020826; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The Forced Flow Flame spreading Test (FFFT) is a study of flame spreading over solid fuels in very low-speed air flows. The FFFT experiment is part of research entitled Solid Inflammability Boundary at Low Speeds, (SIBAL) intended for operations on the Space Station. In the FFFT experiment, a series of 15 experiments conducted aboard the space shuttle during the USA Microgravity Payload (USMP-3) mission provided information about the structure and spreading characteristics of flames in low-speed, concurrent flows. The test samples included flat sheets of cellulose and cast cylinders of cellulose, burned in air at velocities of approximately 1 to 8 cm/sec. The test results have been successfully compared to theoretical predictions of the SIBAL program,

a fundamentally based numerical simulation of concurrent flow flame spread. Additionally, some guidance for the design characteristics of the SIBAL flight experiment have been obtained including some verification of the theoretical predictions of flame size versus the required size of the SIBAL flow duct, and the effect of the presence of thermocouples in the vicinity of near-limit flames in microgravity.
Author
Cellulose; Flame Propagation; Flames; Low Speed; Microgravity; Physics and Chemistry Experiment In Space

19990020832 NASA Lewis Research Center, Cleveland, OH USA
Radiative Ignition and Transition to Spread Investigation (RITSI)
Kashiwagi, Takashi, National Inst. of Standards and Technology, USA; Olson, Sandra L., NASA Lewis Research Center, USA; Third USA Microgravity Payload: One Year Report; November 1998, pp. 97-117; In English; Also announced as 19990020826
Contract(s)/Grant(s): NASA Order C-32001-R; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A total of 25 experiments was conducted in the Glovebox Facility on the Third USA Microgravity payload (USMP3) mission to study the behavior of both flaming and smoldering ignition events, the transition from ignition to the flame/smoldering spread, and the flame/smoldering growth pattern in air. Twenty one of the 25 experiments were flaming experiments and the remainder were smoldering experiments. Ignition was initiated by a heated wire across a thermally thin filter paper in the middle of the sample for the two-dimensional configuration and by a focused beam from a halogen/tungsten lamp at the center of the sample for the three-dimensional configuration. The external air flow velocity was varied from 0 cm/s to 6.5 cm/s. The ignition and subsequent flame spread events were recorded by a video camera, a 35 mm camera, and 6 thermocouples (2 in the gas phase and 4 in the sample). The results indicate that non-piloted radiative ignition of the paper by external thermal radiation tends to occur more easily than in normal gravity. In the two-dimensional configuration, the transition from ignition to downstream flame spread never occurred; only the transition to upstream spread took place. In the three-dimensional configuration, a char growth pattern emerged in the shape of a fan, with the ignited area as the center of the fan and the fan spreading in the upstream direction. The internal angle of the fan increased with an increase in external flow velocity (higher flow velocity gave a more opened fan pattern). At an external flow velocity of 5 cm/s, the flame was horseshoe-shaped and the char pattern became an elongated semicircle toward upstream. It appears that the peak upstream flame spread rate was reached at a higher external velocity than for the two-dimensional flame front. Flame spread much faster along open edges of the sample paper than along the sample face, presumably due to there being larger supply of oxygen and energy feedback at the open edges than at the surface. These results indicate the possible importance of the effect of the flame front shape such as the curvature of the flame front on spread rate and flame strength. A complex, unexpected finger-shaped char growth pattern was observed during the smoldering experiment. Higher external flow velocity increased the number of localized smoldering fronts, of the char fingers they left behind, and frequency of bifurcations from the fingers. At present, it is not clear what caused such a complex char growth pattern.
Author
Charring; Flame Propagation; Flames; Microgravity; Oxygen; Smoldering; Spreading; Spaceborne Experiments; Firing (Igniting); Paper (Material)

19990020833 NASA Lewis Research Center, Cleveland, OH USA
Comparative Soot Diagnostics: 1 Year Report
Urban, David L., NASA Lewis Research Center, USA; Griffin, DeVon W., NASA Lewis Research Center, USA; Gard, Melissa Y., NASA Marshall Space Flight Center, USA; Third USA Microgravity Payload: One Year Report; November 1998, pp. 119-134; In English; Also announced as 19990020826; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The motivation for the Comparative Soot Diagnostics (CSD) experiment lies in the broad practical importance of understanding combustion generated particulate. Depending upon the circumstances, particulate matter can affect the durability and performance of combustion equipment, can be a pollutant, can be used to detect fires and, in the form of soot, can be the dominant source of radiant energy from flames. Bright sooty fires are desirable for efficient energy extraction in furnaces and power equipment. In contrast, soot-enhanced radiation is undesirable in many propulsion systems (e.g. jet engines). The non-buoyant structure of most flames of practical interest (turbulent) makes understanding of soot processes in low gravity flames important to our ability to predict fire behavior on earth. These studies also have direct applications to fire safety in human-crew spacecraft, since smoke is the indicator used for automated detection in current spacecraft. In addition, recent tests conducted on MIR showed that a candle in a truly quiescent spacecraft environment can burn for tens of minutes. Consequently, this test and many earlier tests have demonstrated that fires in spacecraft can be considered a credible risk. In anticipation of this risk, NASA has included fire detectors on Skylab, smoke detectors on the Space Shuttle (STS), and smoke detectors in the design for the International Space Station (ISS). In the CSD experiment, these smoke detectors were tested using, quasi-steady, low-gravity, particulate generating materials. Samples of the particulate were also obtained from these low-gravity sources. This experiment provides the first such measurements

aimed toward understanding of soot processes here on earth and for the testing and design of advanced spacecraft smoke detection systems. This paper describes the operation and preliminary results of the CSD experiment which was was conducted in the Mid-deck Glovebox Facility (MGBX) on USMP-3. The objectives of CSD are to examine the particulate emission from a variety of pyrolyzing and combusting sources and to quantify the performance of several particulate-sensing diagnostic techniques. This paper presents the results of the microgravity portion of the CSD experiment. The results include the temporal response of the detectors and average sizes of the primary and aggregate particles captured on the thermophoretic probes. Complete assessment of the microgravity data and its combination with the normal-gravity data are still in process.
Derived from text
Detection; Fires; Flames; Microgravity; Particulates; Smoke; Smoke Detectors; Soot; Spaceborne Experiments

26
METALLIC MATERIALS

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

19990019394 NASA Lewis Research Center, Cleveland, OH USA
BFS Simulation and Experimental Analysis of the Effect of Ti Additions on the Structure of NiAl
Bozzolo, Guillermo, Ohio Aerospace Inst., USA; Noebe, Ronald D., NASA Lewis Research Center, USA; Ferrante,John, NASA Lewis Research Center, USA; Garg, Anita, AYT Corp., USA; Honecy, Frank S., NASA Lewis Research Center, USA; Amador, Carlos, Universidad Nacional Autonoma de Mexico, Mexico; January 1999; 70p; In English
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TM-1999-208892; NAS 1.15:208892; E-11478; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Bozzolo-Ferrante-Smith (BFS) method for alloy energetics is applied to the study of ternary additions to NiAl. A description of the method and its application to alloy design is given. Two different approaches are used in the analysis of the effect of Ti additions to NiAl. First, a thorough analytical study is performed, where the energy of formation, lattice parameter and bulk modulus are calculated for a large number of possible atomic distributions of Ni, Al and Ti. Substitutional site preference schemes and formation of precipitates are thus predicted and analyzed. The second approach used consists of the determination of temperature effects on the final results, as obtained by performing a number of large scale numerical simulations using the Monte Carlo-Metropolis procedure and BFS for the calculation of the energy at every step in the simulation. The results indicate a sharp preference of Ti for Al sites in Ni-rich NiAl alloys and the formation of ternary Heusler precipitates beyond the predicted solubility limit of 5 at. % Ti. Experimental analysis of three Ni-Al-Ti alloys confirms the theoretical predictions.
Author
Alloying; Additives; Ternary Alloys; Intermetallics; Nickel Aluminides; Titanium Alloys; Computerized Simulation; Monte Carlo Method; Temperature Effects

19990019405 Colorado School of Mines, Center for Welding Joining and Coatings Research, Golden, CO USA
The Effect of Welding Consumables on Arc Welding Process Control and Weld Metal Structure and Properties *Final Report, 1 Jan. 1995 - 31 Mar. 1998*
Olson, David L.; Frost, Robert H.; Jun. 15, 1998; 29p; In English
Contract(s)/Grant(s): DAAH04-95-1-0135
Report No.(s): AD-A357854; CSM-MT-CWJCR-098-014; ARO-34040.9-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The effect of welding consumables on arc welding process control and weld metal structure and properties was investigated. The first study demonstrated the potential use of exothermically (thermite) assisting steel arc welding consumables for field repair welding. Both shielded metal arc (SMA) and flux cored arc (FCA) consumables were prepared to allow generation of chemical energy to supplement electrical energy during welding, allowing for welding with smaller or even no external power sources. Work is in progress to make these consumables both exothermic and self-shielding. These research studies continued with issues related to weld metal microstructure control. Weld metal aluminum grain refining is being investigated to improve the weldability of aluminum alloys, Grain refiners, which are being introduced through the metal cored welding consumables, were selected based on an understanding of the innoculant dissolution kinetics, and weld metal solidification behavior. Also, the role of shielding gas

oxygen on the welding pool chemistry was studied. Finally, a project demonstrating the ability to use magnetic measurements to monitor weld metal phase changes was performed.
DTIC
Mechanical Properties; Arc Welding; Weldability; Titanium Alloys; Aluminum Alloys

19990019483 NASA Marshall Space Flight Center, Huntsville, AL USA
High-Strength Aluminum Casting Alloy for High-Temperature Applications (MSFC Center Director's Discretionary Fund Final Project No. 97-10) ***Final Report***
Lee, J. A., NASA Marshall Space Flight Center, USA; December 1998; 24p; In English
Report No.(s): NASA/TM-1998-209004; NAS 1.15:209004; M-902; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new aluminum-silicon alloy has been successfully developed at Marshall Space Flight Center that has a significant improvement in tensile strength at elevated temperatures (550 to 700 F). For instance, the new alloy shows in average tensile strength of at least 90 percent higher than the current 390 aluminum piston alloy tested at 500 F. Compared to conventional aluminum alloys, automotive engines using the new piston alloy will have improved gas mileage, and may produce less air pollution in order to meet the future U.S. automotive legislative requirements for low hydrocarbon emissions. The projected cost for this alloy is less than $0.95/lb, and it readily allows the automotive components to be cast at a high production volume with a low, fully accounted cost. It is economically produced by pouring molten metal directly into conventional permanent steel molds or die casting.
Author
Aluminum Alloys; Automobiles; Cast Alloys; High Strength Alloys; High Temperature; Tensile Strength; Air Pollution; Tensile Properties

19990019606 Fukui Univ., Faculty of Engineering, Japan
Exoelectron Emission from Inconel Plates Scratched with a Sandpaper
Aoki, Masayoshi, Fukui Univ., Japan; Nishikawa, Tuguo, Fukui Univ., Japan; Nawa, Hidemi, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 01, 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 251-254; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

TSEE/OSEE from Inconel (Ni-alloy) plates scratched with a sandpaper is measured with methan-flow-counter within 2 min after scratching. TSEE is strong from a specimen scratched with a rough emery-paper (# 5) than with a fine one (# 60), while OSEE is very week from the same specimen and it continues for long time. We consider that thermally stimulation and optically stimulation differ in action for exoelectron emission. TSEE is very week from a specimen put 30 min in air after scratching. It seems that the early oxygenation process on a new scratched surface influences TSEE/OSEE.
Author
Inconel (Trademark); Electron Emission; Metal Plates

19990019631 NASA Marshall Space Flight Center, Huntsville, AL USA
Metastable Demixing of Supercooled Cu-Co and Cu-Fe Alloys in an Oxide Flux
Li, D., NASA Marshall Space Flight Center, USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Rathz, T. J., Alabama Univ., USA; Williams, G., Alabama Univ., USA; 1998; 1p; In English; TMS, 15-19 Feb. 1998, San Antonio, TX, USA; Sponsored by Metallurgical Society, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A systematic study on the liquid separation in supercooled Cu-Co and Cu-Fe alloys was performed using a melt fluxing which permits high supercooling to be achieved. Moreover, this method renders it possible to directly measure binodal temperatures and establish metastable liquid miscibility gap (LMG). All phase-separated samples at compositions ranging from 10 to 80 wt pct Co or to 83 wt pct Fe were found to exhibit droplet-shaped morphologies, in spite of various droplet distributions. Uniformly dispersed microstructures were obtained as the minority component was less than 20 vol.%; while beyond this percentage, serious coarsening was brought about. Calculations of the miscibility gap in the Cu-Co system and Stokes movement velocity of Co and Fe droplets in Cu matrix were made to analyze the experimental results.
Author
Metastable State; Copper Alloys; Iron Alloys; Cobalt; Supercooling; Microstructure; Oxides

19990019763 Missouri Univ., Rolla, MO USA

Effects of Surface Active Elements on Pool Convection and Properties of the Welds ***Final Report, 1 Apr. 1995 - 31 Mar. 1998***

Tsai, Hai-Lung; Jun. 15, 1998; 27p; In English; Original contains color plates

Contract(s)/Grant(s): DAAH04-95-1-0136

Report No.(s): AD-A357790; ARO-33659.1-MS; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is well known that surface tension force dominates the fluid flow in the weld pool (Marangoni effect), influencing weld penetration and properties of the weld. In fact, it has been recently reported by EWI that when a thin surface active element rich layer is coated to the surface of the metal, more than several times of penetration depth was increased for a Gas Tungsten Arc Welding (GTAW) process. The objective of the present study is to systematically study the effects of surface active elements for both GTAW and GMAW (Gas Metal Arc Welding), not only on fluid flow patterns and weld penetration, but also on the distribution of surface active elements in the weld pool and possible formation of defects. Among the many accomplishments achieved by the project, the most significant one is that mathematical models were developed for the first time having the capabilities to simulate the droplet impinging process and the effects of surface active elements for both spot and 3-D moving GMAW.

DTIC

Gas Tungsten Arc Welding; Interfacial Tension; Surface Energy; Metal Surfaces

19990019806 Hokkaido Univ., Div. of Chemistry, Sapporo, Japan

Diffusion of Liquid Metals and Alloys: The Study of Self-Diffusion Under Microgravity in Liquid Sn in the Wide Temperature Range

Itami, Toshio, Hokkaido Univ., Japan; Aoki, H., Hokkaido Univ., Japan; Kaneko, Minoru, Ishikawajima Jet Service Co. Ltd., Japan; Uchida, Misako, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Sisa, A., Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Amano, S., Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Odawara, O., Tokyo Inst. of Tech., Japan; Masaki, M., National Space Development Agency, Japan; Ooida, T., National Space Development Agency, Japan; Oda, H., National Space Development Agency, Japan; Yoda, Shinichi, National Space Development Agency, Japan; Microgravity Science Laboratory (MSL-1); November 1998, pp. 59-69; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the MSL-1 mission the self-diffusion coefficient, D, in liquid SRi was investigated at five temperatures in the wide temperature range up to 1622K. The long capillary (LC) method was adopted with the use of stable isotope Sn as a tracer. The concentration profiles of Sn were determined by the SIMS analysis. The D was determined with the use of the analytic solution of the Fick's second law and the effective time, t(sub eff) .In this effective time the effect of diffusion on both the heating and cooling periods was taken into account properly in addition to the keeping time. In practical application the iteration method was adopted. The obtained self-diffusion coefficients remain to be small enough even at 1622K contrary to the abrupt increase of the ground data in the literature due to the same LC method. The present data at 1622K was in good agreement with D obtained by the shear cell technique, which was adopted in the present MSL-1 mission by NASDA. The extrapolation of present data to the low temperature range is in good agreement with the microgravity data of D due to Frohberg et al. The power index in the temperature dependence of D is 1.81 for the present data and 2.04 for the all microgravity data of D though the latter index seems to be much affected by the data due to Frohberg et al. Obtained data was analyzed by the hard sphere model. Agreement between calculations and experiments is qualitatively good though 1.77 was obtained as the power index for the calculated temperature dependence of D. The prediction of the viscosity of some liquid metals was successfully performed by the present improved hard sphere model, in which the present experimental information of D under microgravity is taken into account.

Author

Viscosity; Spheres; Microgravity; Low Temperature; Liquid Metals; Ground Tests; Diffusion Coefficient; Data Acquisition

19990019807 Ishikawajima-Harima Heavy Industries Co. Ltd., Materials Technology Dept., Tokyo, Japan

Microgravity Diffusion Experiments for the Melt of Compound Semiconductor Lead-Tin-Telluride

Uchida, Misako, Ishikawajima-Harima Heavy Industries Co. Ltd., Japan; Kaneko, Minoru, Ishikawajima Jet Service Co. Ltd., Japan; Itami, Toshio, Hokkaido Univ., Japan; Yoda, Shinichi, National Space Development Agency, Japan; Microgravity Science Laboratory (MSL-1); November 1998, pp. 72-78; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In order to obtain the "true" temperature dependence of diffusion coefficient of liquid lead-tin-telluride, microgravity experiments were conducted in MSL-1 mission. The diffusion temperature of each experiments was 1223 K, 1273 K, 1373 K, 1473 K and 1573 K. The diffusion couple (Pb(sub 0.8)Sn(sub 0.2)Te - Pb(sub 0.7)Sn(sub 0.3)Te) of a 2 mm diameter cylinder was melted at each diffusion temperature and quenched by injecting helium gas. The cooling was controlled to avoid the axial directional

solidification, which was confirmed to spoil diffusion experiments from ground experiments. For the experiment at 1573K, the diffusion during heating and cooling periods was included in an analytical solution of Fick's second law with the assumption of D=A(T/T(sub m))(exp n) (A and n are constants, and T(sub m) is the melting temperature). The temperature dependence of diffusion coefficients was calculated by using the results of MSL-1 experiment results and the rocket experiments which were previously carried out.
Author
Cooling; Diffusion; Diffusion Coefficient; Directional Solidification (Crystals); Gravitational Effects

19990019808 Tohoku Univ., Sendai, Japan
Measurements of Impurity Coefficients in Ionic Melts with High Accuracy Under Microgravity
Yamamura, Tsutomu, Tohoku Univ., Japan; Yoda, Shinichi, Tohoku Univ., Japan; Ohida, T., Tohoku Univ., Japan; Masaki, M., Tohoku Univ., Japan; Microgravity Science Laboratory (MSL-1); November 1998, pp. 80-84; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

In order to determine the impurity (tracer) diffusion coefficients in high temperature melts accurately, the diffusion coefficients of silver ions in the eutectic LiCL-KCl melt was measured by a chronopotentiometric technique under microgravity so as to avoid the natural convection, which has been widely considered as the important source of errors accompanying diffusion measurements on the ground. The results obtained have been analyzed to elucidate the accuracy of the measurements, and the accurate diffusion coefficients of silver ion in the eutectic LiCL-KCl melt have been derived over the temperature range of 640 and 860 K.
Author
Melts (Crystal Growth); Coefficients; Accuracy; Diffusion Coefficient; Free Convection; Lithium Chlorides; Microgravity; Potassium Chlorides

19990019819 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Space Simulation, Cologne, Germany
Viscosity and Surface Tension Measurement in Microgravity: THERMO ***Final Report***
Egry, Ivan, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Lohoefer, G., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Seyhan, I., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Feuerbacher, B., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Microgravity Science Laboratory (MSL-1); November 1998, pp. 198-215; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Viscosity and surface tension of liquid metals can be measured by observing the oscillations of a levitated drop. The frequency is related to the surface tension, while the viscosity determines the damping of the oscillations. If no external forces are present, like in microgravity, these relations are particularly simple and precise. During the recent Spacelab mission MSL-1 such experiments have been performed on Co(sub 80)Pd(sub 20) and Pd(sub 78)Cu(sub 6)Si(sub l6) using the electromagnetic levitation facility TEMPUS. It was possible to obtain data over a wide temperature range, including the undercooled regime. While the temperature dependence of the surface tension remains linear throughout, the temperature dependence of the viscosity is much more pronounced and is discussed in terms of different models. In addition, the electrical conductivity of liquid Co(sub 80)Pd(sub 20) was measured, including the undercooled regime by a new, non-contact, inductive method. The results indicate the onset of magnetic ordering in the undercooled liquid.
Author
Electrical Resistivity; Interfacial Tension; Liquid Metals; Microgravity; Spacelab; Temperature Dependence; Viscosity

19990019820 Ulm Univ., Inst. for Electric and Magnetic Materials, Germany
Thermophysical Properties of Undercooled Metallic Glass Forming Liquid Alloys ***Final Report***
Fecht, Hans-J., Ulm Univ., Germany; Wunderlich, R. K., Technische Univ., Germany; Microgravity Science Laboratory (MSL-1); November 1998, pp. 218-230; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Thermophysical properties of glass forming metallic alloys are important for a systematic assessment of the inherent factors determining the ability of different alloy compositions to form metallic glasses within a wide range of critical cooling rates. According to classical nucleation theory these critical cooling rates are basically determined by the viscosity (mobility), the interfacial tension and, the difference in Gibbs free energy between the undercooled melt and crystalline phase combining the kinetic and thermodynamic aspects of undercooling and nucleation. In particular, measurements of the specific heat of undercooled liquid alloys allow evaluation of the Gibbs free energy difference between the liquid and crystalline phase and thus of the thermodynamic stability of the undercooled melt. In order to make the undercooled liquid state accessible to specific heat measurements under clean, quiescent isothermal conditions experiments were performed in microgravity with the containerless electromagnetic proc-

essing device TEMPUS. For these investigations the new method of non-contact ac-calorimetry was developed and applied successfully for the first time during the IML-2 mission. In continuation of our experiments on IML-2 where we have measured the specific heat of binary eutectic glass forming liquid alloys with critical cooling rates in the order of 10(exp -5) K/sec in MSL-1 we have investigated the specific heat of liquid multicomponent bulk metallic glass forming alloys, ZrAlCuNi and ZrAlCuNiCo, having critical cooling rates for glass formation in the range of 5.10(exp 2) sec. The specimen showed excellent stability in the undercooled melt making possible for the first time measurements of the specific heat in an extended temperature range from the stable into the undercooled liquid regime. The experiments were performed in close collaboration with the groups of Prof. W.L. Johnson, Caltech, who processed bulk metallic glass forming alloys of different compositions and the group of Prof. K. Samwer from the University of Augsburg who measured the coefficient of thermal expansion in the liquid phase of these alloys.
Author

Thermophysical Properties; Viscosity; Thermodynamics; Thermal Expansion; Specific Heat; Spaceborne Experiments; Microgravity; Liquid Phases; Liquid Alloys; Gibbs Free Energy

19990019821 Technische Univ., Inst. of Metallic Materials, Berlin, Germany

Measurements of the Surface Tension of Liquid and Undercooled Metallic Alloys by Oscillating Drop Technique

Roesner-Kuhn, Michael, Technische Univ., Germany; Kuppermann, Gunnar, Technische Univ., Germany; Frohberg, Martin G., Technische Univ., Germany; Microgravity Science Laboratory (MSL-1); November 1998, pp. 231-241; In English; Also announced as 19990019800

Contract(s)/Grant(s): DLR-50-WM-9578; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The surface tension of liquid metallic alloys is an important parameter for the understanding of surface phenomena in metallurgical processes; eg. interpretation of metal-slag reactions, wettability of refractory materials, filtration of melts, hot sintering of metallic powders, production of metal matrix composites, welding processes. Containerless electromagnetic levitation conditions are tend to cause surface oscillations on liquid droplets. The oscillations are detectable with the temperature-time signal of pyrometers and the corresponding frequencies can be obtained by fast Fourier transformation (FFT) of those signals. The performance of an on-line analysis of these data during the Space shuttle Mission MSL-1 provided the need for additional experimental procedures in the electromagnetic levitation facility TEMPUS. Investigations have been carried out on high viscous metallic glassformers, pure zirconium and stainless steels. Restrictions of the method have been found by the glassforming alloys where surface oscillations only occur at elevated temperatures of about 1500 C above the melting points.
Author

Drops (Liquids); Fast Fourier Transformations; Filtration; Fourier Transformation; High Temperature; Interfacial Tension; Levitation; Liquid Alloys; Metal Matrix Composites; Sintering; Slags

19990019823 Ruhr Univ., Inst. fuer Experimentalphysik/Festoerperphysik, Bochum, Germany

Undercooled Melts of Alloys With Polytetrahedral Short-Range Order *Final Report*

Holland-Moritz, D., Ruhr Univ., Germany; Herlach, Dieter M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kelton, K. F., Washington Univ., USA; Bach, H., Ruhr Univ., Germany; Feuerbacher, B., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Microgravity Science Laboratory (MSL-1); November 1998, pp. 253-261; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Molecular-dynamics investigations predict that an icosahedral short-range order prevails in the undercooled melt. Such a short-range order in the undercooled melt is expected to have consequences for the specific heat of the melt and for the nucleation of solid phases. Because the icosahedral symmetry is incompatible with the translational invariance of simple crystalline phases it is expected that the nucleation of these phases is hindered leading to a high undercoolability of the melt. On the other hand, quasicrystals and Frank-Kasper phases are characterized by a more or less pronounced degree of polytetrahedral short-range order, which is similar to that anticipated for the undercooled melt. Therefore a low interfacial energy between melt and polytetrahedral nucleus is expected, which leads to a low activation threshold for nucleation of the polytetrahedral phase and by means of this to a low undercoolability of the melt. It was intended to investigate the maximum level of undercooling, the specific heat and the viscosity as a function of temperature at melts which form different quasiycrystalline and Frank-Kasper phases in the TEMPUS facility on the MSL-1/MSL-1R missions in 1997.
Author

Melts (Crystal Growth); Molecular Dynamics; Interfacial Energy; Crystallinity; Cooling; Solid Phases

19990019825 NASA Marshall Space Flight Center, Huntsville, AL USA

Experiments on Nucleation in Different Flow Regimes

Bayuzick, Robert J., Vanderbilt Univ., USA; Hofmeister, W. H., Vanderbilt Univ., USA; Morton, C. M., Vanderbilt Univ., USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 273-280; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The vast majority of metallic engineering materials are solidified from the liquid phase. Understanding the solidification process is essential to control microstructure, which in turn, determines the properties of materials. The genesis of solidification is nucleation, where the first stable solid forms from the liquid phase. Nucleation kinetics determine the degree of undercooling and phase selection. As such, it is important to understand nucleation phenomena in order to control solidification or glass formation in metals and alloys.

Derived from text

Kinetics; Liquid Phases; Microstructure; Nucleation; Solidification

19990019826 Massachusetts Inst. of Tech., Dept. of Materials Science and Engineering, Cambridge, MA USA

Alloy Undercooling Experiments in a Microgravity Environment ***Final Report***

Flemings, Merton C., Massachusetts Inst. of Tech., USA; Matson, Douglas M., Massachusetts Inst. of Tech., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 281-290; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Molten samples of ternary steel alloys were successfully processed in a containerless fashion using the TEMPUS electromagnetic levitator during the first Microgravity Sciences Laboratory (MSL-1R) mission aboard the shuttle Columbia. Transformation from the metastable ferritic to the stable austenitic phase was observed following either spontaneous or triggered nucleation. Although the growth velocity of either phase in microgravity does not significantly differ from ground-based results (to greater than 88% confidence), a significant difference is seen in the delay between nucleation events (99% confidence). The possible reasons for deviation are discussed based on a new model for phase selection based on growth competition. Suppression of melt convection in microgravity is proposed as a potential explanation for the differences in delay times seen at low undercoolings.

Author

Melts (Crystal Growth); Ternary Alloys; Nucleation; Microgravity; Electromagnetic Fields

19990020827 Commissariat a l'Energie Atomique, Grenoble, France

Study of Interesting Solidification Phenomena on the Ground and in Space (MEPHISTO)

Favier, J.-J., Commissariat a l'Energie Atomique, France; Iwan, J., Commissariat a l'Energie Atomique, France; Alexander, D., Alabama Univ., USA; Garandet, J.-P., Commissariat a l'Energie Atomique, France; Third USA Microgravity Payload: One Year Report; November 1998, pp. 9-14; In English; Also announced as 19990020826

Contract(s)/Grant(s): NAG3-1740; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Real-time Seebeck voltage variations in a Sn-Bi melt during directional solidification in the MEPHISTO spaceflight experiment flown on the USMP-3 mission, can be correlated with well characterized thruster firings and an Orbiter Main System (OMS) burn. The Seebeck voltage measurement is related to the response of the instantaneous average melt composition at the melt-crystal interface. This allowed us to make a direct comparison of numerical simulations with the experimentally obtained Seebeck signals. Based on the results of preflight and real-time computations, several well-defined thruster firing events were programmed to occur at specific times during the experiment. In particular, we simulated the effects of the thruster firings on melt and crystal composition in a directionally solidifying Sn-Bi alloy. The relative accelerations produced by the firings were simulated by impulsive accelerations of the same magnitude, duration and orientation as the requested firings. A comparison of the simulation results with the Seebeck signal indicates that there is a good agreement between the two. This unique opportunity allows us, for the first time, to quantitatively characterize actual g-jitter effects on an actual crystal growth experiment and to properly calibrate our models of g-jitter effects on crystal growth.

Author

Crystal Growth; Directional Solidification (Crystals); Melts (Crystal Growth); Seebeck Effect; Vibration; Gravitational Effects; Tin Compounds; Bismuth Compounds; Microgravity; Spaceborne Experiments

19990020829 NASA Lewis Research Center, Cleveland, OH USA

The Isothermal Dendritic Growth Experiment

Glicksman, M. E., Rensselaer Polytechnic Inst., USA; Koss, M. B., Rensselaer Polytechnic Inst., USA; Malarik, D. C., NASA Lewis Research Center, USA; Third USA Microgravity Payload: One Year Report; November 1998, pp. 39-51; In English; Also announced as 19990020826

Contract(s)/Grant(s): NAS3-25368; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The growth of dendrites is one of the commonly observed forms of solidification encountered when metals and alloys freeze under low thermal gradients, as occurs in most casting and welding processes. In engineering alloys, the details of the dendritic morphology directly relates to important material responses and properties. of more generic interest, dendritic growth is also an archetypical problem in morphogenesis, where a complex pattern evolves from simple starting conditions. Thus, the physical understanding and mathematical description of how dendritic patterns emerge during the growth process are of interest to both scientists and engineers. The Isothermal Dendritic Growth Experiment (IDGE) is a basic science experiment designed to measure, for a fundamental test of theory, the kinetics and morphology of dendritic growth without complications induced by gravity-driven convection. The IDGE, a collaboration between Rensselaer Polytechnic Institute, in Troy NY, and NASA's Lewis Research Center (LeRC) was developed over a ten year period from a ground-based research program into a space flight experiment. Important to the success of this flight experiment was provision of in situ near-real-time teleoperations during the spaceflight experiment. Derived from text

Crystal Growth; Dendritic Crystals; Spaceborne Experiments; Microgravity; Supercooling

19990020974 NASA Lewis Research Center, Cleveland, OH USA

Interactions Between Solidification and Compositional Convection in Alloys

Davis, S. H., NASA Lewis Research Center, USA; Worster, M. G., NASA Lewis Research Center, USA; Chiareli, A. O. P., NASA Lewis Research Center, USA; Anderson, D. M., NASA Lewis Research Center, USA; Schultze, T. P., NASA Lewis Research Center, USA; 1998; 4p; In English

Contract(s)/Grant(s): NAG3-1405; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project combined theoretical and experimental ground-based studies of the interactions between convection and solidification of binary melts. Particular attention was focused on the alteration of the composition and microstructure of castings caused by convective flows through the interstices of mushy layers. Two different mechanisms causing convection were investigated. (i) Compositional, buoyancy driven convection is known to cause chimneys and freckles in directionally cast alloys on Earth. The analytical studies provide quantitative criteria for the formation of chimneys that can be used to assess the expediency of producing alloys in Space. (ii) Flow of the melt is also driven by the contraction (expansion) that typically occurs during change of phase. Such convection will occur even in the absence of gravity, and may indeed be the primary cause of macrosegregation during the production of alloys in Space. The studies will employed asymptotic methods in order to determine conditions for the stability of various states of solidifying systems. Further, simple macroscopic models of complete systems were developed and solved. These analytical studies were augmented by laboratory experiments using aqueous solutions, in which the convective flows could be easily observed and the effects of convection could be readily measured. These y experiments guided the development of the theoretical models and provided data against which the predictions of the models can be tested.

Author

Cast Alloys; Asymptotic Methods; Aqueous Solutions; Solidification; Convective Flow; Contraction; Binary Systems (Materials)

19990020995 International Trade Commission, Washington, DC USA

Stainless Steel Wire Rod from Germany, Italy, Japan, Korea, Spain, Sweden and Taiwan. Investigation Nos. 701-TA-373 (Final) and 731-TA-769-775 (Final)

Sep. 1998; 182p; In English

Report No.(s): PB99-116592; USITC/PUB-3126; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Contents include the following: Introduction; Conditions of competition in the US market; Conditions of the US industry; US imports, apparent consumption, and market shares; Pricing and related data; Financial condition of the US industry; Threat considerations.

NTIS

Stainless Steels; Wire; Rods

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.

19990019166 Nagasaki Univ., Faculty of Engineering, Japan
Measurement of Indium Density in the Reactive Sputtering Using the Laser Induced Fluorescence
Kido, Takuya, Nagasaki Univ., Japan; Ano, Kazumi, Nagasaki Univ., Japan; Shirakata, Kazuhiro, Nagasaki Univ., Japan; Matsuda, Yoshinobu, Nagasaki Univ., Japan; Reports of the Faculty of Engineering, Nagasaki University; Jan. 1994; ISSN 0286-0902; Volume 24, No. 42, pp. 51-58; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have investigated the reactive sputtering of Indium-Tin-Oxide (ITO) in a dc glow discharge. Spatial distributions of absolute density of sputtered indium atoms were measured by the laser induced fluorescence spectroscopy. The maximum value of the indium density was 10(exp 11)/sq cm for the case of pure argon dc discharge at the pressure of 0.2 Torr and the discharge voltage of 800 V.
Author
Density Measurement; Indium; Sputtering; Spatial Distribution

19990019296 Stanford Joint Inst. for Surface and Microstructural Research, Moffett Field, CA USA
Summary Abstract: Growth and Alloying of Pd Films on Mo(110) Surfaces
Park, Ch. E., Stanford Joint Inst. for Surface and Microstructural Research, USA; Poppa, H., Stanford Joint Inst. for Surface and Microstructural Research, USA; Bauer, E., Technische Univ., Germany; Journal of Vacuum Science and Technology: Part A3; 1985; ISSN 0734-2101; Volume 3, pp. 822-823; In English
Contract(s)/Grant(s): NCC2-248; R05-030-001; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Alloying in small metal particles and in very thin films has recently received considerable attention. In the past it has been generally assumed that alloying is insignificant up to temperatures. Thus many epitaxy experiments of metals on metals with complete miscibility were performed at temperatures between 200 and 400 C and analyzed assuming no alloying. In particular, alloying was not suspected if the film material was not soluble in the substrate. In the present study, which was stimulated by annealing-induced CO adsorption anomalies on thin film surfaces, it has become evident that low temperature alloying can occur in thin films on a metal substrate which is refractory and has very strong interatomic bonds (as evidenced by a high sublimation energy) provided that the substrate is soluble in the film material. A good example of such a film-substrate combination is Pd on Mo. The solubility of Pd in Mo is very at temperatures below 1000 K but Pd can dissolve slightly more than 40 at. % Mo even at low temperatures.
Author
Alloying; Metal Particles; Palladium; Molybdenum; Thin Films; Chemical Bonds; Annealing

19990019372 Department of the Navy, Washington, DC USA
Method for Synthesis of Linear Inorganic-Organic Hybrid Polymers
Keller, Teddy M., Inventor; Sundar, Raj A., Inventor; May 26, 1998; 7p; In English
Patent Info.: Filed 27 Nov. 96,; US-Patent-Appl-SN-757,170; US-Patent-5,756,629
Report No.(s): AD-D019137; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A method of preparing a linear inorganic-organic hybrid polymer is discussed. It includes the steps of cooling a reaction medium to a first starting temperature below the ambient temperature and not less than about -10 C., adding n-butyllithium and an organic compound capable of reacting with n-butyllithium to form an organo-dilithium compound to the reaction medium, allowing the organic compound and the n-butyllithium to react to form an organo-dilithium compound while allowing the reaction medium to warm, cooling the reaction medium to a second starting temperature below the ambient temperature and not less than about -10 C., adding an inorganic compound containing at least two halogen atoms and capable of reacting with said organo-dilithium compound to form a linear inorganic-organic hybrid polymer to the reaction medium, and allowing the inorganic compound to react with the organo-dilithium compound to form a linear inorganic-organic hybrid polymer while allowing the reaction medium to warm to the ambient temperature. The cooling to the first and second starting temperatures may be accomplished by any method known in the art for cooling a reaction medium, for example by cooling with an ice water or salt/ice water bath or by cooling with an automated cooling or refrigerating system.
DTIC
Polymers; Synthesis (Chemistry); Organic Compounds; Inorganic Compounds

19990019476 NASA Lewis Research Center, Cleveland, OH USA

Simulated Solar Flare X-Ray and Thermal Cycling Durability Evaluation of Hubble Space Telescope Thermal Control Candidate Replacement Materials

deGroh, Kim K., NASA Lewis Research Center, USA; Banks, Bruce A., NASA Lewis Research Center, USA; Sechkar, Edward A., NYMA, Inc., USA; Scheiman, David A., NYMA, Inc., USA; December 1998; 30p; In English; 4th; Protection of Materials and Structures from the LEO Space Environment, 23-24 Apr. 1998, Toronto, Canada; Sponsored by Toronto Univ., Canada

Contract(s)/Grant(s): RTOP 632-1A-1E

Report No.(s): NASA/TM-1998-207426; E-11184; NAS 1.15:207426; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the Hubble Space Telescope (HST) second servicing mission (SM2), astronauts noticed that the multilayer insulation (MLI) covering the telescope was damaged. Large pieces of the outer layer of MLI (aluminized Teflon fluorinated ethylene propylene (Al-FEP)) were torn in several locations around the telescope. A piece of curled up Al-FEP was retrieved by the astronauts and was found to be severely embrittled, as witnessed by ground testing. Goddard Space Flight Center (GSFC) organized a HST MLI Failure Review Board (FRB) to determine the damage mechanism of FEP in the HST environment, and to recommend replacement insulation material to be installed on HST during the third servicing mission (SM3) in 1999. Candidate thermal control replacement materials were chosen by the FRB and tested for environmental durability under various exposures and durations. This paper describes durability testing of candidate materials which were exposed to charged particle radiation, simulated solar flare x-ray radiation and thermal cycling under load. Samples were evaluated for changes in solar absorptance and tear resistance. Descriptions of environmental exposures and durability evaluations of these materials are presented.

Author

Hubble Space Telescope; Temperature Control; Solar Energy Absorbers; Replacing; Propylene; Multilayer Insulation; Ethylene; Embrittlement; Charged Particles

19990019513 Pennsylvania State Univ., Dept. of Chemistry, University Park, PA USA

The Synthesis and Structure of Polyphosphazenes ***Final Report***

Allcock, Harry R.; May 28, 1998; 7p; In English

Contract(s)/Grant(s): DAAH04-94-G-0403

Report No.(s): AD-A357992; ARO-32913.19-CH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The aim of this work was the design and synthesis of new polymers for membrane applications. Specific uses are anticipated in high oxygen transmission films with the exclusion of organic liquids or vapors; in membranes for the capture of toxic or radioactive metal ions; and in ”smart” membranes where the permeability can be controlled by temperature or pH changes. The new high oxygen transmission membranes synthesized are based on a polyphosphazene platform with both fluoroalkoxy and adamantyl side groups. The metal capture membranes utilize a polyphosphazene backbone and sulfur-containing aliphatic side groups. The ”smart” membranes utilize a polyphosphazene backbone and hydrophilic alkoxy-ether side groups or side units with carboxylic acid terminal units. The permeability of these membranes is controlled by lower critical solution temperature (LCST) behavior and by pH changes. In addition, new methods for crosslinking membranes and modifying their surfaces have been developed. The new membranes are of potential utility in protective clothing, toxic waste cleanup, and in advanced protective surface coatings.

DTIC

Synthesis (Chemistry); Procedures; Membranes; Alkyl Compounds; Carboxylic Acids

19990019518 Michigan Technological Univ., Dept. of Metallurgical Engineering, Houghton, MI USA

Mechanical Alloying Processing with Applications to Structural Materials ***Final Report, Aug. 1994 - Mar. 1998***

Courtney, Thomas H.; Jun. 1998; 10p; In English

Contract(s)/Grant(s): DAAH04-94-G-0315

Report No.(s): AD-A357838; ARO-33174.17-MS; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Relationships among the synthesis, processing, structure and properties of materials generated through mechanical alloying (MA) or mechanosynthesis are described. Several materials classes: cermets, particulate metal matrix composites (MMC), and tungsten heavy alloys (WHA) have been produced, and their properties and structures evaluated. Niobium carbide and tungsten, carbide cermets can be conveniently generated either through room temperature synthesis (NbC cermets) or by room temperature milling followed by elevated temperature exposure (WC cermets). Cermet microstructures following consolidation are fine, and the materials demonstrate exceptional hardness albeit their fracture toughness are generally low. Al based MMC can be synthesized similarly. The composites we have studied utilize aluminum carbide as a reinforcement. The yield strengths of these MMC are approximately twice those of high strength aerospace Al alloys. Noncrystalline WHA can be generated via MA. During con-

solidation, these alloys are prone to crystallization. Nonetheless, because of their fine structure the crystalline products manifest high hardness relative to conventional WHA. Current efforts are focusing on retaining the noncrystalline phase during consolidation so as to produce materials having particularly desirable mechanical properties.
DTIC
Metal Matrix Composites; Cermets; Alloying; Aluminum Alloys; Carbon Compounds; Reinforcing Materials; Mechanical Properties

19990019658 Scientific Research Associates, Inc., Glastonbury, CT USA
Transport Phenomena Studies by Computational Simulation in Structural Materials Processing ***Final Report, 15 Apr. 1996 - 14 Apr 1998***
Buggeln, R. C.; Meyyappan, M.; Sep. 1998; 46p; In English
Contract(s)/Grant(s): F49620-96-C-0015
Report No.(s): AD-A356052; AFRL-SR-BL-TR-98-0689; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Chemical vapor deposition (CVD) is one of the most important techniques for the processing of structural materials. It is extremely versatile in that a wide range of materials and coatings is done by CVD, perhaps more than by any other technique. The process is flexible enough to accommodate a variety of sizes and shapes of objects to be processed and allow continuous change of composition of the material or coating. In this report we discuss the application of CVD processes to 'structural materials'. The classification 'structural materials' here is based on the end use being in aerospace, mechanical, and related applications (as opposed to electronics materials) and hence covers coatings and high temperature aerospace materials such as composite structures, ceramic-matrix composites (CMC), functionally-gradient materials (FGM), etc. Representative examples are SiC (fiber, coating), Si3N4, BN, other carbides and nitrides, composites such as SiC-SiC, carbon-SiC, carbon-carbon, and carbon-BN.
DTIC
Transport Properties; Vapor Deposition; Composite Structures; Ceramic Coatings; Ceramic Matrix Composites

19990019663 Advanced Modular Power Systems, Inc., Ann Arbor, MI USA
Low Cost, YAG and Mullite Fibers by Continuous Extrusion an Pyrolysis of Metal Carboxylate Precursors ***Final Report, 1 Mar. 1997 - 31 Aug. 1998***
Svedberg, Robert; Vitale, Michael; Laine, Richard M.; Chew, Kean W.; Weinmann, Marcus; Aug. 31, 1998; 26p; In English; Prepared in cooperation with Michigan Univ., Ann Arbor, MI.
Contract(s)/Grant(s): F49620-97-C-0006
Report No.(s): AD-A356040; AFRL-SR-BL-TR-98-0708; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Optimal ceramic reinforced CMS's and MMC's are the key to the success of many Air Force programs because of the significant promise these lightweight, high strength materials offer for meeting projected performance and protection requirements for a wide variety of aerospace applications. This Phase I program has explored methods of producing continuous yttrium aluminum garnet (Y3Al5O12) and mullite (3Al2O3.SiO2) fibers. In Task 1, synthesis reactors have been constructed with 12:1 and 50:1 capacities that will enable us to produce up to 2 kg of precursor compounds in a single reactor directly from Al(OH)3 and/or SiO2. In Task 2, fiber processing properties were optimized. We can produce 3 m/min of 30 micro-m ave. dia. Fiber and spool it. This translates to 180 m/h. We have initiated efforts to optimize the spinning process to meet the expectations of Phase II work to produce 10s m/h of multi-fiber tows suitable for manufacture of ceramic/ceramic composites. In Task 3, Fiber properties for hand drawn fibers produced in earlier studied showed bend strengths as 1.9 Gpa (assuming e=280 Gpa), but tensile tests on continuously processed fibers have yet to be done. Phase I goals will be to refine the processing steps necessary to produce larger quantities of fibers, with better control of fiber diameters, pyrolysis treatments and finally mechanical properties. We also expect to extend our efforts to improve the mullite fiber system. We must learn to cure these fibers as they are being spun and then conduct pyrolysis studies.
DTIC
Yttrium-Aluminum Garnet; Mullites; Ceramic Fibers; Extruding; Pyrolysis; Carboxylates

19990019824 Augsburg Univ., Inst. fuer Physik, Germany
Thermal Expansion of Glass Forming Metallic Alloys in the Undercooled State ***Final Report***
Samwer, Konrad, Augsburg Univ., Germany; Damaschke, Bernd, Augsburg Univ., Germany; Egry, Ivan, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Microgravity Science Laboratory (MSL-1); November 1998, pp. 263-272; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche
The thermal expansion of liquid samples of glass forming metallic alloys was measured under microgravity conditions. The experiments were performed in an electromagnetic levitation facility (TEMPUS facility) on board the space orbiter Columbia

(mission MSL-1). The sample was imaged by a high resolution CCD camera with on-board recording. After the mission the video tapes were analyzed by digital image processing. The values found for the thermal expansion coefficients are between 1.8 x 10(exp -5) 1/K and 32 x 10(exp -5) 1/K which complements nicely experiments done earlier at lower temperatures. The volume jump at the melting point is Author

Image Processing; Melting Points; Metallic Glasses; Microgravity; Space Missions; Thermal Expansion

19990019828 California Inst. of Tech., Keck Lab. of Engineering Materials, Pasadena, CA USA

Thermo-Physical Properties of Undercooled Metallic Glass Forming Alloys ***Final Report***

Johnson, William L., California Inst. of Tech., USA; Lee, D. S., California Inst. of Tech., USA; Glade, S. C., California Inst. of Tech., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 304-314; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Thermo-physical properties of two bulk metallic glass forming alloys, Ti(sub 34)Zr(sub 11)Cu(sub 47)Ni(sub 8) (VIT 101) and Zr(sub 57)Nb(sub 5)Ni(sub l2.6)Al(sub 10)Cu(sub 15.4) (VIT 106), were investigated in the stable and undercooled melt. Our investigation focused on measurements of the specific heat in the stable and undercooled liquid using the method of AC modulation calorimetry. The experiments were conducted in close collaboration with the group of Prof. Samwer, University of Augsburg, for measurement of the specific volume, the groups of Prof. I. Egry , DLR Cologne and Prof. M.G. Frohberg, Technical University of Berlin, for measurements of surface tension and high temperature viscosity, and the group of Prof. H. J. Fecht, University of Ulm, Germany, for coordination of sample selection and specific heat measurements. The VIT 106 exhibited a maximum undercooling of 140 K in free radiative cooling. Specific heat measurements could be performed in stable melt down to an undercooling of 80 K. Analysis of the specific heat data indicate an anomaly near the equilibrium liquidus temperature. This anomaly is also observed in the temperature dependencies of the external relaxation time, the specific volume, and the surface tension; it is tentatively attributed to a phase separation in the liquid state. The VIT 101 specimen exhibited a small undercooling of about 50 K. Specific heat measurements were performed in the stable and undercooled melt. These various results will be combined with ground based work such as the measurement of T-T-T curves in the electrostatic levitator and low temperature viscosity and specific heat measurements for modeling the nucleation kinetics of these alloys.

Author

Alternating Current; Electrostatics; Heat Measurement; Interfacial Tension; Kinetics; Levitation; Liquidus; Melts (Crystal Growth); Metallic Glasses; Specific Heat; Stability

19990020994 International Trade Commission, Washington, DC USA

Elastic Rubber Tape from India. Investigation No. 701-TA-383 (Preliminary) and Investigation No. 731-TA-805 (Preliminary)

Oct. 1998; 84p; In English

Report No.(s): PB99-116659; USITC/PUB-3133; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: Introduction; Conditions of competition in the US market; Condition of the US industry; US imports, apparent consumption, and market shares; Financial experience of the US producers; Threat considerations.

NTIS

Rubber; Tapes

19990020996 Helsinki Univ. of Technology, Lab. of Physical Chemistry and Electrochemistry, Espoo, Finland

Impedance Measurements on Conductive Polymer Films: Literature Review

Betova, I., Helsinki Univ. of Technology, Finland; Lankinen, E., Helsinki Univ. of Technology, Finland; Oct. 15, 1998; 34p; In English

Report No.(s): PB99-116394; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Conducting polymer films such as polypyrrole, polythiophene, and polyaniline films are very attractive materials because of their unique redox, optical, and electrical properties. These characteristic properties have been applied to batteries, electrochromic devices, capacitors, and electrochemically controlled membranes. to meet the requirements of these applications, many efforts have been directed to the elucidation of charge transport mechanism. Charge transport in a film consist of electron transport and ion transport. Because ion transport in most conducting polymer films is much slower than electron transport, ion transport governs their redox properties. There are two possibilities in the mode of ion transport. In the first one, reduction/oxidation of a film is accompanied by the exclusion/insertion of anion to preserve charge neutrality inside the film. In the other, cation is inerted

into or excluded from the film during its redox reaction. Moreover, simultaneously with ion transport solvent molecules as well as ion pairs are be transported.
NTIS
Polymeric Films; Conducting Polymers; Impedance Measurement; Charge Transfer

19990021013 Rockwell International Corp., Rockwell Science Center, Thousand Oaks, CA USA
High Performance Piezoelectric Thin Films for Shape Control in Large Inflatable Structures ***Final Report, 3 Dec. 1996 - 31 Dec. 1998***
Neurgaonkar, R. R., Rockwell International Corp., USA; Nelson, J. G., Rockwell International Corp., USA; Jan. 1999; 35p; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC7-6
Report No.(s): SC44809.FR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research and development program was to develop PbZr(1-x)Ti(x)O3 (PZT) and Pb(1-x)Ba(x)Nb2O6 (PBN) materials with large piezoelectric response which are suitable for shape control in large inflatable structures. Two approaches were to be considered: (1) direct deposition of PZT and PBN films on flexible plastic or thin metal foil substrates, and (2) deposition on Si followed by fabrication of hybrid structures on mylar or kapton. Testing in shape control concepts was carried out at JPL and based on their results, the required modifications were made in the final film compositions and deposition techniques. The program objective was to identify and then optimize piezoelectric materials for NASA shape control applications. This involved the bulk piezoelectric and photovoltaic responses and the compatibility of the thin films with appropriate substrate structures. Within the PZT system, Rockwell has achieved the highest reported piezoelectric coefficient (d(sub 33) greater than 100 pC/N) of any ceramic composition. We used this experience in piezoelectric technology to establish compositions that can effectively address the issues of this program. The performance of piezoelectric thin films depends directly on d(sub ij) and Epsilon. The challenge was to find PZT compositions that maintained high d(sub ij) and Epsilon, while also exhibiting a large photovoltaic effect and integrate thin films of this composition into the system structure necessary to meet shape control applications. During the course of this program, several PZT and PLZT compositions were identified that meet these requirements. Two such compositions were successfully used in electrical and optical actuation studies of thin film structures.
Author
Inflatable Structures; Piezoelectricity; Thin Films; Lead Zirconate Titanates; Metal Foils; Plastics; Shape Control; Lanthanum Compounds

19990021024 Virginia Univ., Dept.of Materials Science and Engineering, Charlottesville, VA USA
Characterization of Metalorganic Chemical Vapor Deposition ***Final Report, Jul. 1994 - 31 Dec. 1997***
Jesser, W. A., Virginia Univ., USA; Feb. 23, 1998; 10p; In English
Contract(s)/Grant(s): NGT-70404; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A series of experimental and numerical investigations to develop a more complete understanding of the reactive fluid dynamics of chemical vapor deposition were conducted. In the experimental phases of the effort, a horizontal CVD reactor configuration was used for the growth of InP at UVA and for laser velocimetry measurements of the flow fields in the reactor at LaRC. This horizontal reactor configuration was developed for the growth of III-V semiconductors and has been used by our research group in the past to study the deposition of both GaAs and InP. While the ultimate resolution of many of the heat and mass transport issues will require access to a reduced-gravity environment, the series of groundbased research makes direct contributions to this area while attempting to answer the design questions for future experiments of how low must gravity be reduced and for how long must this gravity level be maintained to make the necessary measurements. It is hoped that the terrestrial experiments will be useful for the design of future microgravity experiments which likely will be designed to employ a core set of measurements for applications in the microgravity environment such as HOLOC, the Fluid Physics/Dynamics Facility, or the Schlieren photography, the Laser Imaging Velocimetry and the Laser Doppler Velocimetry instruments under development for the Advanced Fluids Experiment Module.
Derived from text
Metalorganic Chemical Vapor Deposition; Experiment Design; Microgravity; Laser Doppler Velocimeters; Heat Transfer; Gravitational Effects; Gallium Arsenides; Fluid Dynamics

19990021036 San Jose State Univ., Dept. of Mechanical and Aerospace Engineering, CA USA

Measuring Thermal Conductivity and Moisture Absorption of Cryo-Insulation Materials

Lambert, Michael A., San Jose State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

NASA is seeking to develop thermal insulation material systems suitable for withstanding both extremely high temperatures encountered during atmospheric re-entry heating and aero- braking maneuvers, as well as extremely low temperatures existing in liquid fuel storage tanks. Currently, materials used for the high temperature insulation or Thermal Protection System (TPS) are different from the low temperature, or cryogenic insulation. Dual purpose materials are necessary to the development of reusable launch vehicles (RLV). The present Space Shuttle (or Space Transportation System, STS) employs TPS materials on the orbiter and cryo-insulation materials on the large fuel tank slung under the orbiter. The expensive fuel tank is jettisoned just before orbit is achieved and it burns up while re-entering over the Indian Ocean. A truly completely reusable launch vehicle must store aR cryogenic fuel internally. The fuel tanks will be located close to the outer surface. In fact the outer skin of the craft will probably also serve as the fuel tank enclosure, as in jet airliners. During a normal launch the combined TPS/cryo-insulation system will serve only as a low temperature insulator, since aerodynamic heating is relatively minimal during ascent to orbit. During re-entry, the combined TPS/cryo-insulation system will serve only as a high temperature insulator, since all the cryogenic fuel will have been expended in orbit. However, in the event of an.aborted launch or a forced/emergency early re-entry, the tanks will still contain fuel, and the TPS/cryo-insulation will have to serve as both low and high temperature insulation. Also, on long duration missions, such as to Mars, very effective cryo-insulation materials are needed to reduce bod off of liquid propellants, thereby reducing necessary tankage volume, weight, and cost. The conventional approach to obtaining both low and high temperature insulation, such as is employed for the X-33 and X-34 spacecraft, is to use separate TPS and cryo-insulation materials, which are connected by means of adhesives or stand-offs (spacers). Three concepts are being considered: (1) the TPS is bonded directly to the cryo-insulation which, in turn, is bonded to the exterior of the tank, (2) stand-offs are used to make a gap between the TPS and the cryo-insulation, which is bonded externally to the tank, (3) TPS is applied directly or with stand-offs to the exterior so the tank, and cryo-insulation is applied directly to the interior of the tank. Many potential problems are inherent in these approaches. For example, mismatch between coefficients of thermal expansion of the TPS and cryo-insulation, as well as aerodynamic loads, could lead to failure of the bond. Internal cryo-insulation must be prevent from entering the sump of the fuel turbo-pump. The mechanical integrity of the stand-off structure (if used) must withstand multiple missions. During ground hold (i.e., prior to launch) moisture condensation must be minimized in the gap between the cryo-insulation and the TPS. The longer term solution requires the development of a single material to act as cryo- insulation during ground hold and as TPS during re-entry. Such a material minimizes complexity and weight while improving reliability and reducing cost.

Derived from text

Thermal Conductivity; Thermal Insulation; Thermal Protection; Moisture; Cryogenics; Material Absorption

19990021040 San Jose State Univ., Dept. of Mechanical and Aerospace Engineering, CA USA

Thermal Property Parameter Estimation of TPS Materials

Maddren, Jesse, San Jose State Univ., USA; 1998 NASA-ASEE-Stanford Summer Faculty Fellowship Program; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Accurate knowledge of the thermophysical properties of TPS (thermal protection system) materials is necessary for pre-flight design and post-flight data analysis. Thermal properties, such as thermal conductivity and the volumetric specific heat, can be estimated from transient temperature measurements using non-linear parameter estimation methods. Property values are derived by minimizing a functional of the differences between measured and calculated temperatures. High temperature thermal response testing of TPS materials is usually done in arc-jet or radiant heating facilities which provide a quasi one-dimensional heating environment. Last year, under the NASA-ASEE-Stanford Fellowship Program, my work focused on developing a radiant heating apparatus. This year, I have worked on increasing the fidelity of the experimental measurements, optimizing the experimental procedures and interpreting the data.

Author

Thermodynamic Properties; Thermophysical Properties; Estimating; Data Management; Independent Variables

19990021045 California Maritime Academy, Dept. of Engineering and Technology, Vallejo, CA USA

An Integrated Tool for the Coupled Thermal and Mechanical Analysis of Pyrolyzing Heatshield Materials

Pronchick, Stephen W., California Maritime Academy, USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Materials that pyrolyze at elevated temperature have been commonly used as thermal protection materials in hypersonic flight, and advanced pyrolyzing materials for this purpose continue to be developed. Because of the large temperature gradients

that can arise in thermal protection materials, significant thermal stresses can develop. Advanced applications of pyrolytic materials are calling for more complex heatshield configurations, making accurate thermal stress analysis more important, and more challenging. For non-pyrolyzing materials, many finite element codes are available and capable of performing coupled thermal-mechanical analyses. These codes do not, however, have a built-in capability to perform analyses that include pyrolysis effects. When a pyrolyzing material is heated, one or more components of the original virgin material pyrolyze and create a gas. This gas flows away from the pyrolysis zone to the surface, resulting in a reduction in surface heating. A porous residue, referred to as char, remains in place of the virgin material. While the processes involved can be complex, it has been found that a simple physical model in which virgin material reacts to form char and pyrolysis gas, will yield satisfactory analytical results. Specifically, the effects that must be modeled include: (1) Variation of thermal properties (density, specific heat, thermal conductivity) as the material composition changes; (2) Energy released or absorbed by the pyrolysis reactions; (3) Energy convected by the flow of pyrolysis gas from the interior to the surface; (4) The reduction in surface heating due to surface blowing; and (5) Chemical and mass diffusion effects at the surface between the pyrolysis gas and edge gas Computational tools for the one-dimensional thermal analysis these materials exist and have proven to be reliable design tools. The objective of the present work is to extend the analysis capabilities of pyrolyzing materials to axisymmetric configurations, and to couple thermal and mechanical analyses so that thermal stresses may be efficiently and accurately calculated.
Derived from text
Thermal Analysis; Mechanical Measurement; Porosity; Pyrolytic Materials; Specific Heat; Stress Analysis; Thermal Protection

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.

19990019413 Department of the Navy, Washington, DC USA
Fitting for Flexible Fuel Bladder
Marolda, Victor J.; May 26, 1998; 7p; In English
Patent Info.: US-Patent-Appl-SN-668,585; US-Patent-5,755,425
Report No.(s): AD-D019125; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Disclosed is a fuel bladder having a flexible bladder wall with a fuel outlet aperture in which a tubular penetration body extends through the aperture and an interior flange on the tubular penetration abuts the interior side of the flexible bladder wall. A tubular valve connection member is super-imposed over the fuel outlet aperture such that its outer peripheral surface abuts the inner peripheral surface of the tubular penetration body. A washer and a lock nut are positioned over the tubular penetration member to press the fuel bladder wall against the tubular penetration member interior flange. An O-ring seal is positioned between the proximate surface of the tubular penetration body and the interior side of the bladder wall. Another O-ring seal is positioned adjacent the outer peripheral surface of the tubular penetration body and the exterior side of the bladder wall.
DTIC
O Ring Seals; Diaphragms (Mechanics); Expulsion Bladders; Expandable Structures; Fuel Tanks; Fittings; Flexible Bodies

19990019519 Pennsylvania State Univ., Dept. of Nuclear Engineering, University Park, PA USA
Ignition, Combustion and Kinetics of Energetic Materials ***Final Report, 1 Jul. 1992 - 30 Jun. 1998***
Kuo, K. K.; Thynell, S. T.; Brill, T. B.; Yang, V.; Litzinger, T. A.; Jun. 30, 1998; 45p; In English
Contract(s)/Grant(s): DAAL03-92-G-0118
Report No.(s): AD-A357836; ARO-30344.17-CH-URI; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To develop a comprehensive model of nitramine propellant ignition and combustion, the appropriate numerical analysis was developed to solve both transient and steady state combustion, including detailed finite rate chemical kinetics, thermodynamic phase transition, and sub-surface reactions. The model was advanced to predict ignition phenomena. Modeling work was complemented by conducting various experiments. Using fast thermolysis, significant accomplishments were made in studies of the decomposition behavior of propellant ingredients, such as RDX, cellulose acetate butyrate, nitrocellulose, and mixtures of RDX and binders. Intrusive mass spectroscopic techniques were utilized to acquire gas phase species profiles under laser assisted burning of monopropellants and composite propellants. Nonintrusive diagnostic techniques were developed and used to determine temperature and species profiles within propellant flames at elevated pressures, which are needed for model validation. Temperature sensitivities were deduced for RDX and nitramine propellants, and ignition delays were deduced for RDX, HMX and RDX/CAB pseudo propellants. In situ observation of burning surfaces revealed the formation of complex, sooty like structures and intermit-

tent flame attachment. A liquid strand burner was established and successfully demonstrated to have the capability of maintaining a steady liquid propellant (LP) burning surface at the tip of the feeding tube using nitromethane. The burning behavior of nitromethane was also characterized.
DTIC
Reaction Kinetics; Ignition; Composite Propellants; Monopropellants; Combustion Physics; Nitromethane; Numerical Analysis; Propellant Combustion

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MATERIALS PROCESSING

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

19990019568 Universities Space Research Association, Huntsville, AL USA
Convection in an Infinite Vertical Cylinder in the Presence of a Horizontal Magnetic Field
Mazuruk, Konstantin, Universities Space Research Association, USA; Ramachandran, Narayanan, Universities Space Research Association, USA; Microgravity Science and Technology International Journal; 1997; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The use of a magnetic field to suppress convection in low gravity materials processing is an area of active research. This study aims to investigate some of the basic features of an verse magnetic field on convective motion in electrically conducting melts. The geometry considered is in infinite vertical column of liquid metal with an axial temperature gradient and an imposed transverse magnetic field. The incipience and azimuthal orientation of convective roM is investigated. The governing transport equations are nondimensionalized, linearized and the eigen value problem is solved to determine the most physically significant states. The analysis shows that the initial degeneracy (with no magnetic field) is removed by the presence of a magnetic field and the primary convection roll aligns itself so that its plane is perpendicular to the applied magnetic field. A cross over to another mode is also found when the strength of the magnetic field is increased. Velocity distributions are presented corresponding to the lowest modes and the system behavior within limit s of non-linearity is discussed.
Author
Convection; Cylindrical Shells; Magnetic Fields; Research; Liquid Metals

19990019810 Pennsylvania State Univ., P/M Lab., University Park, PA USA
Gravitational Role in Liquid Phase Sintering
Upadhyaya, Anish, Pennsylvania State Univ., USA; Iacocca, Ronald G., Pennsylvania State Univ., USA; German, Randall M., Pennsylvania State Univ., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 94-105; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

To comprehensively understand the gravitational effects on the evolution of both the microstructure and the macrostructure during liquid phase sintering, W-Ni-Fe alloys with W content varying from 35 to 98 wt.% were sintered in microgravity. Compositions that slump during ground-based sintering also distort when sintered under microgravity. In ground-based sintering, low solid content alloys distort with a typical elephant-foot profile, while in microgravity, the compacts tend to spheroidize. This study shows that microstructural segregation occurs in both ground-based as well as microgravity sintering. In ground-based experiments, because of the density difference between the solid and the liquid phase, the solid content increases from top to the bottom of the sample. In microgravity, the solid content increases from periphery to the center of the samples. This study also shows that the pores during microgravity sintering act as a stable phase and attain anomalous shapes.
Author
Gravitational Effects; Liquid Phase Sintering; Liquid Phases; Microgravity; Microstructure

19990019812 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Bubble and Drop Nonlinear Dynamics (BDND)
Trinh, E. H., Jet Propulsion Lab., California Inst. of Tech., USA; Leal, L. Gary, California Univ., USA; Thomas, D. A., NASA Johnson Space Center, USA; Crouch, R. K., NASA, USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 121-129; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Free drops and bubbles are weakly nonlinear mechanical systems that are relatively simple to characterize experimentally in 1-G as well as in microgravity. The understanding of the details of their motion contributes to the fundamental study of nonlinear phenomena and to the measurement of the thermophysical properties of freely levitated melts. The goal of this Glovebox-based

experimental investigation is the low-gravity assessment of the capabilities of a modular apparatus based on ultrasonic resonators and on the pseudo- extinction optical method. The required experimental task is the accurate measurements of the large-amplitude dynamics of free drops and bubbles in the absence of large biasing influences such as gravity and levitation fields. A single-axis levitator used for the positioning of drops in air, and an ultrasonic water-filled resonator for the trapping of air bubbles have been evaluated in low-gravity and in 1-G. The basic feasibility of drop positioning and shape oscillations measurements has been verified by using a laptop-interfaced automated data acquisition and the optical extinction technique. The major purpose of the investigation was to identify the salient technical issues associated with the development of a full-scale Microgravity experiment on single drop and bubble dynamics.
Author
Bubbles; Data Acquisition; Drop Size; Drops (Liquids); Extinction; Fluid Dynamics; Gravitational Effects; Gravitational Fields; Microgravity; Thermophysical Properties

19990019813 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Internal Flows in Free Drops (IFFD)
Trinh, E. H., Jet Propulsion Lab., California Inst. of Tech., USA; Sadhal, Satwindar S., University of Southern California, USA; Thomas, D. A., NASA Johnson Space Center, USA; Crouch, R. K., NASA, USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 131-139; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Within the framework of an Earth-based research task investigating the internal flows within freely levitated drops, a low-gravity technology development experiment has been designed and carried out within the NASA Glovebox facility during the STS-83 and STS-94 Shuttle flights (MSL-1 mission). The goal was narrowly defined as the assessment of the capabilities of a resonant single-axis ultrasonic levitator to stably position free drops in the Shuttle environment with a precision required for the detailed measurement of internal flows. The results of this entirely crew-operated investigation indicate that the approach is fundamentally sound, but also that the ultimate stability of the positioning is highly dependent on the residual acceleration characteristic of the Spacecraft, and to a certain extent, on the initial drop deployment of the drop. The principal results are: the measured dependence of the residual drop rotation and equilibrium drop shape on the ultrasonic power level, the experimental evaluation of the typical drop translational stability in a realistic low-gravity environment, and the semi-quantitative evaluation of background internal flows within quasi-isothermal drops. Based on these results, we conclude that the successful design of a full-scale Microgravity experiment is possible, and would allow accurate the measurement of thermocapillary flows within transparent drops. The need has been demonstrated, however, for the capability for accurately deploying the drop, for a quiescent environment, and for precise mechanical adjustments of the levitator.
Author
Capillary Flow; Drop Size; Flow Measurement; Gravitational Effects; Internal Flow; Microgravity; Space Transportation System; Space Transportation System Flights

19990019827 Massachusetts Inst. of Tech., Dept. of Materials Science and Engineering, Cambridge, MA USA
The Measurement of the Viscosity and Surface Tension of Undercooled Melts Under Microgravity Conditions and Supporting MHD Calculations
Hyers, Robert, Massachusetts Inst. of Tech., USA; Trapaga, Gerardo, Massachusetts Inst. of Tech., USA; Flemings, Merton C., Massachusetts Inst. of Tech., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 292-301; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Successful containerless measurement of the viscosity of a liquid metal was demonstrated for the first time during these microgravity experiments, both for the superheated and undercooled regimes. Also, high-precision containerless measurements of surface tension were performed as a part of these experiments.
Author
Gravitational Effects; Interfacial Tension; Magnetohydrodynamics; Melts (Crystal Growth)

19990019829 NASA Lewis Research Center, Cleveland, OH USA
OARE and SAMS on STS-94/MSL-1 ***Final Report***
Moskowitz, Milton, Tal-Cut Co., USA; Hrovat, Kenneth, Tal-Cut Co., USA; McPherson, Kevin, NASA Lewis Research Center, USA; Tschen, Peter, NASA Lewis Research Center, USA; DeLombard, Richard, NASA Lewis Research Center, USA; Nati, Maurizio, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Microgravity Science Laboratory (MSL-1); November 1998, pp. 316-324; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Four microgravity acceleration measurement instruments were included on MSL-1 to measure the accelerations and vibrations to which science experiments were exposed during their operation on the mission. The data were processed and presented to the principal investigators in a variety of formats to aid their assessment of the microgravity environment during their experiment operations. Two accelerometer systems managed by the NASA Lewis Research Center (LeRC) supported the MSL-1 mission: the Orbital Acceleration Research Experiment (OARE), and the Space Acceleration Measurement System (SAMS). In addition, the Microgravity Measurement Assembly (MMA) and the Quasi- Steady Acceleration Measurement (QSAM) system, both sponsored by the Microgravity Research Division, collected acceleration data as a part of the MSL-1 mission. The NIMA was funded and designed by the European Space Agency in the Netherlands (ESA/ESTEC), and the QSAM system was funded and designed by the German Space Agency (DLR). The Principal Investigator Microgravity Services (PIMS) project at the NASA Lewis Research Center (LeRC) supports Principal Investigators (PIs) of the Microgravity science community as they evaluate the effects of acceleration on their experiments. PIMS primary responsibility is to support NASA-sponsored investigators in the area of acceleration data analysis and interpretation. A mission summary report was prepared and published by PIMS in order to furnish interested experiment investigators with a guide for evaluating the acceleration environment during the MSL-1 mission.
Author

Acceleration Measurement; Accelerometers; Microgravity; Space Transportation System; Test Facilities

19990019830 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany

Microgravity Measurements of QSAM on Spacelab MSL-1

Hamacher, Hans, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Jilg, R., ACSYS, Germany; Richter, H. E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Drees, S., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Microgravity Science Laboratory (MSL-1); November 1998, pp. 326-334; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The residual acceleration (or microgravity) of a space laboratory is a perturbation to experiments intended to be executed under weightlessness. Detailed knowledge of the microgravity is therefore indispensable for the analysis of the experiment results. Measurements of the residual acceleration are required at various locations of the spacecraft. According to the spectral sensitivity of experiments, frequencies from static (O Hz) to high frequency contributions of the order of 100 Hz has to be detected. The low amplitude levels of the static and quasi-static acceleration (typically 1 micro-g and below) requires inflight sensor calibration. The Quasi-Steady Acceleration Measurement system (QSAM), developed by DLR, is an instrument especially designed to detect acceleration in the entire range between 0 and 50 Hz. Continuous sensor calibration is achieved by signal modulation. The MSL-1 mission was the third spaceflight of QSAM. Data analysis started during the mission in the HOSC based on QSAM's real-time data processing capability. Post mission analyses concentrated mainly on investigations of characteristic perturbation pattern like those, induced by crew interaction with the orbiter (exercises), the oscillations of samples in the TEMPUS facility, shuttle induced disturbances (water dumps, thruster firings) and orbit-attitude induced residual accelerations(solar inertial attitude).
Author

Acceleration Measurement; Weightlessness; Spectral Sensitivity; Spacelab; Space Laboratories; Space Flight; Microgravity; Attitude (Inclination)

19990020834 NASA Lewis Research Center, Cleveland, OH USA

Principal Investigator Microgravity Services: USMP-3

Rogers, Melissa J. B., Tal-Cut Co., USA; Hrovat, Kenneth, Tal-Cut Co., USA; Moskowitz, Milton E., Tal-Cut Co., USA; Reckart, Timothy, Tal-Cut Co., USA; McPherson, Kevin M., NASA Lewis Research Center, USA; DeLombard, Richard, NASA Lewis Research Center, USA; Third USA Microgravity Payload: One Year Report; November 1998, pp. 135-169; In English; Also announced as 19990020826; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Two accelerometers provided acceleration data during the STS-75 mission in support of the third USA Microgravity Payload (USMP-3) experiments. The Orbital Acceleration Research Experiment (OARE) and the Space Acceleration Measurement System (SAMS) provided a measure of the microgravity environment of the Space Shuttle Columbia. The OARE provided investigators with quasi-steady acceleration measurements after about a six hour time lag dictated by downlink constraints. SAMS data were downlinked in near-real-time and recorded on-board for post-mission analysis. These two accelerometer systems are briefly described. Using a combination of data analysis techniques, the microgravity environment related to several different Orbiter, crew, and experiment operations is presented and interpreted. The microgravity environment represented by SAMS and OARE data is comparable to the environments measured by these instruments on earlier microgravity science missions. Thruster activity on this mission seen in the SAMS data appear to be more frequent than on other microgravity missions with the combined firings of the F5L and F5R jets producing significant acceleration transients. of the events studied, the crew activities performed in the middeck and flight deck, SPREE table rotations, a waste collection system compaction, and a fuel cell purge had negligible effects

on the microgravity environment of the USMP-3 carriers. The Ku band antenna repositioning activity resulted in a brief interruption of the ubiquitous 17 Hz signal in the SAMS data. In addition, the auxiliary power unit operations during the Flight Control System checkout appeared to have a significant impact on the microgravity environment.
Author
Gravitational Effects; Microgravity; Acceleration; Spaceborne Experiments

31
ENGINEERING (GENERAL)

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

19990019443 Department of the Navy, Washington, DC USA
Fuel Oxidizer Emulsion Injection System
Dura, Anthony W., Inventor; Jun. 30, 1998; 6p; In English; Supersedes US-Patent-Appl-SN-684837, AD-D018298.
Patent Info.: Filed 24 Jun. 96,; US-Patent-Appl-SN-684,837; US-Patent-5,771,847
Report No.(s): AD-D019079; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A system for improving efficiency and reducing harmful emissions in an internal combustion engine and for allowing the engine to run in oxygen poor and oxygen depleted environments is discussed. An oxidant, such as hydrogen peroxide, is emulsified with engine fuel. The emulsion is injected into the combustion chamber of the engine. A controller senses the temperature and oxygen level in the exhaust stream of the engine as well as the oxygen level in the ambient fluid. The controller operates a valve to vary the amount of oxidant added to the fuel as well as controlling the amount of ambient air introduced into the chamber and the injection of the fuel oxidant emulsion into the chamber. The controller parameters are set to maintain maximum efficiency and minimum emissions. The oxidant in the emulsion provides for near stoichiometric combustion to reduce combustion products and reduce the engine's air requirements. The reduced air requirements allow for operation of the engine in oxygen poor environments and is oxygen depleted environments, such as operation at high altitudes or operation underwater. Water is added to the emulsion oxidant to cool the stoichiometric combustion temperature to prevent excessive engine wear and to further block the formation of oxides of nitrogen.
DTIC
Internal Combustion Engines; Oxidizers; Fuel Injection; Controllers; Exhaust Gases; Emulsions

19990019755 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Analysis of the Requirements Refinement Process Used at the JNTF
Pontius, Ryan D.; May 04, 1998; 51p; In English
Report No.(s): AD-A356189; AFIT/98-017; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of this project was to evaluate and make recommendations for improving existing procedures for the Joint National Test Facility (JNTF) engineering process. The research focused on the JNTF project managers process for requirements refinement. Background was provided by a review of the JNTF DIRECTIVE NO. 4200, which outlines the processing of JNTF Task Orders. Some parts of the JNTF Systems Engineering Management Plan (SEMP) were also reviewed. Data were provided by interviews of seven out of a possible twenty JNTF project managers. The data collected from the project managers is the basis for the recommendations made. The survey information is organized using a three P analysis. The three Ps are Preparation, Payoff, and Performance.
DTIC
Systems Engineering; Test Facilities; Systems Management

19990019868 NASA Ames Research Center, Moffett Field, CA USA
Aerospace Engineering Systems and the Advanced Design Technologies Testbed Experience
VanDalsem, William R., NASA Ames Research Center, USA; Livingston, Mary E., NASA Ames Research Center, USA; Melton, John E., NASA Ames Research Center, USA; Torres, Francisco J., NASA Ames Research Center, USA; Stremel, Paul M., NASA Ames Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 197-204; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Continuous improvement of aerospace product development processes is a driving requirement across much of the aerospace community. As up to 90% of the cost of an aerospace product is committed during the first 10% of the development cycle, there is a strong emphasis on capturing, creating, and communicating better information (both requirements and performance) early in the product development process. The community has responded by pursuing the development of computer-based systems de-

signed to enhance the decision-making capabilities of product development individuals and teams. Recently, the historical foci on sharing the geometrical representation and on configuration management are being augmented: 1) Physics-based analysis tools for filling the design space database; 2) Distributed computational resources to reduce response time and cost; 3) Web-based technologies to relieve machine-dependence; and 4) Artificial intelligence technologies to accelerate processes and reduce process variability. The Advanced Design Technologies Testbed (ADTT) activity at NASA Ames Research Center was initiated to study the strengths and weaknesses of the technologies supporting each of these trends, as well as the overall impact of the combination of these trends on a product development event. Lessons learned and recommendations for future activities are reported. Author

Aerospace Engineering; Product Development; Computer Techniques; Design Analysis; Systems Engineering

19990020946 National Inst. of Standards and Technology, Office of Weights and Measures, Gaithersburg, MD USA

Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

Butcher, Tina G., National Inst. of Standards and Technology, USA; Grimes, Terry L., National Inst. of Standards and Technology, USA; Williams, Juana, National Inst. of Standards and Technology, USA; Nov. 1998; 302p; In English, USA

Report No.(s): PB99-118820; NIST/HB-44/1999; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms, beginning in 1918. This 1999 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures, with the assistance of the Office of Weights and Measures of the National Institute of Standards and Technology (NIST). The handbook includes amendments endorsed by the 83rd National Conference on Weights and Measures during its Annual Meeting in 1998.

NTIS

Weight Measurement; Weight Indicators; Tolerances (Mechanics)

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.

19990019115 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

ATR Performance Modeling and Estimation

Dudgeon, Dan E.; Dec. 07, 1998; 42p; In English

Contract(s)/Grant(s): F19628-95-C-0002

Report No.(s): AD-A357723; TR-1051; ESC-TR-97-137; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this document is to assess the state of the art of performance modeling and estimation for synthetic aperture radar (SAR) automatic target recognition (ATR) algorithms. The study underlying this report is part of the Lincoln Laboratory effort under the OSD ATR Program. The intent is not to produce an exhaustive, detailed, voluminous report describing all ongoing efforts, but rather to capture in a succinct yet essentially complete way the approaches currently in use for modeling the performance of SAR ATR algorithms. To provide context for this document's assessment and recommendations, a brief discussion of the breadth of ATR problems and some of the resulting technical challenges will be conducted. This discussion will generally be couched in terms of the SAR ground surveillance problem of detecting and recognizing various military vehicles, though many of the statements are easily extended to other sensors and other applications. Basic performance metrics will be defined, and a discussion will ensue of the kinds of questions it would be useful to have addressed by a performance model. The principal approaches to modeling the performance of SAR ATR algorithms and estimating performance characteristics under a variety of conditions will then be outlined and assessed. The document concludes by recommending certain actions to encourage progress in the development of SAR ATR performance modeling and evaluation tools and methodologies.

DTIC

Target Recognition; Synthetic Aperture Radar; Algorithms

19990019116 Army Research Lab., Information Science and Technology Directorate, White Sands Missile Range, NM USA
924-MHz Wind Profiling Radar Acceptance Tests ***Final Report***
Vaucher, Gail T., Army Research Lab., USA; Creegan, Edward, Army Research Lab., USA; Yarbrough, Jimmy, Army Research Lab., USA; Nov. 1998; 123p; In English
Report No.(s): AD-A357711; ARL-TR-1815; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In March of 1998, the Artillery Branch of the Army Research Laboratory received a Reconstructed 924 MHz Wind Profiling Radar System. Over the subsequent months, several hardware tests were conducted to verify the successful functioning of the radar components and integrated system. In this technical publication, seven radar evaluation tests are documented. The first two radar evaluation tests, the Frequency Survey, and the Local Site and Internal Radar System Noise Tests, examine the non-operational environments for possible radar signal corruption sources. The radar signal itself is reviewed in the Radar Signal Analysis Test. Finally, the radar's components are isolated and evaluated in the
DTIC
Signal Analysis; Meteorological Radar; Wind Profiles

19990019126 Lockheed Sanders, Inc., Nashua, NH USA
Secure Heterogeneous Application Run-Time Environment (SHARE) ***Final Report, Aug. 1995 - Nov. 1997***
Smith, Jeff; Sep. 1998; 231p; In English
Contract(s)/Grant(s): F30602-95-2-0051; DARPA ORDER-D355; AF Proj. D002
Report No.(s): AD-A357636; AFRL-IF-RS-TR-1998-183; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The SHARE (Secure Heterogeneous Application Run Time Environment for High Performance Scalable Computing) is a contractual cooperative agreement between Sanders and DARPA. The SHARE program addresses the critical requirements that will enable next generation Command, Control, Communications and Intelligence (C3I) and combat systems to incorporate low cost distributed High Performance Scalable Computing (HPSC) technology. Research efforts with the high performance Packet-Way protocol, Myricom packet switching network technology, and the Message Passing Interface (MPI) standard have been combined, adapted, and extended to create a secure, interoperable heterogeneous application run time environment.
DTIC
Heterogeneity; Communication Networks

19990019439 Department of the Navy, Washington, DC USA
Sigma-Delta Modulator with Tunable Signal Passband
Harris, Frederick J., Inventor; Caulfield, Robert W., Inventor; McKinght, William H., Inventor; Apr. 07, 1998; 12p; In English
Patent Info.: Filed 31 Jan. 95,; US-Patent-5,736,950; US-Patent-Appl-SN-384,819
Report No.(s): AD-D019121; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A band-pass sigma-delta modulator includes a translator for tuning to a selected signal passband within the tuning range of the modulator is discussed. In a network implementation, the translator is integral with each integrator associated with the sigma-delta modulator(s). The translator can comprise a network having a transfer function defined in the Z-domain as (Zalpha-1)/(Z-alpha), where -1 less than or equal alpha less than or equal 1 defines the tuning. The value of alpha is defined as alpha equivalent cos(2pifgm/fs), where fgm is the geometric mean frequency of the passband and fs is the input sample frequency of the sigma-delta modulator(s). The invention can benefit many signal processing applications such as, for example. A/D, D/A and D/D converters; and digital communication systems including digital radio and digital TV. In digital communications (e.g., radio, TV, etc.), the invention can be used where it is desirable to digitize the full tuning range or bandwidth of a receiver at an intermediate frequency early in the processing chain, thus allowing digital tuning or mixing of the desired signal. Such digital mixing or tuning overcomes the limitations of analog mixers/receivers, for example limited linearity in dynamic range as well as the problems associated with aliasing, artifacts, ghosts, harmonics, distortion, gain and phase mismatch, etc. The sigma-delta modulator of the invention also provides variable bandwidth, is operationally stable and is easily and inexpensively realized.
DTIC
Analog to Digital Converters; Digital to Analog Converters; Signal Processing; Delta Modulation

19990019446 California Univ., Davis, CA USA
Programmable Blind Adaptive Multivariate Filtering ***Final Report, 1 Jun. 1995 - 31 Mar. 1998***
Gardner, William A.; Jul. 15, 1998; 5p; In English
Contract(s)/Grant(s): DAAH04-95-1-0328
Report No.(s): AD-A358093; ARO-33194.5-EL; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We are developing a new framework, called Programmable Canonical Correlation Analysis (PCCA), for the design of blind adaptive spatial filtering algorithms that attempt to separate one or more signals of interest from co-channel interference and noise. Unlike many alternatives, PCCA does not require knowledge of the calibration data for the array, directions of arrival, training signals, or spatial autocorrelation matrices of the noise or interference. A novel aspect of PCCA is the ease with which new algorithms, targeted at capturing all signals from particular classes of interest, can be developed within this framework. The performance of the new method is being investigated analytically and by computer simulations to quantify its capabilities of signal separation, multipath mitigation, and interference rejection. Preliminary results suggest that the new method can converge very quickly to yield estimates that are comparable to those obtained by the MMSE method that uses perfectly known training signals.
DTIC
Adaptive Filters; Electromagnetic Interference; Signal Processing; Spatial Filtering

19990019515 Iowa State Univ. of Science and Technology, Ames, IA USA
Narrowband and Multiple-Access Interference Suppression for Direct Sequence Spread Spectrum Communication Receivers ***Final Report, 1 Sep. 1995 - 31 Aug. 1998***
Doherty, John F.; Aug. 31, 1998; 56p; In English
Contract(s)/Grant(s): DAAH04-95-1-0342; DAAG-97-1-0389
Report No.(s): AD-A357984; ARO-33481.4-MA-YHP; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report presents research results focused on the mitigation of both narrowband and multiple access interference in direct sequence spread spectrum communication systems. Both linear and nonlinear adaptive algorithmic approaches are developed and reported. Specific attention has been paid to making the algorithmic practicable. In addition to the algorithmic development, a software simulation for a code division multiple access system is developed using a commercially available programming environment.
DTIC
Research; Spread Spectrum Transmission; Telecommunication; Narrowband; Algorithms; Radio Frequency Interference

19990019522 Japan Broadcasting Corp., Science and Technical Research Labs., Tokyo, Japan
Improving the Picture Quality of the MUSE Signals
Naemura, Masahide, Japan Broadcasting Corp., Japan; Izumi, Yoshinori, Japan Broadcasting Corp., Japan; Fukuda, Atsushi, Japan Broadcasting Corp., Japan; Iwadate, Yuichi, Japan Broadcasting Corp., Japan; Yamaguchi, Kohichi, Japan Broadcasting Corp., Japan; Ninomiya, Yuichi, Japan Broadcasting Corp., Japan; Gohshi, Seiichi, Japan Broadcasting Corp., Japan; Yamakita, Atsushi, Japan Broadcasting Corp., Japan; R and D of NHK Science and Technical Research Laboratories; Feb. 1996; ISSN 0914-7535, No. 39, pp. 1-13; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper describes a new signal processing method for MUSE encoders and decoders that improves Hi-Vision picture quality. Eight years have passed since MUSE was first developed as an HDTV broadcasting broadcasting system. Although the picture quality of MUSE signals is sufficient for practical use, it is still possible to to improve it further. Our new signal processing method improves the picture quality in the moving areas. In addition, we have been studying how to improve picture quality of the stationary areas as well, which means extending the resolution and the attenuating aliasing noise. On the basis of this research, we have developed a new MUSE encoder and a new MUSE decoder.
Author
Signal Processing; Broadcasting; Coders; Decoders

19990019702 Northern Virgina Community Coll., Dept. of Math, Science and Engineering, Annandale, VA USA
Probing in the New ETR Low Frequency Facility to Optimize the Quiet Zone
Fahed, Charbel T., Northern Virgina Community Coll., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 60; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only
The Electromagnetic Research Branch is upgrading the ETR facility to cover a wider frequency range, especially on the low frequency end, because there is currently a larger demand for low frequency RCS measurements. This summer, the range is near completion. to Characterize the field quality in this range, it is necessary to do field probing. Using a 14 ft composite probe made of carbon graphite, which is very stiff and, at the same time, lighter than other metals, the positioner was placed on a 20-ft tower to probe across the middle of the quiet zone. In addition, the probe was able to move on rails, about 20 ft up and down range. Probing scans were made in two polarization and two directions. For each probing position there were 4 sets of data. There were problem issues to solve with the synthesizer to communicate with the controlling computer. The software was written for an 8753 synthesizer, whereas, the machine available was 8752A. An 8721 machine was borrowed and tried. It works fine except we were

limited in the scan times due to the slower sweep rate. The RF front end, however, limited the frequency range from 0.3 to 2.0 GHz. The data obtained proved that the 26 sq. reflector worked fine instead of the larger previous design. The results came out surprisingly good, with about 1/2dB ripple, which is quite acceptable. A temporarily blocking wall of absorber near the feed reduced stray signals. Next, the other half end of the room will be covered with absorber, and more data will be taken to minimize other scattering.
Author
Frequency Ranges; Synthesizers; Scattering; Reflectors; Radio Frequencies

19990021108 Department of the Navy, Washington, DC USA
Statistical Inference of Electromagnetic Interference Sources Based on a Priori Knowledge of Source and Receiver Parameters
Garcia, Joseph P., Inventor; Cohen, Edgar A., Jr, Inventor; Oct. 23, 1998; 28p; In English
Patent Info.: Filed 23 Oct. 1998; US-Patent-Appl-SN-09/176,932
Report No.(s): AD-D019155; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A transceiver system comprises transceivers and a controller in communication with the transceivers is discussed. Each of the transceivers comprises an emitter, a receiver operatively connected to the emitter, a primary data path operatively connected to the receiver, a secondary data path operatively connected to the receiver, a statistical unit operatively connected to the secondary data path and the controller and a display device operatively connected to the primary data path. The controller determines relative positions of the transceivers, and the statistical unit infers characteristics of the transceivers, forms a composite received signal model for all of the transceivers based on the relative positions and the characteristics, computes an electromagnetic interference likelihood value for a transceiver of the transceivers and identifies whether the transceiver is a source of electromagnetic interference by determining whether the electromagnetic interference likelihood value of the transceiver exceeds a threshold value.
DTIC
Radar Receivers; Radar Transmitters; Signal Processing; Electromagnetic Interference

19990021120 Zhang (Jian-Xiang), Tucson, AZ USA
Effectiveness of Videoconferencing, Phase 1, Pre-Pilot Test Report ***Final Report***
Zhang, J. X., Zhang (Jian-Xiang), USA; Nov. 1998; 170p; In English
Contract(s)/Grant(s): SPR-PL-1-(53) 455
Report No.(s): PB99-118457; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This phase of the project entailed research into the impacts experienced by other organizations that have deployed videoconferencing technology (VCT). Clearly, the study shows that videoconferencing offers much promise for communications between geographically remote parties. There is little doubt that the use of videoconferencing (particularly with features such as shared documents, whiteboard, etc.) will increase as the technology improves and bandwidth limitations are overcome. Additional usage for VCT is sure to develop, as the use of the technology becomes more commonplace. Field interviews and observations provided an insight to how this VCT really helped the companies and organizations to reduce travel costs and enhance effective and efficient use of time. The 'Buyers' Guide' has been designed in an effort to provide a future user of VCT with a useful methodology for buying videoconferencing equipment, either room system units or desktop units. The researcher believes that this report provides the necessary background tools to make educated purchasing decisions.
NTIS
Video Communication; Teleconferencing; Pilot Performance

19990021121 State Univ. of New York, Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY USA
Proceedings of the Workshop on Performance Criteria for Telecommunication Services under Earthquake Conditions
Schiff, A. J., State Univ. of New York, USA; Jul. 15, 1998; 142p; In English, 16 Apr. 1998, Stanford, CA, USA
Contract(s)/Grant(s): NSF BCS-90-25010
Report No.(s): PB99-118952; MCEER-98-0008; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
The FEMA-NIST effort to develop seismic guidelines for lifelines takes a system approach in which performance criteria are to be developed for the system. The long-term objective is to establish appropriate seismic performance criteria for the public switched network (PSN), to address the needs of the National Security/Emergency Preparendness (NS/EP) Community, and to develop measures to assess if the criteria are being satisfied. Accordingly, a workshop was convened, the goals of which were: start the process of establishing seismic performance criteria by identifying critical issues that need to be addressed; explore methods for measuring if the criteria are being satisfied before and after earthquakes; explore additional topics, such as identification of research needs and impact of deregulation of the communications industry; generate a report summarizing the finding of the

workshop. The plan for the workshop was to gather a small working group of telecommunications specialists to review issues related to the performance of communication systems, identify key issues that should be addressed in performance criteria, and suggest measures for evaluating them. This volume presents eleven of the workshop papers along with a workshop summary, recommendations, the workshop program and a participants list.
NTIS
Telecommunication; Earthquakes; Conferences; Communication Networks

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.

19990019181 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
EMI Effects on MOSFETs and CMOS Inverters and their Predictions
Liu, Cheng-Kuang, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Yang, Wu-Der, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Jou, Tzung-Ping, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Lai, Fu-Shun, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Chen, Jen-Ming, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 129-138; In English
Contract(s)/Grant(s): NSC85-2215-E-011-007; NSC86-2221-E-011-016; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The effects of electromagnetic interference (EMI) coupled through the substrate, gate input, and power supply into MOS devices are studied experimentally. This research also investigated the performance degradation of nMOSFET, pMOSFET, and CMOS inverters due to interference. Their bias dependence, RF power, and frequency dependence are taken into account. Furthermore, empirical models are proposed to predict EMI susceptibility. Predicted results compare well with experimental data.
Author
CMOS; Electromagnetic Interference; Metal Oxide Semiconductors; Inverters; Substrates; Field Effect Transistors

19990019255 Notre Dame Univ., IN USA
Proceedings of the Fifth International Workshop on Computational Electronics
Sep. 1998; 558p; In English
Contract(s)/Grant(s): DAAH04-96-1-0337
Report No.(s): AD-A357924; ARO-36171.2-EL-CF; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche

This report contains papers presented at the 5th international workshop on computational electronics. Topics include: (1) device simulation, (2) VLSI, (3) thermal effects, (4) molecular structures, (5) optoelectronics, (6) software developments, (7) mathematical models, (8) high performance computing, (9) quantum simulation, and (10) quantum structures.
DTIC
Metal Oxide Semiconductors; Quantum Electronics; Conferences; Mathematical Models; Electronic Equipment; Electro-Optics

19990019315 Stanford Univ., Stanford, CA USA
Smart Antennas for Battlefield Multimedia Wireless Networks with Dual Use Applications ***Final Report, 15 Aug. 1995 - 15 Aug. 1998***
Paulraj, Arogyaswami, Stanford Univ., USA; Aug. 28, 1998; 23p; In English
Contract(s)/Grant(s): DAAH04-95-1-0249
Report No.(s): AD-A357870; FRI/96/3; ARO-34002.1-EL-FRI; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Work under this contract focused on algorithms for space time processing (STP) address the critical needs of the wireless battlefield network including high speed data, enhanced coverage and capacity, low power, and antijam capability. STP, also known as smart antennas, has application in battlefield multimedia distributed wireless networks and can readily be conformed to civilian mobile communications. Significant progress was made in the areas of space time channel modeling, space time receiver algorithms, and space time transmit algorithms. It was shown that smart antenna enabled systems are capable of improving

performance in severe multipath environments, in the presence of co-channel interference, and with unknown or variable antenna geometry. Many of the proposed algorithms were ultimately demonstrated in a TDMA smart antenna testbed built at Stanford.
DTIC
Time Division Multiplexing; Directional Antennas; Radiotelephones; Antenna Design; Mobile Communication Systems; Algorithms

19990019371 Department of the Navy, Washington, DC USA
Broadband Traveling Wave Amplifier with an Input Stripline Cathode and an Output Stripline Anode
Yoder, Max N., Inventor; Jun. 30, 1998; 16p; In English; Supersedes US-Patent-Appl-SN-623757
Patent Info.: Filed 29 Mar. 96,; US-Patent-Appl-SN-623,757; US-Patent-5,773,933
Report No.(s): AD-D019136; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A broadband, traveling wave amplifier which includes a target anode and an electron gun for bombarding the anode with an electron beam having an amplitude proportional to that of an input signal is discussed. The electron gun includes a NEA semiconductor cold cathode having an electron emitting surface and a modulation structure for modulating the emitted electron beam with an input signal to be amplified. The electron gun and the anode are configured as parallel strip transmission lines having the same phase velocity. The target anode may be a reversed biased stripline diode, Schottky barrier stripline diode, or metal/semiconductor metal stripline structure.
DTIC
Electron Guns; Cold Cathode Tubes; Broadband Amplifiers; Traveling Wave Amplifiers; Microstrip Transmission Lines; Anodes; Electron Beams; Cathodes

19990019395 NASA Lewis Research Center, Cleveland,OH USA
Baseline Testing of the Hybrid Electric Transit Bus
Brown, Jeffrey C., NASA Lewis Research Center, USA; Eichenberg, Dennis J., NASA Lewis Research Center, USA; Thompson, William K., NASA Lewis Research Center, USA; Jan. 1999; 58p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 251-30-07
Report No.(s): NASA/TM-1999-208890; E-11475; NAS 1.15:208890; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A government, industry and academic cooperative has developed a Hybrid Electric Transit Bus (HETB). Goals of the program include doubling the fuel economy of city transit buses currently in service, and reducing emissions to one-tenth of EPA standards. Unique aspects of the vehicle's power system include the use of ultra-capacitors for the energy storage system and the planned use of a natural gas fueled turbogenerator, to be developed from a small jet engine. At over 17000 kg gross weight, this is the largest vehicle to use ultra-capacitor energy storage. A description of the HETB, the results of performance testing, and future vehicle development plans are the subject of this report.
Author
Electric Hybrid Vehicles; Urban Transportation; Engine Design; Design Analysis; Performance Tests; Hybrid Propulsion

19990019403 Massachusetts Inst. of Tech., Cambridge, MA USA
A Microfabricated Motor-Compressor for Fuel Cell Applications ***Final Report, 16 Jun. 1996 - 14 Jun. 1998***
Ayon, A.; Breuer, K.; Chen, K.-S.; Ehrich, F.; Frechette, L.; Aug. 1998; 106p; In English
Contract(s)/Grant(s): DAAH04-96-1-0256
Report No.(s): AD-A357845; ARO-35749.2-CH; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This effort is directed at research leading to microfabricated motor driven compressors suitable far the pressurization of fuel cells in the 50-150 watt range and microblowers (lower pressure rise, high air flows) for instrument aspiration. Micromachined from silicon, these are high power microelectrical and mechanical systems (MEMS). The design performance for the compressor is pumping 0.1 g/sec of air at a pressure ratio of 2:1 while consuming approximately 15-20 watts of electrical power.
DTIC
Turbomachinery; Microelectromechanical Systems; Micromachining; Fabrication; Compressors

19990019409 Department of the Navy, Washington, DC USA
Method of Making Buried Gate Insulator Field Effect Transistor
Aklufi, Monti E., Inventor; Jan. 06, 1998; 14p; In English; Supersedes US-Patent-Appl-SN
Patent Info.: Filed 7 Oct. 96,; US-Patent-Appl-SN-726,724; US-Patent-5,705,412
Report No.(s): AD-D019129; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A buried, gate insulator field effect transistor is disclosed. It comprises a source, drain, substrate, gate, and a gate insulator layer separating the gate from the source, drain and substrate; and a protective silicon dioxide covering layer. Windows are excised into this covering layer to allow electrical connection to the source, substrate, drain, and gate. The substrate and gate are vertically aligned in the resulting structure. The source, drain and gate are fabricated from a doped, semiconductor of one polarity while the substrate is fabricated from doped semiconductor of the opposite polarity. The gate insulator layer is fabricated by implanting an element or elements selected from Group V, VI or VII into the semiconductor to form a semiconductor-compound insulator. Methods of fabricating this device are also disclosed. In one embodiment the device is fabricated on an insulating base layer. The gate is formed next to me base. In a second embodiment, no base is used. The gate insulator is formed between the gate and substrate. In both cases the gate insulator is formed within the semiconductor in a buried and protected mode.
DTIC
Field Effect Transistors; Gates; Electrical Insulation; Insulators; Fabrication; Electric Connectors; Doped Crystals

19990019514 Arizona Univ., Tucson, AZ USA
Improving VCSEL's and Rare-Earth-Doped LED's ***Final Report, 1 Sep. 1995 - 31 Aug. 1998***
Gibbs, hyatt M.; Khitrova, Galina; Nov. 11, 1998; 20p; In English
Contract(s)/Grant(s): DAAH04-95-1-0612
Report No.(s): AD-A357987; ARO-34858.6-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The possibility of enhancing the luminescence efficiency of Er ions embedded in a semiconductor was investigated by growing about forty erbium-doped lnGaAs/GaAs and GaAs/AlGaAs multiple quantum well samples by molecular beam epitaxy. The idea was to enhance the semiconductor-to- erbium transfer by tuning the quantum-well transition energy to equal one of the erbium ion transitions. Although photoluminescence was seen up to room temperature, strong diffusion of erbium and interdiffusion of Ga and Al ions degraded the quantum wells and formed Er traps that differ by positions of fine structure lines, photoluminescence lifetimes, and temperature dependences.
DTIC
Ions; Erbium; Aluminum Gallium Arsenides; Semiconductors (Materials)

19990019523 Japan Broadcasting Corp., Science and Technical Research Labs., Tokyo, Japan
A Measuring Method to Analyze the Causes of VTR Reproduced Output Fluctuation
Sakai, Tadahiro, Japan Broadcasting Corp., Japan; Kondoh, Satoru, Japan Broadcasting Corp., Japan; Sekiguchi, Takuji, Japan Broadcasting Corp., Japan; R and D of NHK Science and Technical Research Laboratories; Feb. 1996; ISSN 0914-7535, No. 39, pp. 14-27; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In order to obtain a stable output signal on a VTR, it is necessary to analyze the causes of output fluctuation and study them quantitatively. A new quantitative measurement method has been developed . In this method, two different frequency-time division signals are recorded and the ratios of the reproduced output to the peak output at each wavelength are plotted two-dimensionally. Using this method, we conducted an experiment and confirmed its validity in measuring off-track and spacing fluctuation. It has also been confirmed that the time division method is superior to the frequency multiplexing method in using two-frequency signals. Furthermore, it has been demonstrated that fluctuation can be measured even in ultra-narrow track recording by carrying out off-track correction taking into account the recording/reproduction crosstalk.
Author
Multiplexing; Frequencies; Output; Variations

19990019524 Japan Broadcasting Corp., Science and Technical Research Labs., Tokyo, Japan
A 40-Inch-Diagonal Hi-Vision Plasma Display
Yamamoto, Toshihiro, Japan Broadcasting Corp., Japan; Kuriyama, Takao, Japan Broadcasting Corp., Japan; Seki, Masahiko, Japan Broadcasting Corp., Japan; Katoh, Toshihiro, Japan Broadcasting Corp., Japan; Takei, Tatsuya, Japan Broadcasting Corp., Japan; Kawai, Takashi, Japan Broadcasting Corp., Japan; Murakami, Hiroshi, Japan Broadcasting Corp., Japan; R and D of NHK Science and Technical Research Laboratories; Feb. 1996; ISSN 0914-7535, No. 39, pp. 28-42; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A 40-inch-diagonal color DC plasma display with an aspect ratio of 16:9 is developed as a hang-on-wall TV for home use. Pattern distortion of the panel during screen printing and firing processes was reduced by introducing the new screen mesh with a high opening ratio and optimizing the firing conditions. These improvements made it possible to fabricate a 40-inch panel with a high precision over the whole active area of the panel. A sufficiently large memory margin is obtained by improvement of the driving technique, in addition to improvements to panel fabrication. Development of electrode drive HICs made it possible to

reduce the thickness of the display unit to 8 cm. Hi-Vision pictures with peak white luminance of 93 cd/sq m have been reproduced on the experimentally fabricated 40-inch panel in hang-on-wall TV style.
Author
Television Systems; Display Devices; Plasmas (Physics); Luminance; Electrodes

19990019634 Fukui Univ., Faculty of Engineering, Japan
Making an User-Friendly Interface with X-window to a Logic Circuit Simulator
Matsumoto, Akira, Fukui Univ., Japan; Yanase, Tatsurou, Fukui Univ., Japan; Hasegawa, Takemitsu, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 333-342; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An user-friendly interface with X-window to a logic circuit simulator is constructed and integrated into a system. Users can use the simulator interactively with the interface constructed which facilitates many operations, such as input, modification and storing of circuit charts or decision of signal waves.
Author
Simulators; Logic Circuits; Fabrication

19990019717 Elizabeth City State Univ., Dept. of Technology, NC USA
Stereolithography in Electronics
Lawrence, Ellis E., Elizabeth City State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 77; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The electronic instrumentation and development section focused on investigating a method of transforming a conceptual design to an electronic part or model quickly. One proposed approach to this method was the use of stereolithography (SL). SL uses a photocurable liquid epoxy resin as a building material. to build the part, a low-powered laser was navigated in the shape of the model as directed by a computer aided drawing file or .STL format. The .STL data used webbing of polygons to approximate the part. The laser etched or pre-cured a two-dimensional cross section onto the top layer of resin which yielded a slice. The slice distance was used to lower the part into the vat (usually around .004). A blade was then passed over the surface of the part to sweep the liquid smooth. The laser moved on to the next slice of the part until the model was formed. Consecutive layers were cured into preceding layers by setting the ”cure depth,” thus providing a dense prototype. This investigation was also concerned with eliminating the need to substitute axial lead resistors or capacitors for microelectronic surface mount components. Due to their size, these axial lead parts are used in prototyping circuits rather than the microparts. Through SL, it was possible to design a part for prototyping microelectronic surface mount components. Unlike other models which are often built in inches, the microelectronic part had to be built in thousandths of an inch. Some features of the microelectronic part are only .022 of an inch high. This is a concern when the slicing by the stereo- lithography machine is in increments of .004 of an inch. The part has to be built in multiples of .004. SL allowed us to evaluate the part’s feasibility, manufacturability and aesthetics, while the model was being built. We were able to test for external loadings, torsion, tension and pressure of the electronic part in the prototype environment. The results of this investigation found that SL has a role to play in microelectronics.
Author
Computer Techniques; Microelectronics; Lithography; Resistors; Lasers; Epoxy Resins; Etching

19990019725 New River Community Coll., Dept. of Electronics/Fiber Optics, Dublin, VA USA
Thunder-Microphone, Thunder-Speaker
Shirvani, Mir S., New River Community Coll., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 85; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

This investigation focuses on the study of a new application of Thunder as a highly sensitive microphone and speaker. The microphone will detect the voice from the neck area, and the speaker will provide a full range of audio frequency. Thunder, a new piezoelectric device, is based on a piezoelectric ceramic wafer attached to a metal backing using a polyimide adhesive. The ferroelectric material used in the manufacture consists of a piezoelectric wafer laminated between layers of materials such as aluminum, stainless steel, beryllium, etc., bonded with a soluble imide adhesive created at NASA. In this manner a more durable and more flexible actuator is obtained. Two clear advantages of this new piezoelectric device class over others are ease of fabrication and the ability to create application specific device. The first phase of the project dealt with designing a highly sensitive linear prototype multi-stage amplifier system. This,system will then amplify extremely small signals that are generated from Thunder due to displacement that is caused by voice. A prototype optical transmitter and receiver was also designed for long distance transmis-

sion. The receiver system had to be highly sensitive in order to drive the Thunder speaker. The second phase of the project was to construct a Thunder that is able to detect a voice (mic) and reproduce the voice (speaker). The characteristics of Thunder in terms of displacement and signal generation are dependent to dimensions, geometry, and fabrication process of their adaptive materials. The final phase of the project was testing the complete prototype system. The results of the study indicate the system can efficiently replace the conventional sensitive microphone and speaker, while reducing cost and increasing performance.
Author
Ferroelectric Materials; Piezoelectric Ceramics; Piezoelectricity; Microphones; Linear Amplifiers; Audio Frequencies; Polyimides

19990019762 Polytechnic Univ., Dept. of Electrical Engineering, Brooklyn, NY USA
Technology Development for Multilayered Microwave and Millimeter Wave Integrated Circuits ***Final Report***
Das, N. K.; Bolle, D. M.; Oct. 31, 1998; 15p; In English
Contract(s)/Grant(s): DAAH04-95-1-0254
Report No.(s): AD-A357789; ARO-31427.13-EL; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the last three years of research we have contributed to the technology development for multilayer microwave/millimeter wave integrated circuits (multilayer MMICs) of the future. Such multilevel integration would allow implementation of smaller sized, higher density, and multi-functional microwave/millimeter wave circuits and systems, that are more reliable and cost effective. Specifically, we have (1) investigated new transmission media that are better suited for multilayer integration, where conventional techniques may not work properly, (2) developed novel geometries for efficient signal transition between circuit layers in a multilayer environment, (3) developed new antenna and feeding structures that are specifically meant to work with multilayer integration, and (4) developed new theory and analytical/computational models for the design of transmission lines, layer to layer coupling structures. multilayer antenna feeds, which will greatly support the future development of the multilayer MMIC technology. Our research shows, that there are several fundamental and technological issues that must be carefully considered to advance the multilayer microwave/millimeter wave integration concept. However, by using new techniques and devices, such as those developed by us, much more sophisticated and cost effective circuits and systems can be built to meet the future demands in radar and wireless telecommunication.
DTIC
Integrated Circuits; Millimeter Waves; Strip Transmission Lines; Antenna Couplers

19990020993 National Inst. of Standards and Technology, Office of Law Enforcement Standards, Gaithersburg, MD USA
New Technology Batteries Guide. NIJ Guide 200-98. Law Enforcement and Corrections Standards and Testing Program
Ingram, William J., National Inst. of Standards and Technology, USA; Oct. 1998; 68p; In English
Report No.(s): PB99-116709; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This battery guide is provided to inform the reader of the latest technology related to battery composition, battery usage, and battery charging techniques.
NTIS
Electric Batteries; Law (Jurisprudence)

19990021039 Middle Tennessee State Univ., Dept. of Chemistry, Murfreesboro, TN USA
A Synthesis of Fluid Dynamics and Quantum Chemistry for the Design of Nanoelectronics
MacDougall, Preston J., Middle Tennessee State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In 1959, during a famous lecture entitled ”There’s Plenty of Room at the Bottom”, Richard Feynman focused on the startling technical possibilities that would exist at the limit of miniaturization, that being atomically precise devices with dimensions in the nanometer range. A nanometer is both a convenient unit of length for medium to large sized molecules, and the root of the name of the new interdisciplinary field of ”nanotechnology”. Essentially, ”nanoelectronics” denotes the goal of shrinking electronic devices, such as diodes and transistors, as well as integrated circuits of such devices that can perform logical operations, down to dimensions in the range of 100 nanometers. The thirty-year hiatus in the development of nanotechnology can figuratively be seen as a period of waiting for the bottom-up and atomically precise construction skills of synthetic chemistry to meet the top-down reductionist aspirations of device physics. The sub-nanometer domain of nineteenth-century classical chemistry has steadily grown, and state-of-the-art supramolecular chemistry can achieve atomic precision in non-repeating molecular assemblies of the size desired for nanotechnology. For nanoelectronics in particular, a basic understanding of the electron transport properties of molecules must also be developed. Quantum chemistry provides powerful computational methods that can accurately predict the properties of small to medium sized molecules on a desktop workstation, and those of large molecules if one has access to a super-

computer. of the many properties of a molecule that quantum chemistry routinely predicts, the ability to carry a current is one that had not even been considered until recently. ”Currently”, there is a controversy over just how to define this key property. Reminiscent of the situation in high-Tc superconductivity, much of the difficulty arises from the different models that are used to simplify the complex electronic structure of real materials. A model-independent approach has been proposed, that sacrifices the plentiful molecular orbitals and Bloch functions of conventional approaches, for a single three-dimensional observable quantity, the electron momentum density Pi(sub rho). This quantity is simply the probability of any electron having momentum rho, multiplied by the total number of electrons in the system (the position of the electron is uncertain). We have explored the utility of this new approach in providing a fundamental understanding of the electron transport properties of molecules that have provi been nominated as candidates for components in the design of nanoelectronics; phenylene-ethynylene oligomers. Some of the molecular systems that have been studied are sketched below.
Author
Synthesis (Chemistry); Fluid Dynamics; Quantum Chemistry; Miniaturization; Transport Properties; Superconductivity; Atomic Structure

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.

19990019167 Nagasaki Univ., Faculty of Engineering, Japan
The Simplified Expression of the Radiative Transfer Equation in the Thermal IR Spectrum
Moriyama, Masao, Nagasaki Univ., Japan; Amiki, Youzo, Nagasaki Univ., Japan; Ishimatsu, Takakazu, Nagasaki Univ., Japan; Reports of the Faculty of Engineering, Nagasaki University; Jan. 1994; ISSN 0286-0902; Volume 24, No. 42, pp. 45-49; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The simplified expression of the radiative transfer equation in the thermal IR spectrum are made for the fundamental formulation of the epsilon-T separation through the multispectral thermal IR sensor such as ASTER onboard EOS-aml will be launched at 1998. In the simplification, there are there approximations are made for the reduction of the unknown variables. The first approximation is the use of the spectrally integrated Planck function, transmittance and surface emissivity instead of the line-by-line radiative transfer process calculation. The second approximation is the reduction of the atmospheric radiation term into the product of total transmittance and the newly defined value named representative atmospheric radiation. and the third is the simplification of the total transmittance calculation on the basis of the assumption which water vapor is the only one absorber. From the numerical simulation based on the 4050 kinds of surface/atmosphere/observation conditions, the proposed simplified radiative transfer equation is sufficient for the epsilon-T separation.
Author
Radiative Transfer; Surface Properties; Infrared Detectors; Atmospheric Radiation

19990019168 Nagasaki Univ., Faculty of Engineering, Japan
Numerical Analysis on Laminar Forced Convective Heat Transfer in Thermal Entrance Region of Circular Tube with Internal Longitudinal Fins
Kanemaru, Kuniyasu, Nagasaki Univ., Japan; Shigechi, Toru, Nagasaki Univ., Japan; Yamada, Takashi, Nagasaki Univ., Japan; Reports of the Faculty of Engineering, Nagasaki University; Jan. 1994; ISSN 0286-0902; Volume 24, No. 42, pp. 25-31; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The laminar forced convective beat transfer is numerically analyzed in a circular tube with internal longitudinal fins, where the effect of the finite conductivity of the finned tube was taken into account in order to investigate the application of carbon steel tubes in heat exchangers. It is assumed that the velocity profiles are fully-developed at the inlet of the tube and that the heat flux at the outer wall is set to be uniform. Owing to the axial symmetry, the cross sectional area to be solved is limited to the circular sector which consists of two parts, fluid and finned tube regions. The governing equation for energy was analyzed by the implicit marching finite difference method after the velocity profiles were numerically obtained. First the numerical solutions in the thermal developing region obtained by the current method were compared with the numerical results based on the fully developed energy and momentum equations and good agreement between the former results far from the inlet and the latter was confirmed. For the wide range of geometrical parameters as well as the conductivity ratio of finned tube to fluid, the numerical calculations

were carried out. It is found that the augmentation of the heat transfer is induced by a flow peak between the fins facing each other and that the optimal fin number at the thermal developing region in most cases agrees to that of the fully-developed case.
Author
Numerical Analysis; Laminar Heat Transfer; Convective Heat Transfer; Finned Bodies; Circular Tubes

19990019170 Nagasaki Univ., Faculty of Engineering, Japan
An Experimental Study of Forced Convective Boiling Heat Transfer of Refrigerants in a Rough Surface Tube
Momoki, Satoru, Nagasaki Univ., Japan; Yu, Jian, Kyushu Univ., Japan; Fujii, Tetsu, Kyushu Univ., Japan; Reports of the Faculty of Engineering, Nagasaki University; Jan. 1994; ISSN 0286-0902; Volume 24, No. 42, pp. 13-18; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Experiments were carried out on the forced convective boiling heat transfer of refrigerants HCFC22 and HCFC123 inside a tube whose surface was rougher than that of an ordinary smooth copper tube used commercially as heat transfer tube. The local heat transfer coefficients were measured in the range of reduced pressure ratio of 0.07 to 0.23 for mass velocity 300 kg/(sq m s). The measured heat transfer coefficients inside the present tube in annular flow regime are 20 - 80% higher than those calculated using the authors' previous correlation for an ordinary smooth tube. Once the term representing the nucleate pool boiling heat transfer contribution in this correlation equation is modified by consider the surface roughness effect, the modified equation can correlate the heat transfer coefficients of the present tube within 25% deviations.
Author
Experimentation; Convective Heat Transfer; Boiling; Refrigerants; Surface Roughness Effects

19990019175 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Development and Application of a Non-Staggered Pace Algorithm for the Solution of Incompressible Navier-Stokes Equations
Jaw, Shenq-Yuh, National Taiwan Ocean Univ., Taiwan, Province of China; Hwang, Robert R., Academia Sinica, Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 197-202; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this study, a non-staggered PACE (Pressure Accurate Continuity Exact) algorithm for the solution of incompressible Navier-Stokes equations is proposed. Time accurate solutions are obtained at each time step using consistent, multi-step iterations of pressure solution and velocity corrections. From the computation of a square cavity flow with different Reynolds numbers, it was found that the proposed non- staggered PACE algorithm consumes less computer memory and CPU time, has a smoother rate of convergence, and can predict incompressible flows as accurately as a well-established staggered SIMPLER algorithm. A non-staggered grid algorithm is easier to implement and is more favorable as body-fitted or three-dimensional computations are required.
Author
Incompressible Flow; Navier-Stokes Equation; Cavity Flow; Algorithms; Iteration

19990019396 NASA Lewis Research Center, Cleveland, OH USA
Prediction of Heat and Mass Transfer in a Rotating Ribbed Coolant Passage With a 180 Degree Turn
Rigby, David L., NYMA, Inc., USA; January 1999; 18p; In English; 43rd; Gas Turbine and Aeroengine Congress, 2-5 Jun. 1998, Stockholm, Sweden; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 523-26-13
Report No.(s): NASA/TM-1999-208501; NAS 1.15:208501; E-11300; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Numerical results are presented for flow in a rotating internal passage with a 180 degree turn and ribbed walls. Reynolds numbers ranging from 5200 to 7900, and Rotation numbers of 0.0 and 0.24 were considered. The straight sections of the channel have a square cross section, with square ribs spaced one hydraulic diameter (D) apart on two opposite sides. The ribs have a height of 0.1D and are not staggered from one side to the other. The full three dimensional Reynolds Averaged Navier-Stokes equations are solved combined with the Wilcox k-omega turbulence model. by solving an additional equation for mass transfer, it is possible to isolate the effect of buoyancy in the presence of rotation. That is, heat transfer induced buoyancy effects can be eliminated as in naphthalene sublimation experiments. Heat transfer, mass transfer and flow field results are presented with favorable agreement with available experimental data. It is shown that numerically predicting the reattachment between ribs is essential to achieving an accurate prediction of heat/mass transfer. For the low Reynolds numbers considered, the standard turbulence model did not produce reattachment between ribs. by modifying the wall boundary condition on omega, the turbulent specific dissipation rate, much better agreement with the flow structure and heat/ mass transfer was achieved. It is beyond the scope of the present work

to make a general recommendation on the omega wall boundary condition. However, the present results suggest that the omega boundary condition should take into account the proximity to abrupt changes in geometry.
Author
Reynolds Averaging; Computational Fluid Dynamics; Navier-Stokes Equation; Turbine Blades; Cooling Systems; Mass Transfer; Heat Transfer; K-Omega Turbulence Model; Engine Coolants; Computational Grids

19990019512 Minnesota Univ., Dept. of Aerospace Engineering and Mechanics, Minneapolis, MN USA
Two Phase Flows of Rheologically-Complex Fluids ***Final Report***
Joseph, Daniel D.; May 15, 1998; 11p; In English
Contract(s)/Grant(s): DAAH04-95-1-0106
Report No.(s): AD-A357993; ARO-33147.17-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The projects on two-phase flows are on the direct simulation of the motion of particles in viscoelastic fluids. The second project is to study the problem of diffusion and fluid mechanics of binary mixtures of incompressible miscible liquids; when the density difference of the mixing liquids is taken into account the velocity field is not solenoidal and theory is not classical. The third problem is to study drop breakup of thickened liquids at high Mach numbers. We received additional funding for ”Aerodynamic Dissemination” to build and instrument a Mach 6 shock tube to visualize and analyze the breakup of drops. This shock tube was built and partly instrumented and interim results have been obtained.
DTIC
Two Phase Flow; Fluid Mechanics; Velocity Distribution; Viscoelasticity; Simulation

19990019567 Moscow State Univ., Russia
Flow and Crystallization in Two-Layer Liquid Systems with and without a Magnetic Field
Feonychev, Alexander I., Moscow State Univ., Russia; Ramachandran, N., Universities Space Research Association, USA; Pokhilko, Viktor I., Academy of Sciences (USSR), USSR; Mazuruk, K., Universities Space Research Association, USA; AIAA Journal of Spacecraft and Rockets; 1997; 1p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Flow, heat and mass transfer in a two-layer liquid system is investigated when the layers are subjected to a static magnetic field. The physical system consists of two immiscible liquids in a layer configuration with a free surface and an interfacial layer simulating two crystal growth configurations, namely, floating zone and horizontal zone melting. Mass transfer effects due to crystallization of one of the layers is also considered. The resulting flows are categorized into three types depending on: (a) the dominance of the free surface effect top layer, (b) a balance between the thermocapillary effect on the free surface and the interface effect between the two layers, or (c) the dominance of interfacial effects, in determining the system thermo-fluid characteristics. The use of an additional liquid layer atop the crystallizing layer leads to a reduction of the radial dopant inhomogeneity in comparison to the one-layer case. The effect an externally imposed magnetic field on dopant distribution in this two-layer configuration is rather ambiguous and depends on its direction and intensity resulting in the necessity of optimizing the applied magnetic field for a specific situation. In case of electrically non-conducting melts, the calculations show that some measure of flow control can be achieved by using an electrically conducting encapsulant layer of the desired thickness.
Author
Crystallization; Capillary Flow; Two Dimensional Flow; Inhomogeneity; Mass Transfer; Magnetostatic Fields

19990019706 State Univ. of New York, Dept. of Mechanical and Aerospace Engineering, Buffalo, NY USA
Filtered Density Function of Velocity in Large Eddy Simulation of Turbulent Flows
Givi, Peyman, State Univ. of New York, USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 64; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The primary objective of this research is to extend our previously developed methodology ”filtered density function” (FDF) to include the transport of velocity in large eddy simulation (LES) of turbulent flows. This new FDF represents the single point joint probability density function of the subgrid scale (SGS) velocity and is obtained by solution of its modeled transport equation. In this equation, the effect of convection appears in a closed form but the influence of SGS mixing is modeled. The stochastic differential equations (SDEs) which yield statistically equivalent results to the of the FDF transport equation are derived and are solved via a Lagrangian Monte Carlo scheme. The consistency, convergence, and accuracy of the FDF and the Monte Carlo solu-

tion of its equivalent SDEs are assessed. These results are being appraised by comparisons with direct numerical simulation (DNS) data.
Author
Direct Numerical Simulation; Turbulent Flow; Monte Carlo Method; Large Eddy Simulation; Lagrangian Function; Convection

19990019718 New Jersey Inst. of Tech., Dept. of Chemical Engineering, Newark, NJ USA
Turbulent Jet in a Coflowing Stream
Loney, Norman W., New Jersey Inst. of Tech., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 78; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The testing of aircraft models in a wind tunnel is a mature technology at Langley Research Center. However, the issue of mixing the fuel and an oxygen rich stream in the 8 Ft. High Temperature tunnel is not quite resolved. There are many approaches that can accomplish the task (mixing a hot and cold fluid), but several of those schemes are not suitable for this unique testing facility. Therefore a theoretical investigation is underway to develop a model of a two dimensional turbulent jet in a coflowing stream. This incompressible jet flow will be modeled by employing an integral method which includes turbulent shear stress, entrainment and heat transfer. A commercially available computation fluid dynamics (CFD) code is being used to test the theory since experimental data will not be available from the tunnel. Essentially, one would like to predict the heat transfer to the wall as a function of the jet proximity to that wall, given the size, velocity direction and energy level of the jet.
Author
Aircraft Models; Computational Fluid Dynamics; Energy Levels; Heat Transfer; Incompressible Flow; Turbulence; Turbulent Jets; Wind Tunnel Models

19990019811 NASA Lewis Research Center, Cleveland, OH USA
Capillary Pumped Heat Transfer (CHT) Experiment
Hallinan, Kevin P., Dayton Univ., USA; Allen, J. S., NASA Lewis Research Center, USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 110-119; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The operation of Capillary Pumped Loops (CPL's) in low gravity has generally been unable to match ground-based performance. The reason for this poorer performance has been elusive. In order to investigate the behavior of a CPL in low-gravity, an idealized, glass CPL experiment was constructed. This experiment, known as the Capillary-driven Heat Transfer (CHT) experiment, was flown on board the Space Shuttle Columbia in July 1997 during the Microgravity Science Laboratory mission. During the conduct of the CHT experiment an unexpected failure mode was observed. This failure mode was a result of liquid collecting and then eventually bridging the vapor return line. With the vapor return line blocked, the condensate was unable to return to the evaporator and dry-out subsequently followed. The mechanism for this collection and bridging has been associated with long wavelength instabilities of the liquid film forming in the vapor return line. Analysis has shown that vapor line blockage in present generation CPL devices is inevitable. Additionally, previous low-gravity CPL tests have reported the presence of relatively low frequency pressure oscillations during erratic system performance. Analysis reveals that these pressure oscillations are in part a result of long wavelength instabilities present in the evaporator pores, which likewise lead to liquid bridging and vapor entrapment in the porous media. Subsequent evaporation to the trapped vapor increases the vapor pressure. Eventually the vapor pressure causes ejection of the bridged liquid. Recoil stresses depress the meniscus, the vapor pressure rapidly increases, and the heated surface cools. The process then repeats with regularity.
Author
Space Shuttles; Heat Transfer; Low Frequencies; Failure Modes; Evaporators; Condensates

19990019849 Illinois Univ., National Center for Supercomputing Applications, Urbana, IL USA
The Development of a Multi-Purpose 3-D Relativistic Hydrodynamics Code
Swesty, F. Douglas, Illinois Univ., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 91-92; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

Many of the most interesting phenomena in astrophysics involve gas flows around compact objects such as white dwarfs, neutron stars, and black holes. Furthermore, a new generation of NASA high energy astronomy missions is providing an unprecedented quantity and quality of observational data from such objects that presents a tremendous modeling challenge for astrophysical theorists. Compact objects possess strong gravitational fields and a correct quantitative description of fluid flows in and around these objects must take into account Einstein's theory of relativity. Furthermore, the gravitational fields are created by the fluid itself and thus the Einstein gravitational field equations must be solved simultaneously and self-consistently with the fluid dynam-

ics equations. As one of the NASA ESS HPCC Grand Challenge science teams we have endeavored to meet these challenges by developing several codes that solve both the relativistic Euler equations of fluid dynamics and the Einstein field equations describing gravity. This complex set of equations poses unique design problems. The relativistic analogs of the Euler equations consist of five hyperbolic equations describing energy, momentum, and baryon conservation which are similar in structure to the non-relativistic Euler equations. Thus we can apply a wide variety of traditional explicit fluid dynamics techniques to solve this set of equations. The Einstein field equations are far more complex and present a more difficult challenge to numerical solution. The Einstein equations are normally written as a set of sixteen second order differential algebraic equations (DAEs) that are not amenable to numerical solution. However, with an appropriate reformulation the equations can be cast into the form of a set of 37 coupled first order hyperbolic PDE's. by employing this latter form we can make use of much of our intuition about CFD to implement a numerical scheme for the solution of these equations. Because of the complexity of the aforementioned equations the numerical time-evolution during a simulation requires a large number of floating point operations per zone per timestep. Additionally, the simulation requires nearly 100 3-D arrays providing a large memory footprint for the code. These requirements together with the need to evolve for many timesteps, for most problems of interest, demands the use of cutting edge parallel computing platforms. Accordingly, we have chosen to implement the codes within a message passing context. This choice has allowed us to obtain excellent scalability and the widest possible range of portability. I will discuss our design strategies and choices for the implementation of these codes. Finally, I will discuss the testbed problem that we are using to drive the development of these codes: modeling the merger of two neutron stars in a binary system. Ultimately, our astrophysical goal in this problem is to provide a systematic comparison of Newtonian, post-Newtonian, and general relativistic models for this phenomenon. I will briefly present some results for this testbed problem.
Author

Gas Flow; Euler Equations of Motion; Einstein Equations; Hydrodynamic Equations; Hyperbolic Differential Equations; Partial Differential Equations; Parallel Processing (Computers); Computer Programs; Relativity; Three Dimensional Models; Computerized Simulation

19990019854 Sandia National Labs., Aerosciences and Compressible Fluid Mechanics Dept., Albuquerque, NM USA

Massively Parallel Computational Fluid Dynamics Calculations for Aerodynamics and Aerothermodynamics Applications

Payne, Jeffrey L., Sandia National Labs., USA; Hassan, Basil, Sandia National Labs., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 111-116; In English; Also announced as 19990019831

Contract(s)/Grant(s): DE-AC04-94AL85000; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Massively parallel computers have enabled the solution of complicated flow fields (turbulent, chemically reacting) that were previously intractable. Calculations are presented using a massively parallel CFD code called SACCARA (Sandia Advanced Code for Compressible Aerothermodynamics Research and Analysis) currently under development at Sandia National Laboratories as part of the Department of Energy (DOE) Accelerated Strategic Computing Initiative (ASCI). Computations were made on a generic reentry vehicle in a hypersonic flowfield utilizing three different distributed parallel computers to assess the parallel efficiency of the code with increasing numbers of processors. The parallel efficiencies for the SACCARA code will be presented for cases using 1, 10, 50, 100 and 500 processors. Computations were also made on a subsonic/transonic vehicle using both 236 and 521 processors on a grid containing approximately 14.7 million grid points. Ongoing and future plans to implement a parallel overset grid capability and couple SACCARA with other mechanics codes in a massively parallel environment are discussed.
Author

Massively Parallel Processors; Parallel Computers; Applications Programs (Computers); Run Time (Computers); Computer Systems Performance; Computation; Distributed Memory

19990019856 Texas Univ., Austin, TX USA

Parallel Finite Element Solution of 3D Rayleigh-Benard-Marangoni Flows

Carey, G. F., Texas Univ., USA; McLay, R., Texas Univ., USA; Bicken, G., Texas Univ., USA; Barth, B., Texas Univ., USA; Pehlivanov, A., Texas Univ., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 125-132; In English; Also announced as 19990019831

Contract(s)/Grant(s): DABT63-96-C-0061; NCCSS-154; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A domain decomposition strategy and parallel gradient-type iterative solution scheme have been developed and implemented for computation of complex 3D viscous flow problems involving heat transfer and surface tension effects. Details of the implementation issues are described together with associated performance and scalability studies. Representative Rayleigh-Benard and microgravity Marangoni flow calculations and performance results on the Cray T3D and T3E are presented. The work is currently

being extended to tightly-coupled parallel ”Beowulf-type” PC clusters and we present some preliminary performance results on this platform. We also describe progress on related work on hierarchic data extraction for visualization.
Author
Finite Element Method; Parallel Processing (Computers); Computation; Marangoni Convection; Rayleigh-Benard Convection; Viscous Flow; Heat Transfer; Interfacial Tension; Applications Programs (Computers); Computer Systems Performance

19990019867 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; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 189-195; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, 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 condition. A one-dimensional (1-D) Euler inlet simulation 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. to aid in this understanding and to help evaluate possible boundary conditions, an inlet-engine experiment was conducted at the University of Cincinnati. The interaction of acoustic pulses, generated in the inlet, with the engine were investigated. Because of the availability of experimental data for validation, it was decided to simulate the experiment using CFD. The philosophy here is that the inlet-engine system is best simulated by coupling (existing) specialized CFD component-codes. The objectives of this work were to aid in a better understanding of inlet-compressor interaction physics and the formulation of a more realistic compressor-face boundary condition for time-accurate CFD simulations of inlets. Previous simulations have used 1-D Euler engine simulations in conjunction with 1-D Euler and axisymmetric Euler inlet simulations. This effort is a first step toward CFD simulation of an entire engine by coupling multidimensional component codes.
Derived from text
Engine Inlets; Supersonic Compressors; Computational Fluid Dynamics; Flow Stability; Boundary Conditions; Pressure Oscillations; Computerized Simulation; Applications Programs (Computers)

19990020948 Sydney Univ., Dept. of Civil Engineering, Australia
Experimental Investigation of Contaminant Transport in Porous Media ***Topical Report***
Wang, J. C., Sydney Univ., Australia; Booker, J. R., Sydney Univ., Australia; Carter, J. P., Sydney Univ., Australia; Oct. 1998; 40p; In English
Report No.(s): PB99-117483; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When numerical methods are applied to simulate a real contaminant transport problem, the values of a number of key parameters such as porosity, hydrodynamic dispersion coefficient or dispersivity and Darcy velocity or seepage velocity or seepage velocity are needed. In this paper, two different experimental programs, involving two types of column test and a well simulation test, were designed to demonstrate that the theory developed to explain contaminant transport in porous media is capable of representing the actual phenomenon of contaminant migration in soil. It is demonstrated that experiments can also be carried out to determine the properties necessary to model a real case of contaminant migration in porous media.
NTIS
Contaminants; Porosity; Transport Properties

19990021026 Saint Martin’s Coll., Mechanical Engineering Dept., Lacey, WA USA
Experimental Measurements of Temperature and Heat Flux in a High Temperature Black Body Cavity
Abdelmessih, Amanie N., Saint Martin’s Coll., USA; 1998 NASA-ASEE-Stanford Summer Faculty Fellowship Program; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

During hypersonic flight, high temperatures and high heat fluxes are generated. The Flight Loads Laboratory (FLL) at Dryden Flight Research Center (DFRC) is equipped to calibrate high heat fluxes up to 1100 kW/sq m. There are numerous uncertainties

associated with these heat flux calibrations, as the process is transient, there are expected to be interactions between transient conduction, natural and forced convection, radiation, and possibly an insignificant degree of oxidation of the graphite cavity. Better understanding, of these mechanisms during the calibration process, will provide more reliable heat transfer data during either ground testing or flight testing of hypersonic vehicles.
Author
Temperature Measurement; Heat Measurement; Heat Flux; Flight Tests; Ground Tests

35
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.

19990019322 NASA Lewis Research Center, Cleveland,OH USA
Advances in Thin Film Thermocouple Durability Under High Temperature and Pressure Testing Conditions
Martin, Lisa C., NASA Lewis Research Center, USA; Fralick, Gustave C., NASA Lewis Research Center, USA; Taylor, Keith F., Cortez 3 Service Corp., USA; Jan. 1999; 12p; In English
Contract(s)/Grant(s): RTOP 537-04-22
Report No.(s): NASA/TM-1999-208812; E-11407; NAS 1.15:208812; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thin film thermocouples for measuring material surface temperature have been previously demonstrated on several material systems and in various hostile test environments. A well-developed thin film fabrication procedure utilizing shadow masking for patterning the sensors elements had produced thin films with sufficient durability for applications in high temperature and pressure environments that exist in air-breathing and hydrogen-fueled burner rig and engine test facilities. However, while shadow masking had been a reliable method for specimens with flat and gently curved surfaces, it had not been consistently reliable for use on test components with sharp contours. This work reports on the feasibility of utilizing photolithography processing for patterning thin film thermocouples. Because this patterning process required changes in the thin film deposition process from that developed for shadow masking, the effect of these changes on thin film adherence during burner rig testing was evaluated. In addition to the results of changing the patterning method, the effects on thin film adherence of other processes used in the thin film fabrication procedure is also presented.
Author
Thermocouples; Thin Films; Photolithography; Durability

19990019397 NASA Lewis Research Center, Cleveland,OH USA
Temperature Measurement of Ceramic Materials Using a Multiwavelength Pyrometer
Ng, Daniel, NASA Lewis Research Center, USA; Fralick, Gustave, NASA Lewis Research Center, USA; Jan. 1999; 15p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 523-21-13
Report No.(s): NASA/TM-1999-208850; E-11471; NAS 1.15:208850; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The surface temperatures of several pure ceramic materials (alumina, beryllia, magnesia, yittria and spinel) in the shape of pellets were measured using a multiwavelength pyrometer. In one of the measurements, radiation signal collection is provided simply by an optical fiber. In the other experiments, a 4.75 inch (12 cm) parabolic mirror collects the signal for the spectrometer. Temperature measurement using the traditional one- and two-color pyrometer for these ceramic materials is difficult because of their complex optical properties, such as low emissivity which varies with both temperature and wavelength. In at least one of the materials, yittria, the detected optical emission increased as the temperature was decreased due to such emissivity variation. The reasons for such changes are not known. The multiwavelength pyrometer has demonstrated its ability to measure surface temperatures under such conditions. Platinum electrodes were embedded in the ceramic pellets for resistance measurements as the temperature changed.
Author
Temperature Measurement; Ceramics; Surface Temperature; Radiation Pyrometers; Optical Properties

19990019437 Department of the Navy, Washington, DC USA

Blackbody Simulating Apparatus for Calibrating an Infrared Imaging Device

Spindler, Jeffrey W., Inventor; May 26, 1998; 7p; In English

Patent Info.: Filed 25 Jul. 96,; US-Patent-Appl-SN-700,642; US-Patent-5,756,992

Report No.(s): AD-D019124; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A blackbody simulating apparatus which has a blackbody simulator for emitting infrared energy in random directions is described. A collimator collects a portion of the infrared radiation emitted by the blackbody simulator and then redirects the infrared radiation as a collimated beam of infrared energy to a dielectric. The dielectric has a thin metallic coating affixed to its rear surface to form a mirror like surface at its rear surface. A primary reflection of the collimated beam of infrared energy occurs at the front surface of the dielectric resulting in a first blackbody image being directed to an infrared imager. A portion of the collimated beam passes through the dielectric to the metallic coating and is then reflected by the metallic coating to the front surface of the dielectric emerging from the dielectric as a second blackbody image which is also directed to the infrared imager. Additional blackbody images are generated by internal reflections within the dielectric with each blackbody image having a different intensity from the other blackbody images. This results in at least two different radiance levels being supplied to the infrared imager for calibrating the infrared imager.

DTIC

Black Body Radiation; Simulators; Infrared Imagery; Calibrating; Metal Coatings

19990019438 Department of the Navy, Washington, DC USA

Methods and apparatus for Distributed Optical Fiber Sensing of Strain or Multiple Parameters

Kersey, Alan D., Inventor; May 26, 1998; 12p; In English; Supersedes US-Patent-Appl-SN-791297, AD-D018374.

Patent Info.: Filed 30 Jan. 97,; US-Patent-Appl-SN-791,297; US-Patent-5,757,487

Report No.(s): AD-D019122; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A distributed optical fiber sensor system including a patterned array of weakly reflecting broadband gratings or other sensors serially disposed along a common fiber is reviewed. The laser sources are multiplexed onto the fiber and are propagated through a directional coupler toward the sensors. The return signals are directed by the directional coupler to a demultiplexer that separates the signals by center frequencies and sends each to a respective detector. All reflection signals generated by a single input pulse of a given wavelength are detected prior to the input coupling of the next input pulse of that wavelength, the input pulse repetition period being T greater than or equal to N, N being the number of grating sensors and to being their spacing or separation in optical propagation time.

DTIC

Fiber Optics; Detectors; Pulsed Lasers; Optical Fibers; Strain Measurement

19990019525 Japan Broadcasting Corp., Science and Technical Research Labs., Tokyo, Japan

New Tracking Method for an Optical Tape Recording System

Arai, Kiyotaka, Japan Broadcasting Corp., Japan; Tokumaru, Haruki, Japan Broadcasting Corp., Japan; Yoshimura, Shin-Ichi, Japan Broadcasting Corp., Japan; R and D of NHK Science and Technical Research Laboratories; Feb. 1996; ISSN 0914-7535, No. 39, pp. 43-53; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a new tracking method using crosstalk signals for an optical tape recording system. Due to the difficulty in forming pits or grooves on tape media, crosstalk signals are employed for the detection of tracking error. On the two tracks adjacent to the one that the focused spot must follow, pilot signals at two different frequencies are recorded respectively. When picking up the signal on the track, the pilot signals from the two adjacent tracks are derived from the readout signal. The tracking error signal is generated by differential detecting of their amplitudes. Fundamental experiments using a magneto-optical recording medium were performed and a total residual tracking error of less than 1 micron was obtained for a +/-2 micron displacement of the recording medium. This value meets a requirement for the precise tracking control in an optical tape recording system.

Author

Tracking (Position); Tape Recorders; Magneto-Optics; Error Signals

19990019645 Ohio Univ., Dept. of Chemistry, Athens, OH USA

Advanced Signal Processing and Pattern Recognition Methods for Passive Infrared Remote Sensors ***Final Report, Apr. 1993 - Aug. 1997***

Small, G. W.; Oct. 1998; 100p; In English

Contract(s)/Grant(s): DAAA15-93-K-0003

Report No.(s): AD-A356290; ERDEC-CR-259; ERDEC-CR-259; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This report describes studies directed to the automated analysis of Fourier transform infrared remote sensing interferogram data. The research presented here demonstrates that both qualitative and quantitative information can be extracted from short segments of digitally filtered interferograms without the need for any background or reference measurement. Through the use of experimental design techniques, an optimization protocol is devised for determining the key implementation parameters of the interferogram based analysis. An automated compound identification algorithm is developed for trichloroethylene (TCE) and is shown to operate effectively in the presence of a wide variety of infrared backgrounds. A quantitative analysis for sulfur dioxide (SO2) is also implemented through the direct use of short interferogram segments.
DTIC
Signal Processing; Pattern Recognition; Infrared Detectors; Remote Sensors; Interferometry; Remote Sensing

19990019694 Idaho State Univ., Pocatello, ID USA
Fringe Control Using Electro-Optic Holography
Blotter, Jonathan D., Idaho State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 50; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Electro-Optic Holography (EOH) is a whole field, laser-based, displacement measurement technique. The EOH technique produces a hologram that contains a fringe pattern from which the surface displacements of the structure can be extracted. For out- of-plane measurements, one complete fringe cycle represents a displacement magnitude equal to the wavelength of the laser. Infrared laser diodes are a low cost light source for an EOH system. The wavelength of these laser diodes typically ranges from 800-900 nm. With this high of a wavelength and the relatively large magnitudes present in many vibrating structures, the fringe density of an EOH hologram is often so high that it is impossible to separate or detect the individual fringes. The research presented in this paper extends the displacement measurement range of a laser diode based EOH system. This is done by frequency translating the reference beam using laser diode current modulation. A sawtooth modulation signal is used to modulate the laser diode because it provides a single sideband suppressed carrier (SSSC) signal. The frequency translated reference beam combines with the object beam and produces a fringe pattern governed by higher order Bessel functions. The order of the Bessel function is determined by the frequency of the modulation provided to the laser diode current controller. Using this technique the sensitivity of the EOH system can be increased or decreased compared to the typical zero order Bessel function EOH systems. Using this technique it is also possible to separate the modes and compute the displacement under multi-frequency excitation.
Author
Holography; Electro-Optics; Bessel Functions; Diffraction Patterns; Displacement Measurement; Semiconductor Lasers

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LASERS AND MASERS

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

19990019256 Optical Society of America, Washington, DC USA
Organization of the 1997 Ultrafast Electronics and Optoelectronics Topical Meeting ***Final Report, 21 Mar. 1997 - 20 Mar. 1998***
Fantone, Stephen D., Optical Society of America, USA; Jun. 01, 1998; 312p; In English
Contract(s)/Grant(s): DAAG55-97-1-0157
Report No.(s): AD-A357933; ARO-37202.1-PH-CF; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The Ultrafast Electronics and Optoelectronics topical meeting explored advances in high speed phenomena in the areas of optics, optoelectronics, and electronics. Topics discussed were classified into the general areas of physics, general and measurement, materials, electronics, optoelectronics, all optical techniques, and applications.
DTIC
Solid State Lasers; Electro-Optics; Image Processing

19990019412 Department of the Navy, Washington, DC USA
Mirrorless, Distributed-Feedback, Ultraviolet, Tunable, Narrow-Linewidth, Solid State Laser
Pinto, Joseph F., Inventor; Esterowitz, Leon, Inventor; May 19, 1998; 6p; In English
Patent Info.: Filed 15 Nov. 96,; US-Patent-Appl-SN-751,062; US-Patent-3,754,572
Report No.(s): AD-D019126; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A mirrorless, distributed-feedback (DFB), ultraviolet, tunable, narrow-linewidth, solid state laser for remote sensing and medical applications is disclosed. Optical pumping in the DFB laser is accomplished using a frequency quadrupled. 10 Hz., Q-switched, Nd:YAG laser operating at 266 nm. The pump beam is diffracted off a grating (2400 grooves per mm.) into two parts. The two beams are subsequently recombined at the side face of the Ce:doped crystal (8 mmx8 mmx30 mm) at an angle of about 29(about 81 degrees). The resulting spatially periodic excitation within the Ce-doped gain medium due to the interferring pump beams determines the operating wavelength of the DFB laser.
DTIC
Distributed Feedback Lasers; Solid State Lasers; Q Switched Lasers; Tunable Lasers; Ultraviolet Lasers; Laser Beams; Doped Crystals; YAG Lasers

19990019455 Duke Univ., Dept. of Physics, Durham, NC USA
Optically Pumped Far-Infrared Lasers Based on Photonic Band Gap Crystals ***Final Report***
Everitt, Henry O.; Jul. 1998; 8p; In English
Contract(s)/Grant(s): DAAH04-93-D-0002
Report No.(s): AD-A358035; ARO-31155.6-PH; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The primary focus of this effort was to demonstrate an ultrasmall optically pumped far infrared (OPFIR) laser based on a photonic band gap (PBG) crystal cavity. Conventional cylindrical copper waveguide ultrasmall OPFIR lasers were constructed and their performance properties were measured as a function of pump power, gas pressure, and cavity length. Pure and doped two dimensional PBG crystals were constructed, and their transmissivity was measured as a function of wavelength, incidence angle, crystal size, and doping configuration. A high resolution THz spectrometer based on a low temperature-grown GaAs photomixer and a mode-locked Ti:Sapphire laser was constructed and molecular spectra were measured. The amplitude and phase noise properties of the Ar(+) laser-pumped Ti:Sapphire were measured as a function of harmonic number using this photomixer. Finally, the photoluminescence of type-II GaAs/AlAs single quantum wells was measured as a function of well width, pump power, and temperature.
DTIC
Infrared Lasers; Doped Crystals; Optical Pumping; Energy Gaps (Solid State); Quantum Wells; Copper; Waveguide Lasers

19990019701 Norfolk State Univ., Dept. of Electronic Engineering, VA USA
Modeling and Optimization of Carbon-Based Thermal Dissipators for Laser Diode Arrays
Ebron, Sonja, Norfolk State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 59; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only
Laser diodes are semiconductor photon sources that are used in medicine, optical communications, navigation, material processing, and a variety of other applications. Diode-pumped solid state lasers are the preferred source for probing purposes in surveying, target location and marking, and space applications. For high power uses, laser diode arrays are fabricated with conduction- or liquid-cooled copper leads for heat dissipation. The primary barriers to high-power laser diode development are insufficient thermal conductivity (TC) and failure due to coefficient of thermal expansion (CTE) mismatches between package components. Increases in temperature severely distort the optical characteristics of laser diodes and can cause jumps in longitudinal mode. Differing CTE's create mechanical stress between the semiconductor die, insulation materials, and the thermal dissipator. Diamond-like compounds and graphitic fiber matrices have high TC's and CTE's that can be matched to other components; as such, they are likely candidates for laser diode packaging. This work involves the thermal analysis of laser diode configurations that use carbon composite materials for heat dissipation. The long-term objective is the development of a conduction-cooled laser diode package with small pitch, high TC, and matched CTE'S. of particular interest are laser diode arrays for pumping Ho:Tm lasers in lidar applications. Previous work at NASA Langley has shown the efficacy of room- temperature diode-pumped Ho:Tm lasers using copper heatsinks with thermoelectric cooling. This report describes a tradeoff study of laser diode array amplifiers fabricated with candidate thermal dissipators, along with dimensional optimization of the dissipators. The primary results include thermal models and comparative heat distributions for laser diode array amplifiers configured with carbon composite materials. Future work includes modeling of alternate laser diode array configurations, a closer look at package interface materials, and parametric evaluation of laser diodes under heat load. Expected benefits include increased laser output power with improved heat dissipation, stability of the output beam, increases in operational life, and smaller package volume and weight. The latter supports miniaturization in the electronics industry and reduced payloads for space applications.
Author
Temperature Distribution; Thermoelectric Cooling; Thermal Expansion; Thermal Conductivity; Semiconductors (Materials); Semiconductor Lasers; Optical Radar; Optical Communication

37
MECHANICAL ENGINEERING

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

19990019127 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Cubic-Spline Contact Element for Frictional Contact Problems
Ju, Shen-Haw, National Cheng Kung Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 119-128; In English
Contract(s)/Grant(s): NSC84-2213-E-006-119; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The main purpose of this paper is to develop a node-to-cubic- spline contact element for frictional contact problems. For node-to-line contact algorithms, the normal and tangent directions of contact stresses are usually discontinuous across two elements. This drawback sometimes causes inaccuracy of the contact analysis near the intersection point of the two target surfaces, or sometimes causes the divergence of the contact analysis when a contact node moves across two target surfaces. Moreover, if the mesh of the target surface is not fine enough, using node-to-line contact elements to model curved surfaces will cause errors. In order to overcome this drawback, a two- dimensional node-to-cubic-spline contact element is developed. Each element contains one contact node and a number of target nodes modeled by a cubic spline with continuous normal and tangent directions. A contact node can slide across several target lines with not only the compatible deformation but also the continuous normal and tangent directions. Numerical results demonstrate that the present cubic-spline contact element can simulate contact problems accurately even using a coarse mesh of the target body.
Author
Spline Functions; Friction Factor; Cubes (Mathematics); Polynomials; Algorithms

19990019169 Nagasaki Univ., Faculty of Engineering, Japan
A Calculation Method for Three Dimensional Envelope Surface Generated by Cutting Tools in Machining Centers with Three Controllable Axes
Kojima, Tatsuhiro, Nagasaki Univ., Japan; Kobayashi, Youichi, Nagasaki Univ., Japan; Nishida, Noriteru, Nagasaki Univ., Japan; Reports of the Faculty of Engineering, Nagasaki University; Jan. 1994; ISSN 0286-0902; Volume 24, No. 42, pp. 19-24; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

It is required to develop the method to examine whether the shape cut by NC machine tools controlled by NC program codes is identical with the shape requested in drawings. In this report, a method to calculate any cross-section profile from the three dimensional envelope surface generated by cutting tools is proposed. If we have only the values of coordinates of tool center path, we cannot get analytically the envelope generated by cutting tool movement owing to lack of information. If the values of slope of tangent on the tool center path are given in addition to the values of tool center coordinates, we can get analytically the three dimensional envelope surface.
Author
Computation; Three Dimensional Models; Surface Finishing; Procedures

19990019185 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
The Undercutting and Pointing of Face-Gears
Chung, Tsang-Dong, National Taiwan Univ., Taiwan, Province of China; Chang, Shuo-Hung, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 181-188; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Undercutting and pointing are serious problems in the performance of face-gears. Based on the theory of gearing, the tooth geometry of the face-gear along with the sufficient and necessary conditions for the existence and regularity of the generated face-gear tooth surfaces were investigated. Undercutting and pointing were initially investigated by Litvin. In this paper, numerical results with design charts for avoiding undercutting and pointing of the shaper and generated face-gear were further developed. The boundary lines of undercutting and pointing for a number of face-gears under different tooth numbers, modules and pressure angles were established.
Author
Gear Teeth; Gears; Shapers; Charts

19990019392 Army Research Lab., Cleveland, OH USA

Three-Dimensional Gear Crack Propagation Studies

Lewicki, David G., Army Research Lab., USA; Sane, Ashok D., Boeing Defense and Space Group, USA; Drago, Raymond J., Boeing Defense and Space Group, USA; Wawrzynek, Paul A., Cornell Univ., USA; December 1998; 15p; In English; 4th; Gearing and Power Transmission, 16-18 Mar. 1999, Paris, France; Sponsored by Institut des Engrenages et des Transmissions, France
Contract(s)/Grant(s): RTOP 581-30-13; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA/TM-1998-208827; E-11436; NAS 1.15:208827; ARL-TR-1833; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three-dimensional crack growth simulation was performed on a split-tooth gear design using boundary element modeling and linear elastic fracture mechanics. Initial cracks in the fillet of the teeth produced stress intensity factors of greater magnitude (and thus, greater crack growth rates) than those in the root or groove areas of the teeth. Crack growth simulation was performed on a case study to evaluate crack propagation paths. Tooth fracture was predicted from the crack growth simulation for an initial crack in the tooth fillet region. Tooth loads on the uncracked mesh of the split-tooth design were up to five times greater than those on the cracked mesh if equal deflections of the cracked and uncracked teeth were considered. Predicted crack shapes as well as crack propagation life are presented based on calculated stress intensity factors, mixed-mode crack propagation trajectory theories, and fatigue crack growth theories.
Author

Crack Propagation; Three Dimensional Models; Gears; Cracking (Fracturing); Gear Teeth

19990019414 Department of the Navy, Washington, DC USA

Limited Rotation Connection Device

Ball, Randall W., Inventor; Jun. 09, 1998; 7p; In English
Patent Info.: Filed 24 Feb. 97,; US-Patent-Appl-SN-804,857; US-Patent-5,764,827
Report No.(s): AD-D019123; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A limited rotation connection device includes a housing defining a central hole extending therethrough and a central shaft extending through the central hole of the housing and being rotatably mounted to the housing is described. The housing also defining an annular slot surrounding and extending in substantially perpendicular relation to the central shaft. The device also includes an elongated flexible communication element disposed in the annular slot of the housing and having a first opposite end portion mounted to the central shaft and a second opposite end portion mounted to the housing. The communication element is collapsible and expandable upon rotation of the central shaft relative to the housing so as to allow limited rotations of the opposite end portions of the communication element relative to one another before reversing rotation direction becomes necessary. The first opposite end portion of the communication element is connectable to a first external communication device. The second opposite end portion of the communication element is held stationary and is connectable to a second external communication device.
DTIC

Fiber Optics; Optical Waveguides; Rotation; Mechanical Devices

19990019711 Old Dominion Univ., Dept. of Mechanical Engineering, Norfolk, VA USA

Identification of Large-Gap Magnetic Suspension Systems

Huang, Jen-Kuang, Old Dominion Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 70; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

This investigation focuses on study of a new linear system identification method to provide state space models of magnetic suspension systems. The Large Angle Magnetic Suspension Test Fixture (LAMSTF) has been assembled by NASA Langley Research Center for a ground-based experiment that will be used to investigate the technology issues associated with magnetic suspension at large gaps, accurate suspended-element control at large gaps, and accurate position sensing at large gaps. This technology is applicable to future efforts that range from magnetic suspension of wind-tunnel models to advanced spacecraft experiment isolation and pointing systems. In this project, the accuracy of the system model during the identification process for dynamics systems under closed-loop operation is first studied. The simulation results show that most of the model error comes from the approximated system description by using a finite difference model which is called the auto- regressive with exogeneous input model. Then a residual whitening method is proposed to improve the model accuracy. An iterative procedure for minimizing and whitening the residual of the auto-regressive moving average with exogeneous input model is provided. By using residual whitening approach, one can enforce the optimal properties of Kalman filter for a finite set of data, the residual of the identified system and observer is minimized, orthogonal to the time-shifted versions of itself and to the given set of input-output data, and the requirement of model order can also be reduced. Although the iterative procedure can be used for whitening the residual, the

computation cost is increased. Numerical simulations of the LAMSTF system show that this new identification algorithm generates small modeling errors for linear stochastic systems corrupted by system disturbances and measurement noises.
Author
Finite Difference Theory; Spaceborne Experiments; Stochastic Processes; Magnetic Suspension; Error Analysis

19990021106 Department of the Navy, Washington, DC USA
Drill Guide for Combination Lock Mounting and Method for Using Drill Guide
Fuller, Jonathan L., Inventor; Nov. 03, 1998; 16p; In English
Patent Info.: Filed 3 Nov. 1998; US-Patent-Appl-SN-184,636
Report No.(s): AD-D019152; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A drill guide for combination lock mounting and method for fabricating and using the drill guide is provided. The drill guide is fabricated using several interior mounting plates bonded together to form a sufficient thickness to maintain a true level bore hole. The fabrication guide plate is attached to a secure door using a threaded clamping device extending through a lock spindle hole. Thereafter, the smaller interior holes are drilled completely through the door. Larger exterior holes are then drilled partway through the door from the outside. The door is then ready to accept an exterior combination lock plate having female studs extending into the door.
DTIC
Drilling; Boreholes

38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990019581 Fukui Univ., Faculty of Engineering, Japan
A Study on Industrial Level Measurement Based on the Use of Gamma-Ray Scattering
Shirakawa, Yoshiyuki, Fukui Univ., Japan; Sugimoto, Hidehiko, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 265-273; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An industrial level measurement technique to make use of Compton scattering of gamma-rays has been studied. A gamma-ray source and a detector are set up at the same side of a measured object. In the case the density of the object is constant, the amount of scattered gamma-rays is not depending on levels. However, the number of gamma-rays detected becomes a function of level. The function is in proportion to the solid angel to the detector from the effective center of a scattering region. by using computer simulation, the performance of this method was evaluated. As a result the precision of the level measurement was +/- 3% within a range of 10 - 100 cm.
Author
Research; Procedures; Measurement; Gamma Rays

19990019729 Old Dominion Univ., Dept. of Mechanical Engineering, Norfolk, VA USA
Detection and Measurement of Hidden Corner Cracks Using a Portable NDI Probe
Williamson, Keith M., Old Dominion Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 89; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Fatigue damage in aircraft structures increase as airplanes are operated beyond their economic design life, typically 20,000 flight cycles. Reduced durability and safety of these aging structures require elaborate inspection and maintenance to ensure continued airworthiness. Cyclic pressure tests on fuselage structures similar to those found on commercial airliners have enabled researchers to characterize the various forms of fatigue damage. These characterizations show the progression of fuselage skin fatigue cracks from the initial stages of multisite damage (MSD) through crack linkup and widespread fatigue damage (WSFD). Detailed tear down examination and fractography of the lap splice joints have revealed crack initiation sites, crack morphology, and crack linkup geometry. Results of these studies have allowed researchers to benchmark critical laboratory simulations, analytical predictions and advanced nondestructive inspection techniques. Ultimately, the goal is to develop analytical models for estimating the fatigue life of aging structures subject some form of MSD. The quality of analytical models relate directly to types and sizes of cracks which characterize MSD. Although nondestructive inspection (NDI) provides excellent means for detecting flaws, results do not provide data on flaw sizes which are important for characterizing MSD. Generally, NDI results are used to determine

the need for repair or to justify airworthiness. Consequently, field data on the sizes of flaws which may define MSD is lacking. The approach used in this investigation is to determine if MSD can be quantified using field data from NDI. During experiments, data will be recorded for quarter-elliptical corner cracks grown from circular holes in 0.63 inch thick aluminum 2024-T3 specimens. After countersinking holes and riveting specimens to hide fatigue crack damage, a portable NDI probe will be used to detect hidden cracks and establish relationships between NDI results and known crack length data.
Author
Aircraft Structures; Aluminum Alloys; Commercial Aircraft; Corners; Countersinking; Crack Geometry; Crack Initiation; Crack Propagation; Lap Joints

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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.

19990019141 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Prediction of Lateral Stiffness for Fully Slitted RC Shear Wall
Sheu, Maw-Shyong, National Cheng Kung Univ., Taiwan, Province of China; Liou, Yuh-Wehn, Chia-Nan Coll. of Pharmacy and Science, Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 221-232; In English
Contract(s)/Grant(s): NSC76-0414-P-006-02-B; NSC77-0414-P-006-09-B; NSC78-0414-P-006-03-B; NSC84-2621-P-006-006-B; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Two analytical models of lateral stiffness for a fully slitted RC shear wall are presented in this paper. Seventeen specimens divided into three categories, including five one-story walls without boundary columns, eight one-story walls with boundary columns, and four two-story walls with boundary columns are investigated. Four types of lateral loads (monotonic loading, repeated loading, reversed cyclic loading, and random cyclic loading) with or without axial force are applied in this study. The column model and the truss model are employed for analysis. The comparison of analytical and experimental results shows that most of the flexural cracking load, yielding load, and ultimate load for one-story specimens predicted by the column model are lower than those of experimental results. However, most of the predicted values for two-story specimens are higher than those of the experimentals. The errors in the analytical ultimate load are found to be between 2.7% and 9.0% for the column model, and between 3.0% and 7.8% for the truss model. In addition, the comparison of load-deflection curves for both models shows that the predicted lateral stiffness has satisfactory accuracy.
Author
Stiffness; Boundaries; Cyclic Loads; Walls; Mathematical Models

19990019721 Old Dominion Univ., Parallel-Vector Computation Center, Norfolk, VA USA
New Out-of-Core Capability for Large-Scale (STAGS (STructural Analysis of General Shells)
Nguyen, Duc T., Old Dominion Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 81; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

General flow charts for STAGS computer code is briefly described. Important and major time consuming subroutines of STAGS finite element code are identified. A new, Out-of-Core, symmetrical, positive/negative, Sparse Equation Solver (OOC_SES) has been developed, tested and ”loosely” integrated into the STAGS code. Theoretical aspects of our newly developed OOC-SES subroutines are explained (with sufficient details). Two (2) structural mechanic examples (with 486, and 640332 degree-of-freedom finite element linear static models) are used to demonstrate potential benefits of having STAGS’ new sparse out-of-core capability for LARGE-SCALE finite element solutions on different computer platforms (from personal computers, and/or workstations to supercomputers with parallel/vector processing capabilities), especially on the readily available workstations (Mushu, Simba) at NASA LARC Structural Mechanics Branch. Finally, suggestions for further improvements of STAGS’ out-of-core capabilities for other important solution options (such as nonlinear statics/dynamics, vibration, buckling, multiple load cases) will also be presented.
Author
Vector Processing (Computers); Supercomputers; Structural Analysis; Static Models; Personal Computers; Parallel Processing (Computers); Finite Element Method; Degrees of Freedom; Computer Programs

19990019859 NASA Ames Research Center, Moffett Field, CA USA

Parallel Aeroelastic Analysis Using ENSAERO and NASTRAN

Eldred, Lloyd B., MCAT Inst., USA; Byun, Chansup, MCAT Inst., USA; Guruswamy, Guru P., NASA Ames Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 143-147; In English; Also announced as 19990019831
Contract(s)/Grant(s): NAS2-14109; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

A high fidelity parallel static structural analysis capability is created and interfaced to the multidisciplinary analysis package ENSAERO-MPI of Ames Research Center. This new module replaced ENSAERO's lower fidelity simple finite element and modal modules. Full aircraft structures may be more accurately modeled using the new finite element capability. Parallel computation is performed by breaking the full structure into multiple substructures. This approach is conceptually similar to ENSAERO's multi-zonal fluid analysis capability. The new substructure code is used to solve the structural finite element equations for each substructure in parallel. NASTRAN/COSMIC is utilized as a front end for this code. Its full library of elements can be used to create an accurate and realistic aircraft mode. It is used to create the stiffness matrices for each sub-structure. The new parallel code then uses an iterative preconditioned conjugate gradient method to solve the global structural equations for the sub-structure boundary nodes. Results are presented for a wing-body configuration.
Author

Structural Analysis; Multidisciplinary Design Optimization; Parallel Processing (Computers); Nastran; Computer Techniques; Computation; Body-Wing Configurations; Aeroelasticity

19990019860 NASA Ames Research Center, Moffett Field, CA USA

Performance and Applications of ENSAERO-MPI on Scalable Components

Farhangnia, Mehrdad, MCAT Inst., USA; Guruswamy, Guru, NASA Ames Research Center, USA; Byun, Chansup, Sun Microsystems, Inc., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 149-150; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The latest improvements and results generated by ENSAERO-MPI are presented in this paper. ENSAERO-MPI is a parallelized, high-fidelity, multi-block code with fluids, structures and controls capabilities developed at NASA Ames Research Center under the support of HPCC. It is capable of multidisciplinary simulations by simultaneously integrating the Navier-Stokes equations, the finite element structural equations as well as control dynamics equations using aeroelastically adaptive, patched grids. Improvements have been made to the code's robustness, moving grid capabilities and performance.
Derived from text

Parallel Processing (Computers); Computerized Simulation; Applications Programs (Computers); Navier-Stokes Equation; Multidisciplinary Design Optimization; Aircraft Design; Aircraft Configurations

19990019861 NASA Ames Research Center, Moffett Field, CA USA

OVERAERO-MPI: Parallel Overset Aeroelasticity Code

Gee, Ken, MCAT Inst., USA; Rizk, Yehia M., NASA Ames Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 151-156; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

An overset modal structures analysis code was integrated with a parallel overset Navier-Stokes flow solver to obtain a code capable of static aeroelastic computations. The new code was used to compute the static aeroelastic deformation of an arrow-wing-body geometry and a complex, full aircraft configuration. For the simple geometry, the results were similar to the results obtained with the ENSAERO code and the PVM version of OVERAERO. The full potential of this code suite was illustrated in the complex, full aircraft computations.
Derived from text

Aeroelasticity; Structural Analysis; Navier-Stokes Equation; Computerized Simulation; Parallel Processing (Computers); Aircraft Configurations; Static Deformation; Applications Programs (Computers)

19990021015 NASA Langley Research Center, Hampton, VA USA

Stable Tearing and Buckling Responses of Unstiffened Aluminum Shells with Long Cracks

Starnes, James H., Jr., NASA Langley Research Center, USA; Rose, Cheryl A., NASA Langley Research Center, USA; 1998; 19p; In English; 2nd; Aging Aircraft, 31 Aug. - 3 Sep. 1998, Williamsburg, VA, USA; Sponsored by Department of Defense, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The results of an analytical and experimental study of the nonlinear response of thin, unstiffened, aluminum cylindrical shells with a long longitudinal crack are presented. The shells are analyzed with a nonlinear shell analysis code that accurately accounts for global and local structural response phenomena. Results are presented for internal pressure and for axial compression loads.

The effect of initial crack length on the initiation of stable crack growth and unstable crack growth in typical shells subjected to internal pressure loads is predicted using geometrically nonlinear elastic-plastic finite element analyses and the crack-tip-opening angle (CTOA) fracture criterion. The results of these analyses and of the experiments indicate that the pressure required to initiate stable crack growth and unstable crack growth in a shell subjected to internal pressure loads decreases as the initial crack length increases. The effects of crack length on the prebuckling, buckling and postbuckling responses of typical shells subjected to axial compression loads are also described. For this loading condition, the crack length was not allowed to increase as the load was increased. The results of the analyses and of the experiments indicate that the initial buckling load and collapse load for a shell subjected to axial compression loads decrease as the initial crack length increases. Initial buckling causes general instability or collapse of a shell for shorter initial crack lengths. Initial buckling is a stable local response mode for longer initial crack lengths. This stable local buckling response is followed by a stable postbuckling response, which is followed by general or overall instability of the shell.
Author
Thin Walled Shells; Aluminum; Buckling; Crack Propagation; Fracturing; Pressure Distribution; Tearing; Cylindrical Shells

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GEOSCIENCES (GENERAL)

19990019875 NASA Goddard Space Flight Center, Greenbelt, MD USA
Parallel Grid Manipulations in Earth Science Calculations
Sawyer, W., NASA Goddard Space Flight Center, USA; Lucchesi, R., NASA Goddard Space Flight Center, USA; daSilva, A., NASA Goddard Space Flight Center, USA; Takacs, L. L., NASA Goddard Space Flight Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 247; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

The National Aeronautics and Space Administration (NASA) Data Assimilation Office (DAO) at the Goddard Space Flight Center is moving its data assimilation system to massively parallel computing platforms. This parallel implementation of GEOS DAS will be used in the DAO's normal activities, which include reanalysis of data, and operational support for flight missions. Key components of GEOS DAS, including the gridpoint-based general circulation model and a data analysis system, are currently being parallelized. The parallelization of GEOS DAS is also one of the HPCC Grand Challenge Projects. The GEOS-DAS software employs several distinct grids. Some examples are: an observation grid- an unstructured grid of points at which observed or measured physical quantities from instruments or satellites are associated- a highly-structured latitude-longitude grid of points spanning the earth at given latitude-longitude coordinates at which prognostic quantities are determined, and a computational lat-lon grid in which the pole has been moved to a different location to avoid computational instabilities. Each of these grids has a different structure and number of constituent points. In spite of that, there are numerous interactions between the grids, e.g., values on one grid must be interpolated to another, or, in other cases, grids need to be redistributed on the underlying parallel platform. The DAO has designed a parallel integrated library for grid manipulations (PILGRIM) to support the needed grid interactions with maximum efficiency. It offers a flexible interface to generate new grids, define transformations between grids and apply them. Basic communication is currently MPI, however the interfaces defined here could conceivably be implemented with other message-passing libraries, e.g., Cray SHMEM, or with shared-memory constructs. The library is written in FORTRAN 90. First performance results indicate that even difficult problems, such as above-mentioned pole rotation- a sparse interpolation with little data locality between the physical lat-lon grid and a pole rotated computational grid- can be solved efficiently and at the GFlop/s rates needed to solve tomorrow's high resolution earth science models. In the subsequent presentation we will discuss the design and implementation of PILGRIM as well as a number of the problems it is required to solve. Some conclusions will be drawn about the potential performance of the overall earth science models on the supercomputer platforms foreseen for these problems.
Author
Grid Generation (Mathematics); Data Processing; Massively Parallel Processors; Parallel Processing (Computers); Software Engineering; Structured Grids (Mathematics); Unstructured Grids (Mathematics)

19990020958 Geological Survey, Reston, VA USA
Loma Prieta, California Earthquake of October 17, 1989: Recovery, Mitigation, and Reconstruction
Nigg, Joanne M., Editor, Geological Survey, USA; 1998; 100p; In English
Report No.(s): PB99-118994; USGS-PP-1553-D; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The papers in this chapter reflect the broad spectrum of issues that arise following a major damaging urban earthquake--the regional economic consequences, rehousing problems, reconstruction strategies and policies, and opportunities for mitigation be-

fore the next major seismic event. While some of these papers deal with structural of physical science topics, their significant social and policy implications make them relevant for improving our understanding of the processes and dynamics that take place during the recovery period.
NTIS
Earthquakes; Earthquake Damage; Damage Assessment; Construction; Seismology; Economic Impact; Geological Faults; Earth Movements

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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.

19990019496 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Determination of Aerosol Optical Depth and Land Surface Directional Reflectances Using Multiangle Imagery
Martonchik, John V., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Jul. 27, 1997; ISSN 0148-0227; Volume 102, No. D14, pp. 17,015-17,022; In English
Report No.(s): Paper 96JD02444; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Spectral aerosol optical depths, surface hemispherical-directional reflectance factors, and bihemispherical reflectances (albedos) are retrieved for an area of Glacier National Park using spectral, multiangle imagery obtained with the airborne advanced solid state array spectroradiometer (ASAS). The retrieval algorithms are described and are identical in principle to those being devised for use by the multiangle imaging spectroradiometer (MISR) which will fly on the EOS-AMI spacecraft in 1998. As part of its science mission, MISR will produce global coverage of both aerosol amounts an an surface reflection properties. The results in this paper represent the initial effort in applying the MISR algorithms to real data. These algorithms will undergo additional testing and validation as more multiangle data become available.
Author
Optical Thickness; Earth Surface; Directional Control; Spectral Reflectance; Imaging Techniques

19990019656 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Satellite Imagery and Remote Sensing Methodology: Applied to Change Detection Along Fountain Creek
Gilbert, Kristen; Apr. 17, 1998; 75p; In English
Report No.(s): AD-A356204; AFIT-98-010; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Remote sensing methodology and GIS technology provide the resources needed to gain an improved understanding of the Earth as a system. Worldwide population growth and development amplify the naturally occurring changes on the Earth's surface and give birth to new types of changes. With the help of remote sensing technology, the energy radiated by surface features or reflected off the Earth's surface by the sun can be used to map the land and trace the changes that take place over time. GIS technology can then be used to integrate large amounts of image data and other related details about an area to analyze the changes and their origin. This paper discusses the methodology and analytical techniques used to process digital images with a focus on change detection processes. It also emphasizes many of the atmospheric affects that must be considered before analysis can begin or inferences can be made. In addition, a change detection analysis of a region of Fountain Creek in Colorado Springs is performed using LANDSAT TM images gathered in 1993, 1994, and 1997. The analysis provides an example of the application of many of the techniques initially discussed and also highlights the cautions that were taken to avoid false conclusions. The investigation includes the generation of change detection images produced using image algebra and change vector analysis.
DTIC
Remote Sensing; Satellite Imagery; Change Detection; Earth Surface; Geographic Information Systems

19990019876 NASA Goddard Space Flight Center, Greenbelt, MD USA
I/O Parallelization for the Goddard Earth Observing System Data Assimilation System (GEOS DAS)
Lucchesi, R., NASA Goddard Space Flight Center, USA; Sawyer, W., NASA Goddard Space Flight Center, USA; Takacs, L. L., NASA Goddard Space Flight Center, USA; Lyster, P., NASA Goddard Space Flight Center, USA; Zero, J., NASA Goddard Space Flight Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 249-250; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

The National Aeronautics and Space Administration (NASA) Data Assimilation Office (DAO) at the Goddard Space Flight Center (GSFC) has developed the GEOS DAS, a data assimilation system that provides production support for NASA missions

and will support NASA's Earth Observing System (EOS) in the coming years. The DAO's support of the EOS project along with the requirement of producing long-term reanalysis datasets with an unvarying system levy a large I/O burden on the future system. The DAO has been involved in prototyping parallel implementations of the GEOS DAS for a number of years and is now converting the production version from shared-memory parallelism to distributed-memory parallelism using the portable Message-Passing Interface (MPI). If the MPI-based GEOS DAS is to meet these production requirements, we must make I/O from the parallel system efficient. We have designed a scheme that allows efficient I/O processing while retaining portability, reducing the need for post-processing, and producing data formats that are required by our users, both internal and external. The first phase of the GEOS DAS Parallel I/O System (GPIOS) will expand upon the common method of gathering global data to a Single PE for output. Instead of using a PE also tasked with primary computation, a number of PEs will be dedicated to I/O and its related tasks. This allows the data transformations and formatting required prior to output to take place asynchronously with respect to the GEOS DAS assimilation cycle, improving performance and generating output data sets in a format convenient for our users. I/O PEs can be added as needed to handle larger data volumes or to meet user file specifications. We will show I/O performance results from a prototype MPI GCM integrated with GPIOS. Phase two of GPIOS development will examine ways of integrating new software technologies to further improve performance and build scalability into the system. The maturing of MPI-IO implementations and other supporting libraries such as parallel HDF should provide performance gains while retaining portability.
Author
Data Systems; Data Processing; Data Transfer (Computers); Input/Output Routines; Parallel Processing (Computers); Software Engineering; Distributed Memory; Interprocessor Communication

19990020944 Geological Survey, Water-Resources Div., Rolla, MO USA
Base (100-Year) Flood Elevations for Selected Sites in Marion County, Missouri
Southard, Rodney E., Geological Survey, USA; Wilson, Gary L., Geological Survey, USA; 1998; 40p; In English
Report No.(s): PB99-113623; USGS/WRI-98-4211; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The report provides base flood elevations (BFE) for a 100-year recurrence flood for use in the management and regulation of 14 flood-hazard areas designated by the Federal Emergency Management Agency as approximate Zone A areas in Marion County, Missouri. The one-dimensional surface-water flow model, HEC-RAS, was used to compute the base (100-year) flood elevations for the 14 Zone A sites.
NTIS
Floods; Water Flow; Elevation; Flood Plains

19990020945 Geological Survey, Water Resources Div., Mounds View, MN USA
Hydrogeology and Sources of Recharge to the Buffalo and Wahpeton Aquifers in the Southern Part of the Red River of the North Drainage Basin, West-Central Minnesota and Southeastern North Dakota
Schoenberg, M. E., Geological Survey, USA; 1998; 46p; In English
Report No.(s): PB99-113615; USGS/WRI-97-4084; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The report describes the hydrogeology and the sources of recharge to the Buffalo and Wahpeton aquifers in the southern Red River of the North drainage basin. Specifically, this report describes: (1) areal extents, recharge areas, and hydraulic properties of the Buffalo and Wahpeton aquifers; (2) hydraulic connections between the aquifers and the sources of recharge; and (3) recharge to the aquifers by induced leakage from nearby rivers, by vertical leakage from precipitation, and by horizontal leakage of ground water through adjacent hydrogeologic units.
NTIS
Hydrogeology; Aquifers

19990020950 Geological Survey, Water-Resources Div., San Juan, Puerto Rico
Low Flow Characteristics at Selected Sites on Streams in Northern and Central Puerto Rico
Santiago-Rivera, Luis, Geological Survey, Puerto Rico; 1998; 68p; In English
Report No.(s): PB99-117236; USGS/WRI-98-4200; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The report provides analyses of low-flow data and tabulations of computed low-flow magnitude and frequency characteristics for 7, 14, 30, 60, and 90 consecutive days with recurrence intervals of 2 and 10 years for 15 continuous-record gaging stations in northern and central Puerto Rico based on the long-Pearson Type III frequency distribution or graphically adjusted log-Pearson frequency curves. Estimates of low-flow characteristics are provided for 94 partial-record gaging stations 7, 14 and 30 consecutive days with recurrence intervals of 2 and 10 years. Low-flow characteristics at partial-record gaging stations were estimated based

on the relation of base-flow discharge measurements at the partial-record gaging stations to concurrent discharges at nearby continuous-record gaging stations.
NTIS
Flow Characteristics; Streams

19990021032 Clark Univ., Graduate School of Geography, Worcester, MA USA
High Resolution Airborne Digital Imagery for Precision Agriculture
Herwitz, Stanley R., Clark Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Environmental Research Aircraft and Sensor Technology (ERAST) program is a NASA initiative that seeks to demonstrate the application of cost-effective aircraft and sensor technology to private commercial ventures. In 1997-98, a series of flight-demonstrations and image acquisition efforts were conducted over the Hawaiian Islands using a remotely-piloted solar- powered platform (Pathfinder) and a fixed-wing piloted aircraft (Navajo) equipped with a Kodak DCS450 CIR (color infrared) digital camera. As an ERAST Science Team Member, I defined a set of flight lines over the largest coffee plantation in Hawaii: the Kauai Coffee Company's 4,000 acre Koloa Estate. Past studies have demonstrated the applications of airborne digital imaging to agricultural management. Few studies have examined the usefulness of high resolution airborne multispectral imagery with 10 cm pixel sizes. The Kodak digital camera integrated with ERAST's Airborne Real Time Imaging System (ARTIS) which generated multi-band CCD images consisting of 6 x 106 pixel elements. At the designated flight altitude of 1,000 feet over the coffee plantation, pixel size was 10 cm. The study involved the analysis of imagery acquired on 5 March 1998 for the detection of anomalous reflectance values and for the definition of spectral signatures as indicators of tree vigor and treatment effectiveness (e.g., drip irrigation; fertilizer application).
Derived from text
High Resolution; Research Aircraft; Airborne Equipment; Imaging Techniques; Charge Coupled Devices

19990021047 California State Univ., Dept. of Geological Sciences, Hayward, CA USA
Analysis of the UV-B Regime and Potential Effects on Alfalfa
Seitz, Jeffery C., California State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Life at the surface of the Earth, over the last 400 m.y., evolved under conditions of decreased short-wave radiation (i.e., ultraviolet) relative to solar output due to absorption and scattering by constituents (e.g., ozone, water vapor, aerosols) in the upper atmosphere. However, a significant amount of ultraviolet radiation in the range from 280-320 nm, known as ultraviolet-B radiation, reaches the Earth's surface and has sufficient energy to be damaging to biologic tissue. Natural fluctuations in atmospheric constituents (seasonal variation, volcanic eruptions, etc.), changes in the orbital attitude of the Earth (precession, axial tilt, orbital eccentricity), and long-term solar variability contribute to changes in the total amount of ultraviolet radiation reaching the surface of the Earth, and thus, the biosphere. More recently, the atmospheric release of commercial propellants and refrigerants, known as chlorofluorocarbons (CFCs), has contributed to a significant depletion in naturally occurring ozone in the stratosphere. Thus, decreased stratospheric ozone has resulted in an increased UV-B flux at the Earth's surface which may have profound effects on terrestrial and marine organisms. In this study, we are investigating the effects of differing solar UV-B fluxes on alfalfa (Medicago sativa L.), an important agricultural crop. A long-term goal of this research is to develop spectral signatures to detect plant response to increased UV-B radiation from remote sensor platforms.
Author
Research; Ultraviolet Radiation; Tissues (Biology); Solar Activity; Marine Biology; Chlorofluorocarbons; Biosphere

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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.

19990021035 Nevada Univ., Dept. of Civil Engineering, Las Vegas, NV USA
Proposed Wind Turbine Aeroelasticity Studies Using Helicopter Systems Analysis
Ladkany, Samaan G., Nevada Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Advanced systems for the analysis of rotary wing aeroelastic structures (helicopters) are being developed at NASA Ames by the Rotorcraft Aeromechanics Branch, ARA. The research has recently been extended to the study of wind turbines, used for electric power generation Wind turbines play an important role in Europe, Japan & many other countries because they are non polluting & use a renewable source of energy. European countries such as Holland, Norway & France have been the world leaders in the design & manufacture of wind turbines due to their historical experience of several centuries, in building complex wind mill structures, which were used in water pumping, grain grinding & for lumbering. Fossil fuel cost in Japan & in Europe is two to three times higher than in the USA due to very high import taxes. High fuel cost combined with substantial governmental subsidies, allow wind generated power to be competitive with the more traditional sources of power generation. In the USA, the use of wind energy has been limited mainly because power production from wind is twice as expensive as from other traditional sources. Studies conducted at the National Renewable Energy Laboratories (NREL) indicate that the main cost in the production of wind turbines is due to the materials & the labor intensive processes used in the construction of turbine structures. Thus, for the US to assume world leadership in wind power generation, new lightweight & consequently very flexible wind turbines, that could be economically mass produced, would have to be developed [4,5]. This effort, if successful, would result in great benefit to the US & the developing nations that suffer from overpopulation & a very high cost of energy.
Author
Wind Turbines; Aeroelasticity; Rotary Wings; Research; Rotary Wing Aircraft

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ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990019136 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Report to the Honorable Scott Klug, House of Representatives. Environmental Cleanup: Defense Funding Allocation Process and Reported Funding Impacts
Nov. 1998; 22p; In English
Report No.(s): GAO/NSIAD-99-34; B-277896; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense (DOD) develops and allocates approved budgets through its departmentwide planning, programming, and budget process. The components used DOD guidance to establish priorities and distribute funds to the various installations, but the impact of that guidance is not necessarily traceable to specific installations or sites. During fiscal years 1993 to 1997, Congress took three actions that significantly affected funding for DOD cleanup activities. In fiscal year 1995, Congress appropriated $400 million less than DOD requested and then rescinded an additional $300 million of the amount appropriated. Finally, Congress appropriated $200 million less than DOD had requested for fiscal year 1996. In each case, DOD components adjusted funding priorities in light of the congressional actions and DOD guidance. While specific guidance varied, both written and verbal guidance encouraged priority for sites of high risk and discouraged cleanup studies that were not essential. Data contained in DOD's annual reports to Congress and in DOD components' records do not show a direct relationship between installations receiving less or more funding than planned and those reporting cleanup schedule delays due to funding. For example, during fiscal years 1995 and 1996, about half of the Army installations with the largest decreases in funding reported cleanup schedule delays--a frequency similar to Army installations with the largest increases in funding. During this period, we also found that actual funding changes under the DOD process often varied from that initially envisioned because of such reasons as inherent uncertainty during cleanup planning. For example, DOD initially identified a potential decrease in funding for two sites at Dugway Proving Ground, Utah, whereas the Army allocated a slight overall funding increase to that installation, which has 199 cleanup sites.
Derived from text
Budgeting; Allocations; Defense Program; Environment Pollution

19990019266 Princeton Univ., Dept. of Ecology and Evolutionary Biology, NJ USA
Critical Slowing Down in Time-to-Extinction: An Example of Critical Phenomena in Ecology
Gandhi, Amar, Princeton Univ., USA; Levin, Simon, Princeton Univ., USA; Orszag, Steven, Princeton Univ., USA; Journal of Theoretical Biology; 1998; ISSN 0022-5193; Volume 192, pp. 363-376; In English; Sponsored in part by the Andrew W. Mellon Foundation
Contract(s)/Grant(s): N00014-92-J-1796; N00014-92-J-1527; NAG5-6422; ASF 97-3-5; NAGw-4688; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We study a model for two competing species that explicitly accounts for effects due to discreteness, stochasticity and spatial extension of populations. The two species are equally preferred by the environment and do better when surrounded by others of

the same species. We observe that the final outcome depends on the initial densities (uniformly distributed in space) of the two species. The observed phase transition is a continuous one and key macroscopic quantities like the correlation length of clusters and the time-to-extinction diverge at a critical point. Away from the critical point, the dynamics can be described by a mean-field approximation. Close to the critical point, however, there is a crossover to power-law behavior because of the gross mismatch between the largest and smallest scales in the system. We have developed a theory based on surface effects, which is in good agreement with the observed behavior. The course-grained reaction-diffusion system obtained from the mean-field dynamics agrees well with the particle system.
Author
Stochastic Processes; Critical Point; Correlation; Extinction; Ecology

19990019271 NASA Langley Research Center, Hampton, VA USA
An Assessment of Ozone Photochemistry in the Extratropical Western North Pacific: Impact of Continental Outflow During the Late Winter/Early Spring
Crawford, J., Georgia Inst. of Tech., USA; Davis, D., Georgia Inst. of Tech., USA; Chen, G., Georgia Inst. of Tech., USA; Bradshaw, J., Georgia Inst. of Tech., USA; Sandholm, S., Georgia Inst. of Tech., USA; Kondo, Y., Georgia Inst. of Tech., USA; Liu, S., Georgia Inst. of Tech., USA; Browell, E., Georgia Inst. of Tech., USA; Gregory, G., Nagoya Univ., Japan; Anderson, B., Georgia Inst. of Tech., USA; Sachse, G., NASA Langley Research Center, USA; Collins, J., Science and Technology Corp., USA; Barrick, J., NASA Langley Research Center, USA; Blake, D., NASA Langley Research Center, USA; Talbot, R., NASA Langley Research Center, USA; Singh, H., Science and Technology Corp., USA; Journal of Geophysical Research; Dec. 20, 1997; ISSN 0148-0227; Volume 102, No. D23, pp. 28,469-28,487; In English
Contract(s)/Grant(s): NCC1-438; NCC1-148
Report No.(s): Paper-97JD-2600; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

This study examines the influence of photochemical processes on tropospheric ozone distributions over the extratropical western North Pacific. The analysis presented here is based on data collected during the Pacific Exploratory Mission-West Phase B (PEM-West B) field study conducted in February-March 1994. Sampling in the study region involved altitudes of 0-12 km and latitudes of 10deg S to 50deg N. The extratropical component of the data set (i.e., 20-50deg N) was defined by markedly different photochemical environments north and south of 30deg N. This separation was clearly defined by an abrupt decrease in the tropopause height near 30deg N and a concomitant increase in total O3 column density. This shift in overhead O3 led to highly reduced rates of O3 formation and destruction for the 30-50deg N latitude regime. Both latitude ranges, however, still exhibited net O3 production at all altitudes. Of special significance was the finding that net O3 production prevailed even at boundary layer and lower free tropospheric altitudes (e.g., less than 4 km), a condition uncommon to Pacific marine environments. These results reflect the strong impact of continental Outflow of O3 precursors (e.g., NO and NMHCS) into the northwestern Pacific Basin. Comparisons with PEM-West A, which sampled the same region in a different season (September-October), revealed major differences at altitudes below 4 km, the altitude range most influenced by continental outflow. The resulting net rate of increase in the tropospheric O3 column for PEM-West B was 1-3 % per day, while for PEM-West A it was approximately zero. Unique to the PEM-West B study is the finding that even under wintertime conditions substantial column production of tropospheric O3 can occur at subtropical and mid-latitudes. While such impacts may not be totally unexpected at near coast locations, the present study suggests that the impact from continental outflow on the marine BL could extend out to distances of more than 2000 km from the Asian Pacific Rim.
Author
Photochemical Reactions; Ozone; Troposphere; Atmospheric Composition

19990019272 NASA Langley Research Center, Hampton, VA USA
Implications of Large Scale Shifts in Tropospheric NO(x) Levels in the Remote Tropical Pacific
Crawford, J. H., Georgia Inst. of Tech., USA; Davis, D. D., Georgia Inst. of Tech., USA; Chen, G., Georgia Inst. of Tech., USA; Bradshaw, J., Georgia Inst. of Tech., USA; Sandholm, S., Georgia Inst. of Tech., USA; Kondo, Y., Nagoya Univ., Japan; Merrill, J., Rhode Island Univ., USA; Liu, S., Georgia Inst. of Tech., USA; Browell, E., NASA Langley Research Center, USA; Gregory, G., NASA Langley Research Center, USA; Anderson, B., NASA Langley Research Center, USA; Sachse, G., NASA Langley Research Center, USA; Barrick, J., NASA Langley Research Center, USA; Blake, D., California Univ., USA; Talbot, R., Institute for the Study of Earth, Oceans and Space, USA; Pueschel, R., NASA Ames Research Center, USA; Journal of Geophysical Research; Oct. 20, 1997; ISSN 0148-0227; Volume 102, No. D23, pp. 28,447-28,468; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC1-148; NCC1-438
Report No.(s): Paper-97JD00011; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

A major observation recorded during NASA's western Pacific Exploratory Mission (PEM-West B) was the large shift in tropical NO levels as a function of geographical location. High-altitude NO levels exceeding 100 pptv were observed during portions of tropical flights 5-8, while values almost never exceeded 20 pptv during tropical flights 9 and 10. The geographical regions encompassing these two flight groupings are here labeled "high" and "low" NOx regimes. A comparison of these two regimes, based on back trajectories and chemical tracers, suggests that air parcels in both were strongly influenced by deep convection. The low NO(x) regime appears to have been predominantly impacted by marine convection, whereas the high NO(x) regime shows evidence of having been more influenced by deep convection over a continental land mass. DMSP satellite observations point strongly toward lightning as the major source of NOx in the latter regime. Photochemical ozone formation in the high NOx regime exceeded that for low NO(x) by factors of 2 to 6, whereas O3 destruction in the low NO(x)regime exceeded that for high NOx by factors of up to 3. Taking the tropopause height to be 17 km, estimates of the net photochemical effect on the O3 column revealed that the high NO(x) regime led to a small net production. By contrast, the low NOx regime was shown to destroy O3 at the rate of 3.4 % per day. One proposed mechanism for off-setting this projected large deficit would involve the transport of 03 rich midlatitude air into the tropics. Alternatively, it is suggested that O3 within the tropics may be overall near self-sustaining with respect to photochemical activity. This scenario would require that some tropical regions, unsampled at the time of PEM-B, display significant net column O3 production, leading to an overall balanced budget for the "greater" tropical Pacific basin. Details concerning the chemical nature of such regimes are discussed.
Author
Nitrogen Oxides; Troposphere; Satellite Observation; Photochemical Reactions

19990019273 Princeton Univ., Dept. of Ecology and Evoutionary Biology, NJ USA
Mathematical and Computational Challenges in Population Biology and Ecosystems Science
Levin, Simon A., Princeton Univ., USA; Grenfell, Bryan, Cambridge Univ., UK; Hastings, Alan, California Univ., USA; Perelson, Alan S., Los Alamos National Lab., USA; Science; Jan. 17, 1997; Volume 275, pp. 334-343; In English
Contract(s)/Grant(s): NAG5-6422; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Mathematical and computational approaches provide powerful tools in the study of problems in population biology and ecosystems science. The subject has a rich history intertwined with the development of statistics and dynamical systems theory, but recent analytical advances, coupled with the enhanced potential of high-speed computation, have opened up new vistas and presented new challenges. Key challenges involve ways to deal with the collective dynamics of heterogeneous ensembles of individuals, and to scale from small spatial regions to large ones. The central issues-understanding how detail at one scale makes its signature felt at other scales, and how to relate phenomena across scales-cut across scientific disciplines and go to the heart of algorithmic development of approaches to high-speed computation. Examples are given from ecology, genetics, epidemiology, and immunology.
Author
Computation; Populations; Biology; Ecosystems; Dynamical Systems

19990019274 Princeton Univ., Dept. of Ecology and Evolutionary Biology, NJ USA
Terrestrial Models and Global Change: Challenges for the Future
Hurtt, George C., Princeton Univ., USA; Moorcroft, Paul R., Princeton Univ., USA; Pacala, Stephen W., Princeton Univ., USA; Levin, Simon A., Princeton Univ., USA; Global Change Biology; 1998; Volume 4, pp. 581-590; In English
Contract(s)/Grant(s): NAG5-6422; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A wide variety of models have illustrated the potential importance of terrestrial biological feedbacks on climate and climate change, yet our ability to make precise predictions is severely limited, due to a high degree of uncertainty. In this paper, after briefly reviewing current models, we present challenges for new terrestrial models and introduce a simple mechanistic approach that may complement existing approaches.
Author
Climate Change; Feedback; Biological Diversity; Ecosystems

19990019277 NASA Langley Research Center, Hampton, VA USA
Impact of Lightning and Convection on Reactive Nitrogen in the Tropical Free Troposphere
Kawakami, S., Nagoya Univ., Japan; Kondo, Y., Nagoya Univ., Japan; Koike, M., Nagoya Univ., Japan; Nakajima, H., Nagoya Univ., Japan; Gregory, G. L., NASA Langley Research Center, USA; Sachse, G. W., NASA Langley Research Center, USA; Newell, R. E., Massachusetts Inst. of Tech., USA; Browell, E. V., NASA Langley Research Center, USA; Blake, D. R., California Univ., USA; Rodriquez, J. M., Atmospheric and Environmental Research, Inc., USA; Merrill, J. T., Rhode Island Univ., USA; Journal of Geophysical Research; Dec. 20, 1997; ISSN 0148-0227; Volume 102, No. D23, pp. 28,367-28,384; In English; Original

contains color illustrations; Sponsored in part by the Daiko Foundation
Report No.(s): Paper-97JD02073; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Latitudinal distributions of NO, NO(y), O3, CO, CH3I, and H2O mixing ratios at 8.9-12 km were obtained between 30deg N and 1deg S by DC-8 aircraft measurements made in February 1994 during Pacific Exploratory Mission-West B (PEM-West B). Very low NO(y), mixing ratios with a median value of 51 parts per trillion by volume (pptv) were observed at 9.5-12 km at 1deg N-14deg N during two flights made within 3 days. A very low median O3 mixing ratio of 19 parts per billion by volume (ppbv) and high mixing ratios of H2O and CH3I were simultaneously observed, suggesting that the low NO(y), values were probably due to the convective transport of air from the tropical marine boundary layer to this altitude. The median NO(y)/O3 ratio being a factor of 2 smaller than in the air masses in the tropical marine boundary layer might suggest the possibility that the heterogeneous removal of HNO3 during convective transport further reduced NO(y) levels. In addition to the measurements between 9.5 and 12 km, low values of NO(y) and O3 were observed between 4 and 12 km at 1deg N. Divergent wind fields at 200 and 1000 hPa and infrared (IR) cloud images show that there was large scale convection (greater than 1000 km x 1000 km) in the northeast of New Guinea Island centered around Odeg S and 150deg E as part of systematic convective activity of the Intertropical Convergence Zone (ITCZ) and the South Pacific Convergence Zone (SPCZ). This type of large scale convection could have transported air with low levels of NO(y) and O3 to the middle and upper troposphere over a wide area in the tropics. On the other hand, NO mixing ratios of 50-200 pptv and high NQ,/NOY ratios of 0.4-0.6 were observed at 9.5 km between 4deg S and 10deg S. High H2O Mixing ratios of 600-1200 parts per million by volume (ppmv) and low CO mixing ratios of 65 ppbv observed in the air mass indicated that the high NO values were probably due to NO production by lightning. Satellite observations showed relatively frequent lightning flashes over the New Guinea Island for 3 days prior to the aircraft measurements. These results are considered to be consistent with the idea that, in general, marine convection is not accompanied by lightning activity, whereas convection over land is. Because of the large areal extent of the influences from these processes, the convective transport of low NO(y) air and NO production by lightning should play critical roles in controlling the abundance of reactive nitrogen in the equatorial region.
Author
Troposphere; Convection; Lightning; Air Water Interactions; Nitrogen; Wind Velocity

19990019292 NASA Langley Research Center, Hampton, VA USA
Distributions of Beryllium 7 and Lead 210, and Soluble Aerosol-Associated Ionic Species Over the Western Pacific: PEM West B, *Feb. - Mar. 1994*
Didd, J. E., Institute for the Study of Earth, Oceans and Space, USA; Talbot, R. W., Institute for the Study of Earth, Oceans and Space, USA; Lefer, B. L., Institute for the Study of Earth, Oceans and Space, USA; Scheuer, E., Institute for the Study of Earth, Oceans and Space, USA; Gregory, G. L., NASA Langley Research Center, USA; Browell, E. V., NASA Langley Research Center, USA; Sandholm, S. T., Georgia Inst. of Tech., USA; Singh, H. B., NASA Ames Research Center, USA; Journal of Geophysical Research; Dec. 20, 1997; ISSN 0148-0227; Volume 102, No. D23, pp. 28,287-28,302; In English
Report No.(s): Paper-96JD02981; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerosol sampling for the determination of the concentrations of soluble ionic species and the natural radionuclides Be-7 and Pb-210 was conducted from the NASA DC-8 over the western Pacific as part of GTE/PEM-West B during February - March 1994. Concentrations of most soluble ionic species in the free troposphere were higher in samples collected on flights originating from Hong Kong and Japan than those collected further east over the open ocean. In both regions the measured concentrations were higher than those found during PEM-West A (fall 1991). Activities of Pb-210 tracer of air masses influenced by sources on the Asian continent, showed the same patterns. These data indicate the effect of stronger continental outflow from Asia over the western Pacific during the spring compared to fall season. For readily scavenged aerosol-associated species and soluble acidic gases the strongest indications of Asian outflow were restricted to altitudes below 6 km. The distribution of the continental tracer Pb-210 was also compared to those of a large number of gas phase species measured on the DC-8. Relatively strong correlations were found with O3 and peroxyacetylnitrate (PAN), but only during the flights over the remote Pacific. During PEM-West A, similar correlations were seen, but they were stronger near Asia. We believe that these correlations are a signature of continental air that has been processed by deep wet convection over land before being advected over the ocean. One flight over the Sea of Japan provided the opportunity to sample upper troposphere/lower stratosphere air in and around a tropopause fold. Concentrations of Be-7 reached 7 pCi/cu m STP, and peak O3, mixing ratios of 480 ppb were encountered at 10.7 km. The Be-7 data are used to estimate the fraction of stratospheric air mixed down into the troposphere by circulation in the fold.
Author
Beryllium 7; Lead Isotopes; Mixing Ratios; Aerosols; Atmospheric Chemistry; Upper Atmosphere; Radioactive Isotopes

19990019319 University of Southern California, Dept. of Electrical Engineering and Electrophysics, Los Angeles, CA USA
Plasma Based Devices ***Final Report, 1 Jul. 1995 - 30 Jun. 1998***
Gundersen, M., University of Southern California, USA; Sep. 1998; 5p; In English
Contract(s)/Grant(s): DAAH04-95-1-0413
Report No.(s): AD-A357943; ARO-34397.4-PH; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The most important result relates to the reduction of emissions from NO(x) sources, and is basically a breakthrough in energy efficiency, based on the application of a transient, short-pulse plasma. The project was a study of physics and applications of plasma devices, and as a result of promising early data, focused on the use of transient plasma devices for NO(x) remediation. The most important results are: (1) A cost-effective regime, maintaining the simplicity of a pulsed discharge, was successfully found. (2) The pulsed discharge, a ”plasma muffler”, achieves results of 30% NO(x) reduction, requiring less than or equal 10 eV/molecule energy cost for flow rates from operating diesel engines, corresponding to operating efficiencies that would be useful for the transportation industry. (3) The role of transient discharges in this process is found to be key, and a preliminary, phenomenological rationale has been found. (4) Further research leading to the understanding of the transient processes, and the subsequent chemistry, promises many new applications. (5) Preliminary results of Laser Induced Fluorescence (LIF) studies are now available. (6) Low energy cost was found to be driven by current density, so that an efficient operation at a low energy cost is actually better at low current densities. (7) Power modulator design, and reactor design, are found to be interrelated. (8) New reactor and power modulator designs have been developed, and, following the goals of the previous work as well as the requirements for many practical implementations, {”miniaturization” of the power conditioning is under development.
DTIC
Electron Accelerators; Nitrogen Oxides; Energy Conservation; Plasmas (Physics); Cost Effectiveness; Emission

19990019436 Georgia Inst. of Tech., School of Earth and Atmospheric Sciences, Atlanta, GA USA
Measurement of Reactive Nitrogen Compounds over the Tropical Pacific
Sandholm, Scott, Georgia Inst. of Tech., USA; 1996; 5p; In English
Contract(s)/Grant(s): NAG1-1767; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report covers the Tropospheric Trace Gas and Airborne Measurement Group’s (TTGAMG) participation in the NASA Global Tropospheric Experiment (GTE) Pacific Exploratory Mission: Tropics A (PEM-TA) field measurement program. With other university and NASA centers, the Georgia Institute of Technology Airborne Laser Induced Fluorescence Experiment (GITALIFE) was deployed on the NASA Ames DC-8 aircraft for the measurement of NO and NO2 One of the PEM-TA objectives was to collect the data and interpret the fast photo-chemical processes taking place in the remote and relatively pristine environment over Hawaii, Tahiti, Easter Island, New Zealand, and Fiji.
Author
Airborne Lasers; Atmospheric Composition; Chemical Reactions; Laser Induced Fluorescence; Nitrogen Compounds; Trace Elements; Tropical Regions; Troposphere

19990019487 NASA Langley Research Center, Hampton, VA USA
Nitrogen Species in the Post-Pinatubo Stratosphere: Model Analysis Utilizing UARS Measurements
Danilin, M. Y., Atmospheric and Environmental Research, Inc., USA; Rodriquez, J. M., Atmospheric and Environmental Research, Inc., USA; Hu, W., Atmospheric and Environmental Research, Inc., USA; Ko, M. K. W., Atmospheric and Environmental Research, Inc., USA; Weisenstein, D. K., Atmospheric and Environmental Research, Inc., USA; Mergenthaler, J. L., Lockheed Martin Corp., USA; Russell, J. M., III, Hampton Univ., USA; Koike, M., Nagoya Univ., Japan; Yue, G. K., NASA Langley Research Center, USA; Sep. 14, 1998; 40p; In English
Contract(s)/Grant(s): NAS5-32844; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present an analysis of the impact of heterogeneous chemistry on the partitioning of nitrogen species measured by the Upper Atmosphere Research Satellite (UARS) instruments. The UARS measurements utilized include: N2O, HNO3 and ClONO2 (Cryogen Limb Array Etalon Spectrometer (CLAES), version 7), temperature, methane, ozone, H2O, HCl, NO and NO2 (HALogen Occultation Experiment (HALOE), version 18). The analysis is carried out for the data from January 1992 to September 1994 in the 100-1 mbar (approx.17-47 km) altitude range and over 10 degree latitude bins from 70degS to 70degN. Temporal-spatial evolution of aerosol surface area density (SAD) is adopted according to the Stratospheric Aerosol and Gas Experiment (SAGE) 11 data. A diurnal steady-state photochemical box model, constrained by the temperature, ozone, H2O, CH4, aerosol SAD and columns of O2 and O3 above the point of interest, has been used as the main tool to analyze these data. Total inorganic nitrogen (NO(y)) is obtained by three different methods: (1) as a sum of the UARS measured NO, NO2, HNO3, and ClONO2; (2) from the N2O-NO(y) correlation, and (3) from the CH4-NO(y) correlation. to validate our current understanding of stratospheric heterogeneous chemistry for post-Pinatubo conditions, the model-calculated NO(x)/NO(y) ratios and the NO, NO2, and HNO3 profiles

are compared to the UARS-derived data. In general, the UARS-constrained box model captures the main features of nitrogen species partitioning in the post-Pinatubo years. However, the model underestimates the NO2 content, particularly, in the 30-7 mbar (approx. 23-32 km) range. Comparisons of the calculated temporal behavior of the partial columns of NO2 and HNO3 and ground based measurements at 45degS and 45degN are also presented. Our analysis indicates that ground-based and HALOE v. 18 measurements of the NO2 vertical columns are consistent within the range of their uncertainties and are systematically higher (up to 50%) than the model results at mid-latitudes in both hemispheres. Reasonable agreement is obtained for HNO3 columns at 45degS suggesting some problems with nitrogen species partitioning in the model. Outstanding uncertainties are discussed.
Author
Upper Atmosphere Research Satellite (UARS); Nitrogen; Photochemical Reactions; Stratosphere; Atmospheric Chemistry; Cryogenics; Nitric Acid; Hydrochloric Acid

19990019507 Columbia Univ., Dept. of Applied Physics, New York, NY USA
Theoretical Calculation and Validation of the Water Vapor Continuum Absorption ***Final Report, 1 Aug. 1997 - 31 Jul. 1998***
Ma, Qiancheng, Columbia Univ., USA; Tipping, Richard H., Alabama Univ., USA; 1998; 7p; In English
Contract(s)/Grant(s): NAG5-6372; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary objective of this investigation is the development of an improved parameterization of the water vapor continuum absorption through the refinement and validation of our existing theoretical formalism. The chief advantage of our approach is the self-consistent, first principles, basis of the formalism which allows us to predict the frequency, temperature and pressure dependence of the continuum absorption as well as provide insights into the physical mechanisms responsible for the continuum absorption. Moreover, our approach is such that the calculated continuum absorption can be easily incorporated into satellite retrieval algorithms and climate models. Accurate determination of the water vapor continuum is essential for the next generation of retrieval algorithms which propose to use the combined constraints of multispectral measurements such as those under development for EOS data analysis (e.g., retrieval algorithms based on MODIS and AIRS measurements); current Pathfinder activities which seek to use the combined constraints of infrared and microwave (e.g., HIRS and MSU) measurements to improve temperature and water profile retrievals, and field campaigns which seek to reconcile spectrally-resolved and broad-band measurements such as those obtained as part of FIRE. Current widely used continuum treatments have been shown to produce spectrally dependent errors, with the magnitude of the error dependent on temperature and abundance which produces errors with a seasonal and latitude dependence. Translated into flux, current water vapor continuum parameterizations produce flux errors of order 10 W/sq m, which compared to the 4 W/sq m magnitude of the greenhouse gas forcing and the 1-2 W/sq m estimated aerosol forcing is certainly climatologically significant and unacceptably large. While it is possible to tune the empirical formalisms, the paucity of laboratory measurements, especially at temperatures of interest for atmospheric applications, preclude tuning, the empirical continuum models over the full spectral range of interest for remote sensing and climate applications. Thus, we propose to further develop and refine our existing, far-wing formalism to provide an improved treatment applicable from the near-infrared through the microwave. Based on the results of this investigation, we will provide to the remote sensing/climate modeling community a practical and accurate tabulation of the continuum absorption covering the near-infrared through the microwave region of the spectrum for the range of temperatures and pressures of interest for atmospheric applications.
Author
Water Vapor; Frequencies; Pressure Dependence; Formalism; Continuum Modeling; Climate Models; Algorithms; Remote Sensing; Parameterization

19990019720 Cumberland Coll., Dept. of Mathematics, Physics and Geography, Williamsburg, KY USA
Organizing and Analyzing Lidar Data Obtained From the Contrails of a Boeing 737
Newquist, Lawrence A., Cumberland Coll., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 80; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

With the production of the High Speed Civil Transport (HSCT) , which will fly in the stratosphere, comes a need to monitor the emissions from these aircraft. With the presence of the ozone layer at the top of the stratosphere, it is important to study the composition and evolution of these emissions as well as the circulation of these emissions throughout the stratosphere to understand their impact on the stratosphere and the ozone layer. In experiments carried out in 1995, 1996, and 1997, a 48 inch zenith Lidar (Light Detection and Ranging) system and a scanning Lidar system were used to detect the backscatter radiation from the contrails of a Boeing 737 jet aircraft as the plumes were advected across the Lidar systems. Radiation at wavelengths of 1064 nm and 532 nm was used on the 48 inch system. Only radiation at 1064 nm was used on the scanning system. This data needs to be processed and organized into a uniform format since the formats changed over the three years due to better ways to acquire and store the data. Also, for some runs, two lasers each running at 10 Hz were interleaved to generate 20 Hz data. Methods for correctly

interleaving the two laser signals will be studied. The data then needs to be posted to the Web to make it available to the scientific community. Analysis of this data will include calculating the ratio of the 532 nm return to the 1064 nm return. This will be referred to as the beta ratio since it is essentially the ratio of the backscatter cross sections (typically symbolized using the Greek letter beta) for the two wavelengths. Since small particles will scatter 532 nm radiation more efficiently then 1064 nm radiation a large beta ratio could be indicative of regions of small particle formation which could indicate interesting chemistry within the plume region.
Author
Boeing 737 Aircraft; Optical Radar; Lasers; Supersonic Transports

19990019757 Johns Hopkins Univ., Dept. of Geography and Environmental Engineering, Baltimore, MD USA
Studies of Contaminant Diffusion in an Aquitard and Groundwater Remediation by Reactive Metals at Dover Air Force Base Delaware *Final Report, Oct. 1996 - Jan. 1998*
Ball, William P.; Liu, Chongxuan; Wilson, Ryan D.; Mackay, Douglas M.; Jan. 23, 1998; 80p; In English; Prepared in cooperation with the Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, Canada.
Contract(s)/Grant(s): F08635-93-C-0032
Report No.(s): AD-A356193; AFRL-ML-TY-TR-1998-4542; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This project focused on analysis of in-situ concentrations of chlorinated hydrocarbons in an aquitard underlying the site of a prior field-scale investigation of pump-and-treat remediation in sheet-pile ”test cells” at Dover AFB, DE. Another aspect was the conduct of exploratory long-term column investigations of zero-valent metal barrier technologies, as applied to contaminated groundwater taken from the aquifer surrounding the cells. During the post-pumping period, unique conditions of zero flow were maintained within the sheet-pile enclosures. Extensive soil coring was conducted at times corresponding to roughly seven and sixteen months after the termination of the prior project. New modeling approaches were developed both to (1) apply concentration profile information toward more accurate estimation of plume history (inverse modeling for forensic interpretation); and (2) obtain predictions of the post-pumping contaminant movement (multi-layer diffusion modeling). Results were used to (1) test the assumption that diffusion alone affected contaminant fate, and (2) conduct additional forensic interpretations and field-scale simulations. The column investigations provided long-term verification of halogenated alkene removal under essentially in situ groundwater conditions, including continuous removal of cis-1,2-dichlororoethene. Results also confirmed that dichloromethane is not removed and showed apparent breakthrough of two other chemicals, tentatively identified as dichloroethanes.
DTIC
Ground Water; Contaminants; Aquifers; Water Pollution; Contamination; Chlorine Compounds; Hydrocarbons

19990019836 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Kalman Filter and High Performance Computing at NASA’s Data Assimilation Office (DAO)
Lyster, Peter M., NASA Goddard Space Flight Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 29; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

Atmospheric data assimilation is a method of combining actual observations with model simulations to produce a more accurate description of the earth system than the observations alone provide. The output of data assimilation, sometimes called ”the analysis”, are accurate regular, gridded datasets of observed and unobserved variables. This is used not only for weather forecasting but is becoming increasingly important for climate research. For example, these datasets may be used to assess retrospectively energy budgets or the effects of trace gases such as ozone. This allows researchers to understand processes driving weather and climate, which have important scientific and policy implications. The primary goal of the NASA’s Data Assimilation Office (DAO) is to provide datasets for climate research and to support NASA satellite and aircraft missions. This presentation will: (1) describe ongoing work on the advanced Kalman/Lagrangian filter parallel algorithm for the assimilation of trace gases in the stratosphere; and (2) discuss the Kalman filter in relation to other presentations from the DAO on Four Dimensional Data Assimilation at this meeting. Although the designation ”Kalman filter” is often used to describe the overarching work, the series of talks will show that the scientific software and the kind of parallelization techniques that are being developed at the DAO are very different depending on the type of problem being considered, the extent to which the problem is mission critical, and the degree of Software Engineering that has to be applied.
Author
Atmospheric Composition; Data Processing; Assimilation; Kalman Filters; Parallel Processing (Computers); Atmospheric Models; Meteorological Parameters

19990019850 NASA Goddard Space Flight Center, Greenbelt, MD USA

Parallelization of the Physical-Space Statistical Analysis System (PSAS)

Larson, J. W., NASA Goddard Space Flight Center, USA; Guo, J., NASA Goddard Space Flight Center, USA; Lyster, P. M., NASA Goddard Space Flight Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 93; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

Atmospheric data assimilation is a method of combining observations with model forecasts to produce a more accurate description of the atmosphere than the observations or forecast alone can provide. Data assimilation plays an increasingly important role in the study of climate and atmospheric chemistry. The NASA Data Assimilation Office (DAO) has developed the Goddard Earth Observing System Data Assimilation System (GEOS DAS) to create assimilated datasets. The core computational components of the GEOS DAS include the GEOS General Circulation Model (GCM) and the Physical-space Statistical Analysis System (PSAS). The need for timely validation of scientific enhancements to the data assimilation system poses computational demands that are best met by distributed parallel software. PSAS is implemented in FORTRAN 90 using object-based design principles. The analysis portions of the code solve two equations. The first of these is the ”innovation” equation, which is solved on the unstructured observation grid using a preconditioned conjugate gradient (CG) method. The ”analysis” equation is a transformation from the observation grid back to a structured grid, and is solved by a direct matrix-vector multiplication. Use of a factored-operator formulation reduces the computational complexity of both the CG solver and the matrix-vector multiplication, rendering the matrix-vector multiplications as a successive product of operators on a vector. Sparsity is introduced to these operators by partitioning the observations using an icosahedral decomposition scheme. PSAS builds a large (approx. 128MB) run-time database of parameters used in the calculation of these operators. Implementing a message passing parallel computing paradigm into an existing yet developing computational system as complex as PSAS is nontrivial. One of the technical challenges is balancing the requirements for computational reproducibility with the need for high performance. The problem of computational reproducibility is well known in the parallel computing community. It is a requirement that the parallel code perform calculations in a fashion that will yield identical results on different configurations of processing elements on the same platform. In some cases this problem can be solved by sacrificing performance. Meeting this requirement and still achieving high performance is very difficult. Topics to be discussed include: current PSAS design and parallelization strategy; reproducibility issues; load balance vs. database memory demands, possible solutions to these problems.

Author

Atmospheric General Circulation Models; Statistical Analysis; Parallel Processing (Computers); Message Processing; Conjugate Gradient Method; Distributed Processing; Software Engineering

19990019855 California Univ., Dept. of Atmospheric Sciences, Los Angeles, CA USA

Development of an Earth System Model in High Performance Computing Environments

Mechoso, C. R., California Univ., USA; Drummond, L. A., California Univ., USA; Farrara, J. D., California Univ., USA; Spahr, J. A., California Univ., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 119-124; In English; Also announced as 19990019831

Contract(s)/Grant(s): CAN-21425/041; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Under the framework of NASA High Performance Computing and Communications for the Earth and Space Sciences (HPCC-ESS) program, we are developing an Earth System Model (ESM). The ESM produced by this effort will be used for ensembles of climate simulations in high performance computing environments to study the coupled atmosphere/ocean system dynamics with chemical tracers. Here, we outline the design, implementation, optimization and performance of two modules of the ESM: 1) Models (dynamical and chemical), and 2) Data Broker. The Data Broker module is used for handling the communication between the Models module and the Earth System Model Information System (ESMIS) module.

Author

Air Water Interactions; Applications Programs (Computers); Programming Environments; Dynamic Models; Atmospheric Models; Atmospheric General Circulation Models; Ocean Models

19990019895 NASA Goddard Space Flight Center, Greenbelt, MD USA

Aviation Fuel Tracer Simulation: Model Intercomparison and Implications

Danilin, M. Y., Atmospheric and Environmental Research, Inc., USA; Fahey, D. W., National Oceanic and Atmospheric Administration, USA; Schumann, U., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Prather, M. J., California Univ., USA; Penner, J. E., Michigan Univ., USA; Ko, M. K. W., Atmospheric and Environmental Research, Inc., USA; Weisenstein, D. K., Atmospheric and Environmental Research, Inc., USA; Jackman, C. H., NASA Goddard Space Flight Center, USA; Pitari, G., Aquila Univ., Italy; Koehler, I., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Sausen, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Weaver, C. J., NASA Goddard Space Flight Center, USA; Douglass, A. R.,

NASA Goddard Space Flight Center, USA; Connell, P. S., Lawrence Livermore National Lab., USA; Kinnison, D. E., Lawrence Livermore National Lab., USA; Dentener, F. J., Utrecht Univ., Netherlands; Fleming, E. L., NASA Goddard Space Flight Center, USA; Berntsen, T. K., Center for International Climate and Environmental Research, Norway; Isaksen, I. S. A., Oslo Univ., Norway; Geophysical Research Letters; Nov. 01, 1998; ISSN 0094-8276; Volume 25, No. 21, pp. 3947-3950; In English
Report No.(s): Paper-GRL-1998900058; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An upper limit for aircraft-produced perturbations to aerosols and gaseous exhaust products in the upper troposphere and lower stratosphere (UT/LS) is derived using the 1992 aviation fuel tracer simulation performed by eleven global atmospheric models. Key findings are that subsonic aircraft emissions: (1) have not been responsible for the observed water vapor trends at 40degN; (2) could be a significant source of soot mass near 12 km, but not at 20 km; (3) might cause a noticeable increase in the background sulfate aerosol surface area and number densities (but not mass density) near the northern mid-latitude tropopause; and (4) could provide a global, annual mean top of the atmosphere radiative forcing up to +0.006 W/sq m and -0.013 W/sq m due to emitted soot and sulfur, respectively.
Author
Atmospheric Models; Aircraft Fuels; Aerosols; Perturbation; Combustion Products; Exhaust Emission; Simulation

19990020949 Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Municipal Solid Waste Landfills, Volume 2, Summary of Requirements for Section 111(d) State Plans for Implementing the Municipal Solid Waste Landfills Emission Guidelines ***Final Report***
Warner, M. A., Environmental Protection Agency, USA; Fanjoy, J., Environmental Protection Agency, USA; Nov. 1998; 304p; In English
Report No.(s): PB99-117434; EPA/456/R-98/009; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

This document summarizes the requirements for section 111(d) State plans for municipal solid waste (MSW) landfills. The March 12, 1996 Emission guidelines required States to submit State plans that explain how they will implement and enforce the guidelines for existing MSW landfills. This document explains the required content of State plans, outlines the time line and responsibilities for developing and submitting State plans, and answers general questions about how to prepare State plans.
NTIS
Solid Wastes; Landfills; Waste Disposal; Emission

19990020954 Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Municipal Solid Waste Landfills, Volume 1, Summary of Requirements for the New Source Performance Standards and Emission Guidelines for Municipal Solid Waste Landfills ***Final Report***
Sep. 1998; 358p; In English
Report No.(s): PB99-117426; EPA/453/R-96/004; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This volume is one of several documents designed to assist States, EPA regional offices, and municipal solid waste (MWS) landfill owners and operators in implementing the New Source Performance Standard (NSPS) and Emission Guidelines (EG) for MSW landfills. Full references to all related documents are provided. Enclosed is a summary of the NSPS and EG and the control, monitoring, recordkeeping and reporting requirements. Explanations are included to help implementing agencies determine applicability, ensure compliance, collect and review reports, and conduct inspections. The appendices include tools for ensuring compliance.
NTIS
Solid Wastes; Landfills; Emission; Waste Disposal

19990020955 Congressional Budget Office, Washington, DC USA
CBO Memorandum: Climate Change and the Federal Budget
Aug. 1998; 52p; In English
Report No.(s): PB99-116352; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Congressional Budget Office (CBO) memorandum was prepared at the request of the Senate Committee on the Budget to document current U.S. efforts in the area of global climiate change and to review current federal spending programs and tax policies that relate to climate change. The memorandum also describes proposals contained in the President's 1999 budget for funding for those programs and several new tax policies. It should be helpful to policymakers as they consider options to respond to international proposals for reducing the threat of climate change.
NTIS
Climate Change; Congressional Reports; Federal Budgets; Policies; Environment Effects

19990020959 NASA Goddard Space Flight Center, Greenbelt, MD USA

Reactive Nitrogen and its Correlation with O3 and CO Over the Pacific in Winter and Early Spring

Koike, M., Nagoya Univ., Japan; Kondo,Y., Nagoya Univ., Japan; Kawakami, S., Nagoya Univ., Japan; Nakajima, H., Nagoya Univ., Japan; Sachse, G. W., NASA Langley Research Center, USA; Singh, H. B., NASA Ames Research Center, USA; Browell, E. V., NASA Langley Research Center, USA; Merrill, J. T., Rhode Island Univ., USA; Newell, R. E., Massachusetts Inst. of Tech., USA; Journal of Geophysical Research; Dec. 20, 1997; ISSN 0148-0227; Volume 102, No. D23, pp. 28,385-28,404; In English; Sponsored in part by the Daikou Foundation

Report No.(s): Paper-97JD02085; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Measurements of NO, NO(y), O3, and CO were made during NASA's Global Tropospheric Experiment/Pacific Exploratory Mission-West B (GTE/PEM-West B) carried out over the western Pacific in February and March 1994. NO(x) was calculated from NO using a photostationary state model ((NO(x)(sub mc)). Correlations between these species are presented, and some insights into the sources of NO(x) and NO(y) are described. The boundaries between the lower, middle, and upper troposphere have been defined at potential temperatures of 311 K and 328 K, which correspond to the geometric altitudes of about 5 and 9 km at 30degN. Enhancements in the mixing ratios of NO(y) and CO were observed in the lower and middle troposphere. A positive correlation was found between these two species suggesting that the high NO(y) values were due to anthropogenic emissions over the continental surface. On the other hand, O3 increased little with increase in CO. As a result, NO(y)/O3 ratios were higher in air more influenced by pollution. NO(y), values in 55 and 28% of the air masses sampled in the lower and middle troposphere, respectively, were higher than the clean free tropospheric NO(y)-O3 range when O3 values simultaneously observed were used. High (NOx)mc/NOy ratios between 0.15 and 0.3 were found in the boundary layer with relatively low mixing ratios of CO and NOy during the three flights. These air masses were transported from a higher altitude (approximately 5 km) and a higher latitude (approximately 50degN) within a few days. The peroxyacetyl nitrate (PAN)/NO(y) ratios were generally high (approximately 0.4) in these air masses, and the thermal decomposition of PAN was a probable source of NO(x). In the middle troposphere the (NO(x))mc mixing ratio did not generally increase with NO(y) or CO, suggesting that the transport of air masses affected by anthropogenic emissions did not increase the NO(x) level significantly. In the upper troposphere, very minor effects from the continental surface sources were seen in the CO mixing ratio. by contrast, NO(y) values in 33% of the air masses were higher than those expected when stratospheric air intrusion is assumed to be a single source of NO(y) based on NO(y)-O3 correlation analyses. This result suggests significant free tropospheric NO(y) sources, namely exhaust from the aircraft and NO production by lightning activity. In fact, spikes in the (NO(x))(sub m)c mixing ratios were observed near the aircraft corridor south of Tokyo at an altitude of 10 km. These two free tropospheric NO(x) sources were considered to be important in determining the levels of the upper tropospheric NO(x) and NO(y) during PEM-West B.

Author

Atmospheric Composition; Nitrogen Oxides; Carbon Monoxide; Nitrogen; Nitrates; Atmospheric Chemistry

19990020985 California Inst. of Tech., Dept. of Environmental Engineering Science, Pasadena, CA USA

Characterization and Control of Organic Compounds Emitted from Air Pollution Sources ***Final Report***

Schauer, James J., California Inst. of Tech., USA; Kleeman, Mike J., California Inst. of Tech., USA; Cass, Glen R., California Inst. of Tech., USA; Simoneit, Bernd R. T., Oregon State Univ., USA; Apr. 1998; 332p; In English

Contract(s)/Grant(s): CARB-93-329

Report No.(s): PB99-118937; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

A dilution source sampling system is used to quantify the air pollutant emissions from major urban air pollution sources. The emissions from catalyst-equipped gasoline powered-motor vehicles, noncatalyst gasoline-powered motor vehicle, diesel trucks, meat charbroiling, the cooking of vegetables with seed oils, fireplace combustion of softwood and hardwood, cigarette combustion, and paint spray coating operations are characterized. Semi-volatile and particle-phase organic compounds in the diluted source emissions are collected simultaneously by both a traditional filter/PUF (polyurethane foam) sampling train and by an advanced organic compound-based denuder/filter/PUF sampling train to provide information on the gas/particle phase distribution of the semi-volatile organic compounds. Emission rates of hundreds of organic compounds, spanning carbon number from C1 to C29 are determined by gas chromatography/mass spectrometry and gas chromatography with flame ionization detection. Fine particle mass emission rates and fine particle elemental chemical composition are measured as well.

NTIS

Organic Compounds; Air Pollution; Chemical Composition; Particles

19990020986 California Univ., Davis, CA USA

Temporal, Spatial, and Ambient Temperature Effects in the Sacramento Modeling Region ***Final Report***

Rocke, David M., California Univ., USA; Chang, Daniel P. Y., California Univ., USA; May 1998; 200p; In English

Contract(s)/Grant(s): CARB-94-333

Report No.(s): PB99-118887; R-98/667; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The objective of this study is to identify and investigate important temporal and spatial variations in factors that affect emissions in the Sacramento modeling region, especially from non-road mobile sources and industrial surface coatings and related process solvents. In addition the project assesses the effect of ambient temperature on emissions from those sources. to accomplish the objective, this study develops spatial activity indicators and temporal activity profiles for the emission source categories included in the study. Specifically, a geographical information (GIS) based approach is developed to spatially allocate regional or county-level emissions to units such as grid cells used in photochemical air quality simulation models. Most temporal activity profiles developed in this study are based on the authors' surveys of emission source facilities in the study area. The temporal activity profiles can be used to scale the annual emission estimated by the ARB to determine monthly, weekly (day of the week), and hourly emissions. The effects of ambient temperature and weather on the source activities are estimated based on the data from the authors' surveys.

NTIS

Air Quality; Temporal Distribution; Environment Models; Air Pollution; Temperature Effects; Ambient Temperature; Spatial Distribution

19990020997 Southern Research Inst., Chapel Hill, NC USA

Greenhouse Gas (GHG) Mitigation Technology Performance: Activities of the GHG Technology Verification Center

Piccot, S. D., Southern Research Inst., USA; Kirchgessner, D. A., Environmental Protection Agency, USA; 1998; 14p; In English

Report No.(s): PB99-115578; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper describes the Greenhouse Gas (GHG) Technology Verification Center's mission, operational characteristics, and current activities in the natural gas industry, solid waste landfill industry, energy industries, and microelectronics industry. It also outlines the Center's future plans and gives results of a recent phosphoric acid fuel cell verification at two landflls in the U.S. It describes how technology vendors, developers, users, and others can utilize the Center's testing, analysis, and outreach activities and outlines the types of technologies planned for testing over the next 3 to 5 years.

NTIS

Air Pollution; Pollution Control; Greenhouse Effect; Phosphoric Acid Fuel Cells

19990021019 Washington Univ., Saint Louis, MO USA

SEMS: System for Environmental Monitoring and Sustainability ***Final Report, 1 Oct. 1997 - 30 Sep. 1998***

Arvidson, Raymond E., Washington Univ., USA; 1998; 5p; In English

Contract(s)/Grant(s): NAG5-6533; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The goal of this project was to establish a computational and data management system, SEMS, building on our existing system and MTPE-related research. We proposed that the new system would help support Washington University's efforts in environmental sustainability through use in: (a) Problem-based environmental curriculum for freshmen and sophomores funded by the Hewlett Foundation that integrates scientific, cultural, and policy perspectives to understand the dynamics of wetland degradation, deforestation, and desertification and that will develop policies for sustainable environments and economies; (b) Higher-level undergraduate and graduate courses focused on monitoring the environment and developing policies that will lead to sustainable environmental and economic conditions; and (c) Interdisciplinary research focused on the dynamics of the Missouri River system and development of policies that lead to sustainable environmental and economic floodplain conditions.

Derived from text

Education; Data Management; Environmental Monitoring; Deforestation; Degradation; Desertification; Mission to Planet Earth; Economic Factors

19990021058 NASA Goddard Space Flight Center, Greenbelt, MD USA

Urban Environment Initiative

Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference; May 1998, pp. 233-238; In English; Also announced as 19990021057; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Urban Environment Initiative (UEI), has been established as part of a Cooperative Agreement with the National Aeronautics and Space Administration (NASA). The UEI is part of NASA's overall High Performance Computing and Communications (HPCC) and the Information Infrastructure Technology Applications (IITA) programs. The goal of the UEI is to provide public

access to Earth Science information and promote its use with a focus on the environment of urban areas. This goal will be accomplished through collaborative efforts of the UEI team with both community-based and local/regional governmental organizations. The UEI team is comprised of four organizations representing private industry, NASA, and universities: Prime Technologies Service Corporation, NASA's Minority University Space Interdisciplinary Network (MU-SPIN) California State University, at Los Angeles, and Central State University (Wilberforce, OH). "Urban Environment" refers to the web of environmental, economic, and social factors that combine to create the urban world in which we live. Examples of these factors are population distribution, neighborhood demographic profiles, economic resources, business activities, location and concentration of environmental hazards and various pollutants, proximity and level of urban services, which form the basis of the urban environment and ultimately affect our lives and experiences. The use of Geographic Information Systems (GIS) and remote sensing allows data to be visualized in the forms of maps and spatial images. The use of these tools allow analysis of information about urban environments. Also included are descriptions of the four query types which will assist in understanding the maps.
Derived from text
Demography; Earth Sciences; Maps

46
GEOPHYSICS

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

19990019146 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Atmospheric Blocking in the Southern Hemisphere ***Bloqueio Atmosferico no Hemisferio Sul***
deFatimaCruzMarques, Rosa, Instituto Nacional de Pesquisas Espacias, Brazil; 1996; 182p; In Portuguese
Report No.(s): INPE-6742-TDI/632; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Atmospheric blocking in the Southern Hemisphere is studied using 14 years (1980-1993) of daily data. Results confirmed the three regions of blocking in winter, viz Pacific Ocean near New Zealand, Indian and Atlantic Oceans. A new region of blocking is found in the Southeast Pacific Ocean. All the preferred regions of blocking show large interannual variations. The interannual variations are large in the New Zealand region. It is found during the La Nino years the blocking frequency in the New Zealand region is more than double of that in El Nino years. The possible causes for this behaviour are explored. It is found that the jet split over New Zealand region is better defined and stronger during the La Nina years than in El Nino years. It is known that the jet split is favorable for formation of blocking highs. This explains why blocking frequency is higher during the La Nino years than in El Nino years. A case study of a long lasting blocking event which occurred in the Southeast Pacific Ocean is performed. The physical mechanisms which maintain this blocking event are explored calculating Eliassen-Palm flux and its local energetics. Transient barotropic disturbances decelerate the jet in the blocking region favoring the split jet character. The contribution of different (time) scales are calculated in maintenance of the energetics of the blocking situation. The interaction of intra-seasonal component with the high frequency component is noted to be very relevant. The role of baroclinic instability is also important.
Author
Atmospheric Effects; Southern Hemisphere; El Nino; Baroclinic Instability; Blocking

19990019275 NASA Langley Research Center, Hampton, VA USA
Atmospheric Layers Measured from the NASA DC-8 During PEM-West B and Comparison with PEM-West A
Wu, Zhongxiang, Massachusetts Inst. of Tech., USA; Newell, Reginald E., Massachusetts Inst. of Tech., USA; Zhu, Yong, Massachusetts Inst. of Tech., USA; Anderson, Bruce E., NASA Langley Research Center, USA; Browell, Edward V., NASA Langley Research Center, USA; Gregory, Gerald L., NASA Langley Research Center, USA; Sachse, Glen W., NASA Langley Research Center, USA; Collins, James E., Jr., Science and Technology Corp., USA; Journal of Geophysical Research; Dec. 20, 1997; ISSN 0148-0227; Volume 102, No. D23, pp. 28,353-28,365; In English
Contract(s)/Grant(s): NAG1-1252
Report No.(s): Paper 97JD01097; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

The Pacific Exploratory Mission-West B (PEM-West B) explored atmospheric layer structure using measurements of O3, H2O, CO, and CH4 from the NASA DC-8 fast-response instruments. The mission took place in February-March 1994 over the western Pacific, mainly in the northern hemisphere. Results were compared with similar measurements made during the Pacific Exploratory Mission-West A (PEM-West A) in September-October 1991. PEM-West B sampled 94 vertical profiles, with an average atmospheric depth per profile of 6.4 km, and this sampling yielded 254 discrete layers. PEM-West A sampled 105 profiles, also with a 6.4 km average depth, yielding 538 layers. Both missions revealed that layers containing high ozone and low water

vapor were the most abundant, and low ozone and high water vapor layers were the next most abundant. Lidar images and potential vorticity cross sections showed the former associated with subsidence from the stratosphere in middle latitudes, spreading into the tropics. The latter was associated with convection from the boundary layer. The partition among different types of layers only changed slightly in the two missions, although PEM-West B had half as many layers. Compared to PEM-West A, PEM-West B showed only one-third the number of layers associated with polluted continental air. However, PEM-West B revealed significantly more layers showing characteristics of descended clean marine air. In some cases these layers originated from the southern hemisphere. For ozone- and water-vapor-rich layers, the ozone deviation amplitude was higher in low latitudes and lower in high latitudes in PEM-West B. The mean thickness of layers increased from about 450 m in PEM-West A to 680 in in PEM-West B. Layers also existed in the Intertropical Convergence Zone. CO2 measurements had sufficient vertical resolution to show layer structure as well.
Author
Air Quality; Boundary Layers; Air Pollution; Atmospheric Stratification; Stratosphere; Northern Hemisphere; Ozone

19990019383 NASA Goddard Space Flight Center, Greenbelt, MD USA
Elementary Theoretical Forms for the Spatial Power Spectrum of Earth's Crustal Magnetic Field
Voorhies, C., NASA Goddard Space Flight Center, USA; Dec. 1998; 44p; In English
Contract(s)/Grant(s): RTOP 579-31-07; RTOP 579-31-08; RTOP 670-72-03
Report No.(s): NASA/TP-1998-208608; NAS 1.60:208608; Rept-99B00004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The magnetic field produced by magnetization in Earth's crust and lithosphere can be distinguished from the field produced by electric currents in Earth's core because the spatial magnetic power spectrum of the crustal field differs from that of the core field. Theoretical forms for the spectrum of the crustal field are derived by treating each magnetic domain in the crust as the point source of a dipole field. The geologic null-hypothesis that such moments are uncorrelated is used to obtain the magnetic spectrum expected from a randomly magnetized, or unstructured, spherical crust of negligible thickness. This simplest spectral form is modified to allow for uniform crustal thickness, ellipsoidality, and the polarization of domains by an periodically reversing, geocentric axial dipole field from Earth's core. Such spectra are intended to describe the background crustal field. Magnetic anomalies due to correlated magnetization within coherent geologic structures may well be superimposed upon this background; yet representing each such anomaly with a single point dipole may lead to similar spectral forms. Results from attempts to fit these forms to observational spectra, determined via spherical harmonic analysis of MAGSAT data, are summarized in terms of amplitude, source depth, and misfit. Each theoretical spectrum reduces to a source factor multiplied by the usual exponential function of spherical harmonic degree n due to geometric attenuation with attitude above the source layer. The source factors always vary with n and are approximately proportional to n(exp 3) for degrees 12 through 120. The theoretical spectra are therefore not directly proportional to an exponential function of spherical harmonic degree n. There is no radius at which these spectra are flat, level, or otherwise independent of n.
Author
Power Spectra; Earth Crust; Magnetization; Geomagnetism; Magnetic Domains; Magnetic Fields; Magnetic Dipoles

19990019472 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Detection of an ENSO Signal in Seasonal Length-of-Day Variations
Gross, Richard S., Jet Propulsion Lab., California Inst. of Tech., USA; Marcus, Steven L., Jet Propulsion Lab., California Inst. of Tech., USA; Eubanks, T. Marshall, Naval Observatory, USA; Dickey, Jean O., Jet Propulsion Lab., California Inst. of Tech., USA; Keppenne, Christian L., Jet Propulsion Lab., California Inst. of Tech., USA; Geophysical Research Letters; Nov. 15, 1996; ISSN 0094-8534; Volume 23, No. 23, pp. 3373-3376; In English
Report No.(s): Paper 96GL03260; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Conservation of angular momentum dictates that as the wind-driven axial atmospheric angular momentum changes, so will the length-of-day (LOD). In particular, as the strength of the seasonal zonal winds change, so should the strength of the seasonal LOD signals. Here, observed changes in the strengths of the annual and semiannual LOD signals during 1963-1991 are analyzed and shown to be both significantly correlated (at the 99% significance level) with the Southern Oscillation Index (SOI), and to exhibit trends of comparable magnitude but opposite signs. This reported correlation between the SOI and changes in the amplitude of the seasonal LOD signals demonstrates a linkage between seasonal LOD (and hence seasonal zonal wind) variability and the El Nino / Southern Oscillation (ENSO) phenomenon. Furthermore, this study suggests that observed variations in the ampli-

tudes of the seasonal LOD signals can be used to study changes in the strengths of the seasonal atmospheric zonal winds on interannual to decadal and longer time scales.
Author
Atmospheric Circulation; Linkages; Angular Momentum; Length; Daytime

19990019486 NASA Goddard Space Flight Center, Greenbelt, MD USA
Earth Probe Total Ozone Mapping Spectrometer (TOMS) Data Product User's Guide
McPeters, R., NASA Goddard Space Flight Center, USA; Bhartia, P. K., NASA Goddard Space Flight Center, USA; Krueger, A., NASA Goddard Space Flight Center, USA; Herman, J., NASA Goddard Space Flight Center, USA; Wellemeyer, C., Raytheon STX Corp., USA; Seftor, C., Raytheon STX Corp., USA; Jaross, G., Raytheon STX Corp., USA; Torres, O., Raytheon STX Corp., USA; Moy, L., Raytheon STX Corp., USA; Labow, G., Raytheon STX Corp., USA; Byerly, W., Raytheon STX Corp., USA; Taylor, S., Raytheon STX Corp., USA; Swissler, T., Raytheon STX Corp., USA; Cebula, R., Raytheon STX Corp., USA; November 1998; 72p; In English
Report No.(s): NASA/TP-1998-206895; Rept-98B00076; NAS 1.60:206895; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Two data products from the Earth Probe Total Ozone Mapping Spectrometer (EP/TOMS) have been archived at the Distributed Active Archive Center, in the form of Hierarchical Data Format files. The EP/ TOMS began taking measurements on July 15, 1996. The instrument measures backscattered Earth radiance and incoming solar irradiance; their ratio is used in ozone retrievals. Changes in the reflectivity of the solar diffuser used for the irradiance measurement are monitored using a carousel of three diffusers, each exposed to the degrading effects of solar irradiation at different rates. The algorithm to retrieve total column ozone compares measured Earth radiances at sets of three wavelengths with radiances calculated for different total ozone values. The initial error in the absolute scale for TOMS total ozone is 3 percent, the one standard deviation random error is 2 percent, and the drift is less than 0.5 percent over the first year of data. The Level-2 product contains the measured radiances, the derived total ozone amount, and reflectivity information for each scan position. The Level-3 product contains daily total ozone and reflectivity in a 1-degree latitude by 1.25 degrees longitude grid. Level-3 files containing estimates of LTVB at the Earth surface and tropospheric aerosol information are also available, Detailed descriptions of both HDF data-files and the CD-ROM product are provided.
Author
Total Ozone Mapping Spectrometer; Ozone; Reflectance; Light (Visible Radiation); Irradiation; Irradiance; Backscattering; Aerosols

19990019502 NASA Lewis Research Center, Cleveland, OH USA
COOP 3D ARPA Experiment 109 National Center for Atmospheric Research *Final Report*
1998; 26p; In English
Report No.(s): AD-A353849; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Coupled atmospheric and hydrodynamic forecast models were executed on the supercomputing resources of the National Center for Atmospheric Research (NCAR) in Boulder, Colorado and the Ohio Supercomputing Center (OSC)in Columbus, Ohio. respectively. The interoperation of the forecast models on these geographically diverse, high performance Cray platforms required the transfer of large three dimensional data sets at very high information rates. High capacity, terrestrial fiber optic transmission system technologies were integrated with those of an experimental high speed communications satellite in Geosynchronous Earth Orbit (GEO) to test the integration of the two systems. Operation over a spacecraft in GEO orbit required modification of the standard configuration of legacy data communications protocols to facilitate their ability to perform efficiently in the changing environment characteristic of a hybrid network. The success of this performance tuning enabled the use of such an architecture to facilitate high data rate, fiber optic quality data communications between high performance systems not accessible to standard terrestrial fiber transmission systems. Thus obviating the performance degradation often found in contemporary earth/satellite hybrids.
Author
Telecommunication; Data Transmission; Supercomputers; Fiber Optics; Communication Satellites

19990019572 National Inst. of Polar Research, Tokyo, Japan
JARE Data Reports No. 226 (Ionosphere 58). Radio Observation Data at Syowa Station, Antarctica during 1995
Inamori, Koji, Communications Research Lab., Japan; Ichinose, Masaru, Communications Research Lab., Japan; 1995; ISSN 0075-3343; 186p; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Communications Research Laboratory has been observing the absorption of cosmic radio noise with a standard rheometer (relative ionospheric opacity meter) at 30 MHz at Syowa Station, Antarctica since February 1966. This report presents the data

observed in January 1 through December 31, 1995. The combined data plots also contain geomagnetic field, HF, VLF, and radar observations for reference.
Derived from text
Cosmic Noise; Electromagnetic Noise; Antarctic Regions; Electromagnetic Absorption; Ionospherics

19990019629 NASA Marshall Space Flight Center, Huntsville, AL USA
Conjugate Observations of Optical Aurora with POLAR Satellite and Ground Based Imagers in Antarctica
Mende, S. H., NASA Marshall Space Flight Center, USA; Frey, H., NASA Marshall Space Flight Center, USA; Vo, H., NASA Marshall Space Flight Center, USA; Geller, S. P., NASA Marshall Space Flight Center, USA; Doolittle, J. H., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; AGU, 8-12 Dec. 1998, San Francisco, CA, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Operation of the ultraviolet imager on the POLAR satellite permits the observation of Aurora Borealis in daylight during northern summer. With optical imagers in the Automatic Geophysical Observatories (AGO-s) large regions of the oval of Aurora Australis can be observed simultaneously during the southern winter polar night. This opportunity permits conducting a systematic study of the properties of auroras on opposite ends of the same field line. It is expected that simultaneously observed conjugate auroras occurring on closed field lines should be similar to each other in appearance because of the close connection between the two hemispheres through particle scattering and mirroring processes. On open or greatly distorted field lines there is no a priori expectation of similarity between conjugate auroras. to investigate the influence of different IMF conditions on auroral behavior we have examined conjugate data for periods of southward IMF. Sudden brightening and subsequent poleward expansions are observed to occur simultaneously in both hemispheres. The POLAR data show that sudden brightening are initiated at various local time regions. When the local time of this region is in the field of view of the AGO station network then corresponding brightening is also found to occur in the southern hemisphere. Large features such as substorm induced westward propagation and resulting auroral brightening seem to occur simultaneously on conjugate hemispheres. The widely different view scales make it difficult to make unique identification of individual auroral forms in the POLAR and in the ground based data but in a general sense the data is consistent with conjugate behavior.
Author
Auroras; Satellite Observation; Imaging Techniques; Antarctic Regions; Data Acquisition; Ultraviolet Imagery

19990019754 Air Force Research Lab., Materials and Manufacturing Directorate, Tyndall AFB, FL USA
Atmospheric Chemistry of Oxygenated Organic Compounds ***Final Report, Oct. 1995 - Sep. 1998***
Wells, J. R.; Baxley, J. S.; Wyatt, S. E.; Markgraf, S. J.; Oct. 1998; 95p; In English
Report No.(s): AD-A356188; AFRL-ML-TY-TR-1998-4545; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The newly revised ozone and particulate matter regulations will impact decisions on chemical substitution and formulation selection for the Air Force and DoD. Removal of toxic organics and halogenated organics from formulations has been the primary method to meet these new regulatory burdens. However, the substitutes which consist mainly of oxygenated organic compounds (alcohol, aldehydes, ketones and acetates) have poorly understood environmental impacts. To bridge this knowledge gap, investigations into the atmospheric chemistry of this useful class of compounds has begun. New information presented in this report demonstrates the wide variety of rate constants and transformation mechanisms observed. It was also observed that certain molecular structures enhance hydroxyl radical reactions. This data is important for improving the air quality assessments of new substitutes and formulations and minimizing regulatory constraints.
DTIC
Atmospheric Chemistry; Toxic Hazards; Environment Effects; Organic Compounds; Air Quality; Ozone; Halogen Compounds; Oxygenation; Regulations; Substitutes

19990019891 NASA Marshall Space Flight Center, Huntsville, AL USA
A Study of Fixed-Order Mixed Norm Designs for a Benchmark Problem in Structural Control
Whorton, Mark S., NASA Marshall Space Flight Center, USA; Calise, Anthony J., NASA Marshall Space Flight Center, USA; Hsu, C. C., NASA Marshall Space Flight Center, USA; Earthquake Engineering and Structural Dynamics; 1998; ISSN 0098-8847; Volume 27, pp. 1315-1330; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This study investigates the use of H2, p-synthesis, and mixed H2/mu methods to construct full-order controllers and optimized controllers of fixed dimensions. The benchmark problem definition is first extended to include uncertainty within the controller bandwidth in the form of parametric uncertainty representative of uncertainty in the natural frequencies of the design model. The sensitivity of H2 design to unmodelled dynamics and parametric uncertainty is evaluated for a range of controller levels of authority. Next, mu-synthesis methods are applied to design full-order compensators that are robust to both unmodelled dynamics

and to parametric uncertainty. Finally, a set of mixed H2/mu compensators are designed which are optimized for a fixed compensator dimension. These mixed norm designs recover the H, design performance levels while providing the same levels of robust stability as the u designs. It is shown that designing with the mixed norm approach permits higher levels of controller authority for which the H, designs are destabilizing. The benchmark problem is that of an active tendon system. The controller designs are all based on the use of acceleration feedback.
Author
Controllers; Hydrogen; Bandwidth; Compensators

19990019894 Atmospheric and Environmental Research, Inc., Cambridge, MA USA
Transport Between the Tropical and Midlatitude Lower Stratosphere: Implications for Ozone Response to High Speed Civil Transport Emissions
Shia, R.-L., Atmospheric and Environmental Research, Inc., USA; Ko, M. K. W., Atmospheric and Environmental Research, Inc., USA; Weisenstein, D. K., Atmospheric and Environmental Research, Inc., USA; Scott, C., Atmospheric and Environmental Research, Inc., USA; Rodriquez, J., Atmospheric and Environmental Research, Inc., USA; Journal of Geophysical Research; Oct. 20, 1998; ISSN 0148-0227; Volume 103, No. D19, pp. 25,435-25,446; In English
Contract(s)/Grant(s): NAS5-32371; NAS5-97039
Report No.(s): Paper-98JD01882; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Several recent studies have quantified the air exchange rate between the tropics and midlatitudes in the lower stratosphere using airborne and satellite measurements of chemical species. It is found that the midlatitude air is mixed into the tropical lower stratosphere with a replacement timescale of 13.5 months (with 20% uncertainty) for the region from the tropopause to 21 km and at least 18 months for the region of 20-28 km. These estimates are used to adjust the horizontal eddy diffusion coefficients, K(sub yy), in a two-dimensional chemistry transport model. The value of K(sub yy) previously used to simulate the subtropical barrier, 0.03 x 10(exp 6)sq m/s, generates an exchange time of about 4 years, and the model without subtropical barrier (K(sub yy) = 0.3 x 10(exp 6)sq m/s) has an exchange time of 5 months. Adjusting the K(sub yy) to 0.13 x 10(exp 6) sq m/s from the tropopause to 21 km and 0.07 x 10(exp 6)sq m/s above 21 km produces the exchange timescales which match the estimates deduced from the measurements. The subtropical barrier prevents the engine emissions of the high-speed civil transport (HSCT) aircraft from being transported into the tropics and subsequently lifted into the upper atmosphere or mixed into the southern hemisphere. The model results show that the calculated ozone response to HSCT aircraft emissions using the K(sub yy), adjusted to observed mixing rates is substantially smaller than that simulated without the subtropical barrier.
Author
Exhaust Emission; Supersonic Transports; Tropical Regions; Transport Aircraft; Exhaust Gases; Temperate Regions; Combustion Products; Ozone; Stratosphere

19990021016 Iowa State Univ. of Science and Technology, Ames, IA USA
Dynamical Analysis of MLS and ISAMS Data from the Upper Atmosphere Research Satellite ***Final Report, 15 Nov. 1994 - 14 Nov. 1998***
Stanford, John L., Iowa State Univ. of Science and Technology, USA; 1998; 5p; In English
Contract(s)/Grant(s): NAG5-2787; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary goal of this project is to investigate two aspects of upper stratosphere and mesosphere circulation dynamics using data from the Upper Atmosphere Research Satellite's (UARS) Microwave Limb Sounder (MLS) and Improved Stratospheric and Mesospheric Sounder (ISAMS) instruments. The first aspect involves observational analyses and comparison with model predictions for the polar night "4-day wave". The second project focus is the distribution of carbon monoxide (CO) in the middle atmosphere and circulation features that can be deduced from analyses of such a tracer and comparison with atmospheric circulation models.
Derived from text
Upper Atmosphere Research Satellite (UARS); Microwave Landing Systems; Atmospheric Models; Stratosphere; Microwave Sounding

19990021029 San Francisco State Univ., Dept. of Meteorology, CA USA
Detection of Polar Stratospheric Clouds Using AVHRR Imagery
Garcia, Oswaldo, San Francisco State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In recent years, the role of PSCs in the ozone depletion process has become better understood. PSCs provide the surfaces upon which heterogeneous reactions take place that affect the gas phase partitioning between active and reservoir chlorine and nitrogen

species. Present methods of PSC detection include in situ measurements by lidar and various satellite-borne instruments such as the Stratospheric Aerosol Measurement II (SAM II) on the Nimbus 7 spacecraft, which produced PSC measurements from 1978 to 1994 and several instruments onboard the Upper Atmospheric Research Satellite (UARS) such as the Cryogenic Limb Array Etalon Spectrometer (CLAES) which provided measurements for 1991-1993. All of the PSC-detection methods devised so far have been hampered by incomplete sampling of the places and times in which PSCs are likely to form. There is a need to understand the climatology of PSCS, in particular the timing of their onset and duration, their vertical distribution, geographic extent, annual variability and responses to volcanic aerosol forcing. Poole and Pitts [1994] assembled a PSC climatology based on SAM II data, but this climatology is incomplete, as it is limited to the edge of the polar night due to the limitations of the solar occultation scan geometry. The Advanced Very High Resolution Radiometer (AVHRR) five- channel sensors onboard the NOAA polar-orbiting satellites have been collecting data over the polar regions continuously since 1979. These operational satellites provide unmatched coverage in space and time of both polar regions, but were not designed for the detection of optically-thin PSCS. However, the AVHRR data archive would be an invaluable source for the construction of a long-term climatology of PSCs if techniques can be developed and tested to detect PSCs in AVHRR data. In the last few years, the members of our group at San Francisco State University and NASA Ames Research Center have been engaged in the development of various PSC detection methods using AVHRR data. There is strong evidence that a subset of PSCS, those that are optically thick, can be readily identified in the AVHRR data set. Our group has also made significant progress in the identification of optically thinner PSCs using a variety of techniques.
Derived from text
Polar Meteorology; Polar Regions; Ice Clouds; Stratosphere; Procedures; Advanced Very High Resolution Radiometer; Data Acquisition

19990021054 Eckerd Coll., Dept. of Marine Sciences, Saint Petersburg, FL USA
Textural and Carbon Isotopic Analyses of Modern Carbonate Microbialites: Possible Ancient and Martian Analogs
Thompson, Joel B., Eckerd Coll., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Many modem and ancient carbonate deposits around the world have been recognized as microbial buildups or microbialites. Ancient microbialite structures have been divided into two basic categories based on their internal fabric or texture. They include stromatolites which have a predominantly laminated internal fabric and thrombolites which have an open-porous clotted fabric, that lacks laminae. The origin of these two basic microbial fabrics is still being debated in the literature. Understanding the origin and the various microorganisms involved in forming these modem fabrics is the key to the interpretation of similar fabrics in ancient and possibly Martian rocks. Therefore, detailed studies are needed on the microbiological makeup and origin of the fabrics in modem microbialites. Such studies may serve as analogs for ancient and Martian microbialites in the future. The purpose of this study is to examine the textures and carbon isotopic signatures of the following modem microbialites from the Bahamas: 1) a modem subtidal microbialite from Iguana Cay, Bahamas and 2) a modem microbial mat (stromatolite) from a hypersaline pond on Lee Stocking Island, Bahamas.
Author
Carbon; Isotopic Labeling; Carbonates; Laminates; Mars Surface; Microbiology; Microorganisms

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990019510 Wisconsin Univ., Madison, WI USA
Measurement of Mean Wind Profiles and Spatial Gradients of the Mean Wind with the Volume Imaging Lidar ***Final Report, 4 Feb. 1994 - 3 Feb. 1998***
Eloranta, Edwin W.; Feb. 1998; 50p; In English
Contract(s)/Grant(s): DAAH04-94-G-0022
Report No.(s): AD-A357793; ARO-30961.7-EV; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The University of Wisconsin Volume Imaging Lidar was modified to increase the laser repetition rate from 30 to 100 Hz and to increase the resolution and dynamic range of the recorded signals. The modified system was used to observe cold air flows over Lake Michigan during the winter. These data, analyzed with improved algorithms for measuring wind velocities from the motions

of aerosol inhomogeneities, have provided spatially resolved velocity, divergence and velocity maps with a spatial resolution of 250 meters covering areas of greater than 50 square kilometers.
DTIC
Optical Radar; Wind Velocity; Wind Measurement; Velocity Distribution; Spatial Resolution; Infrared Imagery

19990019516 Massachusetts Univ., Dept. of Electrical and Computer Engineering, Amherst, MA USA
Remote Sensing Turbulence in the Atmospheric Boundary Layer ***Final Report, 1 Jul. 1992 - 30 Jun. 1998***
McIntosh, Robert E.; Aug. 13, 1998; 16p; In English
Contract(s)/Grant(s): DAAL03-92-G-0110
Report No.(s): AD-A357864; ARO-30353.2-EV-URI; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes MIRSL's activities under the Department of Defense University Research Initiative (URI) to develop a radar remote sensing system that is able to measure atmospheric turbulence for ABL studies, including the verification of LES results. This radar, called the Turbulent Eddy Profiler (TEP) is capable of imaging the structure of turbulence throughout a conical volume that extends from the ground to the top of the ABL. Preliminary field measurements made at Duck, NC and Rock Springs, PA verified TEP's ability to resolve the three dimensional Cn2 and velocity fields at spatial and temporal scales comparable to LES communications. We observed agreement in qualitative and quantitative comparisons of the morphology and intermittence of small scale ABL structures.
DTIC
Turbulence; Turbulent Boundary Layer; Remote Sensing; Atmospheric Boundary Layer

19990019562 NASA Marshall Space Flight Center, Huntsville, AL USA
Assimilation of GOES-Derived Skin Temperature Tendencies into Mesoscale Models to Improve Forecasts of near Surface Air Temperature and Mixing Ratio
Lapenta, William M., NASA Marshall Space Flight Center, USA; McNider, Richard T., Alabama Univ., USA; Suggs, Ron, NASA Marshall Space Flight Center, USA; Jedlovec, Gary, NASA Marshall Space Flight Center, USA; Robertson, Franklin R., NASA Marshall Space Flight Center, USA; 1998; 2p; In English; 12th; Numerical Weather Prediction, 11-16 Jan. 1998, Phoenix, AZ, USA; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

A technique has been developed for assimilating GOES-FR skin temperature tendencies into the surface energy budget equation of a mesoscale model so that the simulated rate of temperature chance closely agrees with the satellite observations. A critical assumption of the technique is that the availability of moisture (either from the soil or vegetation) is the least known term in the model's surface energy budget. Therefore, the simulated latent heat flux, which is a function of surface moisture availability, is adjusted based upon differences between the modeled and satellite-observed skin temperature tendencies. An advantage of this technique is that satellite temperature tendencies are assimilated in an energetically consistent manner that avoids energy imbalances and surface stability problems that arise from direct assimilation of surface shelter temperatures. The fact that the rate of change of the satellite skin temperature is used rather than the absolute temperature means that sensor calibration is not as critical. An advantage of this technique for short-range forecasts (0-48 h) is that it does not require a complex land-surface formulation within the atmospheric model. As a result, the need to specify poorly known soil and vegetative characteristics is eliminated. The GOES assimilation technique has been incorporated into the PSU/NCAR MM5. Results will be presented to demonstrate the ability of the assimilation scheme to improve short- term (0-48h) simulations of near-surface air temperature and mixing ratio during the warm season for several selected cases which exhibit a variety of atmospheric and land-surface conditions. In addition, validation of terms in the simulated surface energy budget will be presented using in situ data collected at the Southern Great Plains (SGP) Cloud and Radiation Testbed (CART) site as part of the Atmospheric Radiation Measurements Program (ARM).
Author
Assimilation; Procedures; Simulation; Skin Temperature (Biology); Energy Budgets; Heat Flux; Surface Energy; Surface Temperature

19990019570 NASA Marshall Space Flight Center, Huntsville, AL USA
Assessment Regarding Impact of Atmospheric Conditions on Space Shuttle Launch Delays
Johnson D. L., NASA Marshall Space Flight Center, USA; Pearson, S. D., NASA Marshall Space Flight Center, USA; Vaughan, W. W., NASA Marshall Space Flight Center, USA; Batts, G. W., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The atmospheric environment definition has played a key role in the development and operation of the NASA Space Shuttle as it has in other NASA Space Vehicle Programs. The objective of any definition of natural environment design requirements for

a space vehicle development is to insure that the vehicle will perform safely and in a timely manner relative to the mission(s) for which the vehicle is being developed. The NASA Space Shuttle has enjoyed the longest tenure of any Space Vehicle from an operational standpoint. As such, it has provided a wealth of information on many engineering aspects of a Space Vehicle plus the influence of the atmosphere on operational endeavors. The atmospheric environment associated with the NASA Space Shuttle launches at the NASA Kennedy Space Center in Florida has been reviewed and studied over the entire NASA Space Shuttle flight history. The results of the analysis of atmospheric environment related launch delays relative to other sources of launch delays has been assessed. This paper will provide a summary of those conditions as well as mission analysis examples focused on atmospheric constraints for launch. Atmospheric conditions associated with NASA Space Shuttle launch delays will be presented to provide a reference as to the type conditions experienced which have mainly caused the delays.
Author
Spacecraft Launching; Delay; Meteorology; Assessments

19990019650 Pennsylvania State Univ., Dept. of Meteorology, University Park, PA USA
Boundary Layer Coherent Structures (MBL ARI)
Shirer, Hampton N.; Young, George S.; Jan. 1998; 6p; In English
Contract(s)/Grant(s): N00014-93-1-0252
Report No.(s): AD-A356272; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

It is well known that a substantial portion of the air/sea fluxes of heat, moisture, and momentum is accomplished via intermittent processes (Khalsa and Greenhut 1985), processes that are poorly understood at the present time. Recently, Mahrt (1989) and Sikora and Young (1993) have demonstrated that coherent structures in the marine boundary layer (MBL) are responsible for this flux intermittency. These coherent structure types include such secondary circulations as two-dimensional rolls (cloud streets), three-dimensional convective cells (thermals), and shear-driven eddies (billows) (Brown 1980). These features occur in different atmospheric boundary-layer thermal stratification and shear regimes; some are forced primarily by thermodynamic, and others by dynamic, mechanisms. Our ultimate goal is to determine the mechanisms underlying the intermittency in air/sea fluxes produced by these coherent structure types. As summarized below, we are using a variety of complementary statistical/mathematical approaches to objectively identify the spatial and temporal characteristics of these structures. Our primary data sources include both the high resolution output produced by the Penn State version of Moeng's Large-Eddy Simulation (LES) code (e.g. Schumann and Moeng 1991) and observations from the MBL ARI experiments performed in 1995 off the California coast.
DTIC
Air Water Interactions; Marine Meteorology; Atmospheric Boundary Layer; Coasts; Large Eddy Simulation

19990019654 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Comparative Analysis of Total Lighting Observations and Cloud-to-Cloud Lighting Observations in the Southeastern USA Region
Hugo, Keith M.; Oct. 27, 1998; 97p; In English
Report No.(s): AD-A356212; AFIT-98-103; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

A comparison was performed employing lightning data collected by the Optical Transient Detector (OTD) satellite and the National Lightning Detection Network (NLDN). The feasibility of using total lightning flash data, both intracloud (IC) and cloud-to-ground (CG), collected from the OTD satellite in conjunction with CG lightning flashes detected by the NLDN was demonstrated. The IC and CG lightning flashes were determined for the period from 1 August 1995 to 31 July 1996. The percentage positive, mean negative multiplicity, positive mean peak current, and negative mean peak current of the CG lightning was determined and compared to the IC lightning.
DTIC
Lightning; Clouds (Meteorology); Satellite Observation; Optical Measuring Instruments

19990021112 Desert Research Inst., Atmospheric Sciences Center, Reno, NV USA
Analytical Tools for Cloudscope Ice Measurement ***Final Report, 1 Jan. 1997 - 31 Dec. 1998***
Arnott, W. Patrick, Desert Research Inst., USA; December 1998; 25p; In English
Contract(s)/Grant(s): NAG2-1104; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The cloudscope is a ground or aircraft instrument for viewing ice crystals impacted on a sapphire window. It is essentially a simple optical microscope with an attached compact CCD video camera whose output is recorded on a Hi-8 mm video cassette recorder equipped with digital time and date recording capability. In aircraft operation the window is at a stagnation point of the flow so adiabatic compression heats the window to sublimate the ice crystals so that later impacting crystals can be imaged as well. A film heater is used for ground based operation to provide sublimation, and it can also be used to provide extra heat for aircraft

operation. The compact video camera can be focused manually by the operator, and a beam splitter - miniature bulb combination provide illumination for night operation. Several shutter speeds are available to accommodate daytime illumination conditions by direct sunlight. The video images can be directly used to qualitatively assess the crystal content of cirrus clouds and contrails. Quantitative size spectra are obtained with the tools described in this report. Selected portions of the video images are digitized using a PCI bus frame grabber to form a short movie segment or stack using NIH (National Institute of Health) Image software with custom macros developed at DRI. The stack can be Fourier transform filtered with custom, easy to design filters to reduce most objectionable video artifacts. Particle quantification of each slice of the stack is performed using digital image analysis. Data recorded for each particle include particle number and centroid, frame number in the stack, particle area, perimeter, equivalent ellipse maximum and minimum radii, ellipse angle, and pixel number. Each valid particle in the stack is stamped with a unique number. This output can be used to obtain a semiquantitative appreciation of the crystal content. The particle information becomes the raw input for a subsequent program (FORTRAN) that synthesizes each slice and separates the new from the sublimating particles. The new particle information is used to generate quantitative particle concentration, area, and mass size spectra along with total concentration, solar extinction coefficient, and ice water content. This program directly creates output in html format for viewing with a web browser.
Author
Ice; Cirrus Clouds; Adiabatic Conditions; Contrails; Crystals; Fourier Transformation; Image Analysis; Mass Spectra; Moisture Content; Particle Mass; Stagnation Point

19990021113 NASA Goddard Space Flight Center, Greenbelt, MD USA
TRMM Validation During the Texas and Florida Underflights Experiment (TEFLUN): Experiment Design and Preliminary Results
Heymsfield, Gerald M., NASA Goddard Space Flight Center, USA; Zipser, E. J., Texas A&M Univ., USA; 1998; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The TExas and FLorida UNderflights Experiment (TEFLUN) was a mission to obtain validation measurements for the Tropical Rain Measuring Mission (TRMM). TEFLUN is the first in a series of experiments using a combination of airborne and surface-based measurements to complement the satellite data. The DC-8 and ER-2 aircraft provide remotely sensed measurements, similar to those on the TRMM satellite. They are used for direct comparisons with TRMM where possible, but more frequently to simulate the TRMM data by flying over precipitation systems within experimental domain. Along with cloud physics data from an additional aircraft, surface-based measurements and computer models, the data sets collected will make unique contributions to our understanding of the low latitude precipitation spectrum. The overarching scientific objective of TEFLUN is to obtain a database suitable for case studies of a few MCSs, early in the TRMM lifetime, from which cloud resolving models and forward radiative transfer models can be used to understand and improve the performance of the satellite and TRMM Ground Validation (GV) algorithms. The NASA ER-2 and DC-8 aircraft provide important remotely sensed measurements which provide similar, but higher resolution measurements than the TRMM radar and radiometer measurements. TEFLUN-A was focused on the TRMM Texas GV site, while TEFLUN-B was focused on the Florida TRMM GV site.
Author
Experiment Design; Tropical Regions; Rain; Airborne Equipment; Remote Sensing; Texas; Florida; Observation

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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.

19990019117 Columbia Univ., Lamont-Doherty Earth Observatory, Palisades, NY USA
Experimental and Theoretical Studies of Near-Bottom Sediments to Determine Geoacoustic and Geotechnical Properties *Final Report*
Stoll, R. D., Columbia Univ., USA; Flood, R., State Univ. of New York, USA; Bautista, E. O., Columbia Univ., USA; Dec. 14, 1998; 5p; In English
Contract(s)/Grant(s): N00014-93-1-6003
Report No.(s): AD-A357703; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In a program designed to develop methods for predicting and measuring certain geoacoustic and geotechnical properties of the sediments immediately beneath the sea floor, several new tools were developed to measure in situ properties such as undrained shear strength, shear wave velocity and angle of internal friction. These tools include a motorized penetrometer designed to mea-

sure quasi static cone penetration resistance up to depths of two meters into the bottom, a Love wave source and linear receiving array to measure shear wave velocity, and a 22-caliber source and array designed to generate Scholte waves with higher dominant frequency than conventional airgun sources. Using data obtained with this equipment as well as from other CBBL investigators, dynamic shear moduli derived from measurements of shear wave velocity were correlated with cone penetration resistance and the results were found to be consistent with results obtained by geotechnical engineers for many different clay soils. This result suggests that their regression equation may also be used for marine sediments of the type tested in the current program. In addition to the above work, the Biot-Stoll model was used to establish a baseline geoacoustic model for the soft, gassy soils of Eckernfoerde Bay which constitutes the starting point for studies of the perturbing effects of free gas bubbles and other scatterers in the sediment. DTIC

Sediments; Geotechnical Engineering; Acoustics

19990019143 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Numerical Analysis of the Sea State Bias for Satellite Altimetry

Glazman, R. E., Jet Propulsion Lab., California Inst. of Tech., USA; Fabrikant, A., Pennsylvania State Univ., USA; Srokosz, M. A., Chilworth Research Centre, UK; Journal of Geophysical Research; Feb. 15, 1996; ISSN 0148-0227; Volume 101, No. C2, pp. 3789-3799; In English

Report No.(s): Paper 95JC03619; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Theoretical understanding of the dependence of sea state bias (SSB) on wind wave conditions has been achieved only for the case of a unidirectional wind-driven sea. Recent analysis of Geosat and TOPEX altimeter data showed that additional factors, such as swell, ocean currents, and complex directional properties of realistic wave fields, may influence SSB behavior. Here we investigate effects of two-dimensional multimodal wave spectra using a numerical model of radar reflection from a random, non-Gaussian surface. A recently proposed ocean wave spectrum is employed to describe sea surface statistics. The following findings appear to be of particular interest: (1) Sea swell has an appreciable effect in reducing the SSB coefficient compared with the pure wind sea case but has less effect on the actual SSB owing to the corresponding increase in significant wave height. (2) Hidden multimodal structure (the two-dimensional wavenumber spectrum contains separate peaks, for swell and wind seas, while the frequency spectrum looks unimodal) results in an appreciable change of SSB. (3) For unimodal, purely wind-driven seas, the influence of the angular spectral width is relatively unimportant; that is, a unidirectional sea provides a good qualitative model for SSB if the swell is absent. (4) The pseudo wave age is generally much better fo parametrization the SSB coefficient than the actual wave age (which is ill-defined for a multimodal sea) or wind speed. (5) SSB can be as high as 5% of the significant wave height, which is significantly greater than predicted by present empirical model functions tuned on global data sets. (6) Parameterization of SSB in terms of wind speed is likely to lead to errors due to the dependence on the (in practice, unknown) fetch.
Author

Mathematical Models; Numerical Analysis; Sea States; Satellite Altimetry; Wind Velocity; Parameterization

19990019495 Jet Propulsion Lab., California Inst. of Tech., Center for Space Microelectronics Technology, Pasadena, CA USA

A Laboratory Study of the Effect of Frost Flowers on C Band Radar Backscatter from Sea Ice

Nghiem, S. V., Jet Propulsion Lab., California Inst. of Tech., USA; Martin, S., Washington Univ., USA; Perovich, D. K., Army Cold Regions Research and Engineering Lab., USA; Kwok, R., Jet Propulsion Lab., California Inst. of Tech., USA; Drucker, R., Washington Univ., USA; Gow, A. J., Army Cold Regions Research and Engineering Lab., USA; Journal of Geophysical Research; Feb. 15, 1997; ISSN 0148-0227; Volume 102, No. C2, pp. 3357-3370; In English

Contract(s)/Grant(s): N00014-90-J-0161; N00014-95-MP-3002; N00014-95-MP-3019

Report No.(s): Paper 96JC03208; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

C band images of Arctic sea ice taken by the ERS 1 synthetic aperture radar show transitory regions of enhanced radar backscatter from young sea ice. Published field observations associate this increase with frost flower growth and the capture of blowing snow by the flowers. to investigate the first part of this phenomenon, we carried out a laboratory experiment on the response of C band radar backscatter to frost flowers growing on the surface of newly formed saline ice. The experiment took place in a 5 m by 7 m by 1.2 m deep saline water pool located in a two-story indoor refrigerated facility at the Cold Regions Research and Engineering Laboratory. Sodium chloride ice was grown in this pool at an air temperature of -28 C. The frost flowers first appeared on the ice surface as dendrites and then changed to needles as the ice sheet grew thicker and the surface temperatures became colder. The frost flowers reached to a height of 10-15 mm, and beneath each cluster of frost flowers a slush layer formed to a thickness of approximately 4 mm. Far-field radar measurements of the backscatter from the ice were made at incident angles from 20 C to 40 C and at approximately 6-hour intervals throughout the 3-day period of the experiment. A backscatter minimum occurred early in the flower growth at the time coincident with an abrupt doubling in the ice surface salinity. Once the full flower coverage was achieved, we removed first the crystal flowers and then the slush layer from the ice surface. The results for these cases show

that the crystals have little impact on the backscatter, while the underlying slush patches yield a backscatter increase of 3-5 dB over that o f bare ice. The laboratory results suggest that this relative backscatter increase of approximately 5 dB can be used as an index to mark the full areal coverage of frost flowers.
Author
Experimentation; Laboratories; Frost; C Band; Backscattering; Ice; Image Resolution

19990021023 Pennsylvania State Univ., Dept. of Geosciences, University Park, PA USA
Shallow Remineralization in the Sargasso Sea Estimated from Seasonal Variations in Oxygen and Dissolved Inorganic Carbon
Ono, S., Pennsylvania State Univ., USA; Ennyu, A., Pennsylvania State Univ., USA; Najjar, R. G., Pennsylvania State Univ., USA; Bates, N., Bermuda Biological Station for Research, Inc., Bermuda; Oct. 16, 1998; 38p; In English; Supported in part by YKK Corp., Yoshida Scholarship Foundation
Contract(s)/Grant(s): NAG5-6451; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A diagnostic model of the mean annual cycles of dissolved inorganic carbon (DIC) and oxygen below the mixed layer at the Bermuda Atlantic Time-series Study (BATS) site is presented and used to estimate organic carbon remineralization in the seasonal thermocline. The model includes lateral and vertical advection as well as vertical, diffusion. Very good agreement is found for the remineralization estimates based on oxygen and DIC. Net remineralization averaged from mid-spring to early fall is found to be a maximum between 120 and 140 in. Remineralization integrated between 100 (the compensation depth) and 250 m during this period is estimated to be about 1 mol C/sq m. This flux is consistent with independent estimates of the loss of particulate and dissolved organic carbon.
Author
Annual Variations; Carbon; Particulates; Sargasso Sea; Diffusion; Advection

51
LIFE SCIENCES (GENERAL)

19990019291 Queens Univ., Advisory Research Committee, Kingston, Ontario Canada
Modeling the C Economy of Anabaena Flos-Aquae
Turpin, David H., Queens Univ., Canada; Layzell, David B., Queens Univ., Canada; Elrifi, Ivor R., Queens Univ., Canada; Plant Physiology; 1985; ISSN 0032-0889; Volume 78, pp. 746-752; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Steady state cultures of Anabaenaflos-aquae were established over a wide range of phosphate-limited growth rates while N was supplied as either NH3, NO3(-), or N2 gas. At growth rates greater than 0.03 per hour, rates of gross and net carbon fixation were similar on all N sources. However, at lower growth rates (less than 0.03 per hour) in the NO3(-) and N2 cultures, gross photosynthesis greatly exceeded net photosynthesis. The increase in photosynthetic O2 evolution with growth rate was greatest when N requirements were met by NO3(-) and least when met by NH3. These results were combined with previously reported measurements of cellular chemical composition, N assimilation, and acetylene reduction to construct empirical models of carbon and energy flow for cultures grown at 30, 60, and 100% of their maximal growth rate on all N sources. The models suggested that over this growth range, 89 to 100% of photodriven electrons were allocated to biomass production in the NH3 cells, whereas only 49 to 74% and 54 to 90% were partitioned to biomass in the NO3(-)- and N2-grown cells, respectively. The models were used to estimate the relative contribution of active, maintenance, and establishment costs associated with NO3(-) and N2 assimilation over the entire range of growth rates. The models showed that the relative contribution of the component costs of N assimilation were growth rate dependent. At higher growth rates, the major costs for NO3(-) assimilation were the active costs, while in N2-fixing cultures the major energetic requirements were those associated with heterocyst establishment and maintenance. It was concluded that compared with NO3(-) assimilation, N2 fixation was energetically unfavorable due to the costs of heterocyst establishment and maintenance, rather than the active costs of N2 assimilation.
Author
Nitrogen Compounds; Chemical Composition; Costs; Anabaena; Estimating; Nitrogen; Photosynthesis; Phosphates; Biochemistry

19990019297 Cornell Univ., Dept. of Mathematics, Ithaca, NY USA

Spatial Aspects of Interspecific Competition

Durrett, Rick, Cornell Univ., USA; Levin, Simon, Princeton Univ., USA; Theoretical Population Biology; Feb. 1998; ISSN 0040-5809; Volume 53, No. 1, pp. 30-43; In English

Contract(s)/Grant(s): N00014-92-J-1527; NAG5-6422; NSF DMS-93-01070; NSF BIR-94-23339; NAGw-4688; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Using several variants of a stochastic spatial model introduced by Silvertown et al., we investigate the effect of spatial distribution of individuals on the outcome of competition. First, we prove rigorously that if one species has a competitive advantage over each of the others, then eventually it takes over all the sites in the system. Second, we examine tradeoffs between competition and dispersal distance in a two-species system. Third, we consider a cyclic competitive relationship between three types. In this case, a nonspatial treatment leads to densities that follow neutrally stable cycles or even unstable spiral solutions, while a spatial model yields a stationary distribution with an interesting spatial structure.

Author

Spatial Distribution; Competition; Stability; Mathematical Models; Stochastic Processes

19990019801 Colorado Univ., BioServe Space Technologies, Boulder, CO USA

A Review of Plant Experiments Supported by the Astro/Plant Generic Bioprocessing Apparatus on MSL-1

Heyenga, A. G., Colorado Univ., USA; Stodieck, Louis S., Colorado Univ., USA; Hoehn, A., Colorado Univ., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 2-7; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The utilization of plant-based materials in modern human society is extensive and of considerable commercial value including the production of food, pharmaceutical, lumber, and paper products. The advent of space flight research and the means to cultivate plants in the near absence of gravity have provided a unique opportunity to expand our understanding of plant physiology, metabolism, and genetics and to develop new approaches to further utilize this resource. An area of specific commercial interest encompasses the prospect that microgravity may be used to alter and help elucidate the control mechanisms of certain plant metabolic pathways enabling the further genetic engineering and cultivation of plants with desired traits on Earth. Particular attention is being directed towards the study of the cell structural compound lignin. A potential decrease in the production of such a compound could result in a corresponding increase in the production of metabolically related compounds including lignans and neolignans that are of significant medicinal value. An alteration in metabolic flux may equally extend to an enhancement in the production of compounds arising from the valuable alkaloid and terpene pathways. Additional areas in which the absence of gravity may influence plant metabolism include the production and distribution of plant growth control factors such as auxins and in the production of ligand molecules involved in the recognition system of plant symbiotic associations with microorganisms. The latter process is of significant value to agriculture in such areas as nitrogen fixation. The implementation of the MSL-1 plant study conducted on the Shuttle mission STS-94 was directed towards establishing an initial experimental baseline in plant response and applying investigative techniques that include the use of radioisotopes and molecular markers. A number of plant species were cultivated for 16 days in the Astro/Plant Generic Bioprocessing Apparatus (Astro/PGBA) under defined environmental conditions. The principle areas of investigation involved an examination of (a) lignin and vinca alkaloid metabolism, (b) the response of an auxin inducible GH3 gene, and (c) the interactive association of wheat with Rhizobium bacteria.

Author

Radioactive Isotopes; Plants (Botany); Nitrogenation; Pharmacology; Genetic Engineering; Vegetation Growth; Microgravity; Genetics

19990020846 Toronto Univ., Dept. of Geology, Ontario Canada

Bacterial Mineral Precipitation and the Making of Microfossils

Ferris, F. G., Toronto Univ., Canada; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 12-13; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

An important prerequisite for the precipitation of minerals from aqueous solutions, even where bacteria are involved, is that a moderate degree of oversaturation must be achieved. This requirement is imposed thermodynamically by an activation energy barrier that constrains the spontaneous formation of insoluble precipitates from solution. Bacteria intervene in mineral precipitation reactions in two ways, either directly as catalysts of aqueous geochemical reactions or indirectly as chemically reactive solids. In the first case, bacterial metabolic activity is often significant and can trigger changes in solution chemistry that lead to oversaturation (e.g., through the production of reactive ligands like sulfide). This alone can induce mineral formation by lowering the activation energy barrier for homogenous (precipitation in solution) and heterogeneous (surface precipitation on foreign solids)

nucleation reactions. The second case relates to the presence of reactive amphoteric sites on bacterial cells that facilitate sorption of dissolved mineral-forming elements, and foster heterogeneous surface precipitation reactions. Thus, minerals precipitated directly from solution as a result of bacterial metabolic activity can form on the inside, outside, or even some distance away from cells. Indirect chemical precipitation as a consequence of changing geochemical conditions is also possible and is accompanied by passive epicellular nucleation and crystal growth on the outside of living or dead bacterial cells, this is the most likely pathway leading toward preservation of structurally intact microfossils. In natural systems, however, direct and indirect bacterial mineral precipitation reactions may occur at the same time and are difficult to recognize as entirely separate processes. When bacteria are metabolically involved in mineral formation, biogenecity can sometimes be inferred from chemical (e.g., stable isotope) or mineralogical (e.g., magnetite produced by magnetotactic bacteria) data. On the other hand, microscopic techniques are useful in the assessment of cell-surface-mediated mineral precipitation providing that diligence is exercised to unequivocally establish the composite nature (i.e., mineralogical and bacterial) of the specimen.
Author
Bacteria; Chemical Reactions; Geochemistry; Microorganisms; Mineralogy; Fossils; Paleobiology

19990020849 Granada Univ., Facultad de Ciencias, Spain
Biomimetic but Abiotic Carbonates: New Geochemical Markers for Primitive Environments
Garcia-Ruiz, J. M., Granada Univ., Spain; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 16-17; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The unambiguous detection of ancient life is a crucial necessity in assessing the timing of life on Earth. Today, the strategy to reveal features of past life forms is also of utmost importance in seeking out living beings on other planets. Among other very few biomarkers used today (stromatolite structures, autigenic minerals, biological degradation compounds, and isotopic analysis), morphological recognition of living forms still plays a critical role in Precambrian micropaleontological studies. The underlying principle supporting life detection using morphological and textural tools derived from the old idea that inorganic precipitates are unable to produce neither shapes displaying certain symmetry groups nor certain bizarre textural arrangements. In this frame of mind, there is a substantial morphological difference between the inanimate and the animate worlds: it was thought that certain complex shapes with noncrystallographic symmetry were characteristic of life and would be impossible to obtain by inorganic precipitation. The most recent and conspicuous application of this ”law” is the fossillike microstructures found in ALH-84001.
Author
Exobiology; Carbonates; SNC Meteorites; Extraterrestrial Life; Biogeochemistry

19990020856 Harvard Univ., Botanical Museum, Cambridge, MA USA
The Signature of Life: Is it Legible?
Knoll, A. H., Harvard Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998; 2p; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Everyday experience suggests that the gulf between biology and the physical world is conspicuous. This impression arises, however, because the biology most familiar to us is largely that of organisms found on distal branches of the tree of life. The difficulty in distinguishing biogenic from abiogenic forms lies at the other end of the tree; life arose as the self-perpetuating product of physical processes, and it is likely that the characteristics of Earth’s earliest organisms - their size, shape, molecular composition, and catalytic properties - bore a close resemblance to products of the physical processes that gave rise to life.
Author
Chemical Composition; Organisms; Mars Environment; Mars Surface; Extraterrestrial Life; Microorganisms

19990020857 Institute of Space Research, Moscow, USSR
Martian Biogenic Activity: Looking for Viruses and DNA Traces Instead of Extant Bacteria Traces
Ksanfomality, L. V., Institute of Space Research, USSR; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 26; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

A current program of investigations of organic components in ALH 84001 meteorite findings includes a study of the polyaromatic hydrocarbons traces, C-isotopic analysis, a search for amino-acid traces, O-isotopic analysis, etc. All of these studies are based on a hypothesis about a presence of martian prehistoric primitive life traces in the SNC meteorite from Mars. The hypothesis is based on the contemporary existing notions of the origin of life that originated in natural fashion, through numberless chemical reactions, which were highly probable under the conditions of young Earth. There are a number of proofs that these same condi-

tions occurred early in martian history, which means life could have originated on Mars as well. The only known terrestrial life form is amino-nucleic-acid life that uses nucleic acids as an information system. Primitive life forms include both microbes and viruses. It is known that viruses are able to withstand much more severe conditions than bacteria. Their inactive forms may survive for a long time until favorable conditions occur again. Thus, it could make sense to look for viruses or even DNA traces both in the body of the ALH84001 meteorite and on Mars in future space missions.
Author
Amino Acids; Deoxyribonucleic Acid; Mars (Planet); SNC Meteorites; Viruses; Extraterrestrial Life; Exobiology; Planetary Environments

19990020862 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Principal Component Analysis for Biosignature Detection in Extraterrestrial Samples
McDonald, G. D., Jet Propulsion Lab., California Inst. of Tech., USA; Storrie-Lombardi, M. C., Jet Propulsion Lab., California Inst. of Tech., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 30-31; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Analysis of extraterrestrial samples for organic signatures of past or present life presents several problems. Chief among these is distinguishing bonafide extraterrestrial organic material from terrestrial contamination, either carried on a spacecraft or present in the terrestrial environment to which the sample is exposed. A related problem is separating biologically derived molecules from those produced by abiotic syntheses in the interstellar medium, on meteorite parent bodies, or in planetary atmospheres and oceans.
Author
Meteorites; Organic Materials; Principal Components Analysis; Signatures; SNC Meteorites; Extraterrestrial Life; Exobiology

19990020867 Stanford Univ., Dept. of Geological and Environmental Sciences, Stanford, CA USA
Recognizing Life and its Evolution Through Biomarkers
Moldowan, J. M., Stanford Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 37-38; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Biomarkers are molecular fossils found in sedimentary rocks and petroleum. Like fossils, they are recognized as remnants of enzyme-mediated biosynthesis dictated by genetic code. They cannot be confused with abiogenic molecules. because they are produced in abundances that far exceed their relative chemical stabilities.
Author
Biosynthesis; Fossils; Paleobiology; Microorganisms

19990020868 NASA Johnson Space Center, Houston, TX USA
Possible Microfossils (Warrawoona Group, Towers Formation, Australia, approximately 3.3 - 3.5 Ga)
Morris, P. A., Houston Univ., USA; Wentworth, S. J., Lockheed Martin Corp., USA; Allen, C. C., Lockheed Martin Corp., USA; McKay, D. S., NASA Johnson Space Center, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 38-39; In English; Also announced as 19990020835
Contract(s)/Grant(s): NAG9-980; NAG9-867; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Early in the twentieth century there were reports of Archean stromatolite-like structures that were similar to organic rich stromatolites from the base of the Cambrian (600 m.y.). It was not until the latter half of this century that fossilized Archean-age (3.9-2.5 Ga) life forms were found in the Fig Tree Formation of South Africa and the Towers Formation of Australia. Some of the ancient stromatolites contained streaks and clots of kerogen, pyrite grains, remnants of microbial cells, and filaments that represented various stages of preservation, while others appeared to lack fossils. A set of physical criteria was established for evaluating the biogenicity of these Archean discoveries: (1) rocks of unquestionable Archean age; (2) microfossils indigenous to Archean sediments; and (3) microfossils occurring in clasts that are syngenetic with deposition of the sedimentary unit. In the case of bedded cherts, the fossils should predate the cherts; (4) the microfossils are biogenic; and (5) replicate sampling of the fossil-iferous outcrop firmly demonstrates the provenance of these microfossils. Sample 002 from the Precambrian Paleobiology Research Group (PPRG) was examined. This stromatolitic carbonaceous chert contains microbial remains that meet the established criteria

[10]. Using a scanning electron microscope (SEM), we have analyzed the morphologies and chemistry of these possible microbial remains.
Author
Microorganisms; Paleobiology; Precambrian Period; Rocks

19990020871 Lockheed Martin Corp., Houston, TX USA
Reconnaissance Sampling of Airborne Molecular Organic Contamination in the Meteorite Curation Facility of Johnson Space Center
Schilling, E. A., Lockheed Martin Corp., USA; Schneider, M. N., Lockheed Martin Corp., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 40-42; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Determining the extent of contamination of meteorites by terrestrial organic compounds has become a question of critical importance in the last several years. Contamination issues have been considered in the past and recognized as important, resulting in a good deal of study. However, more thoroughly understanding organic contamination issues is especially pressing when considering possible evidence of previous life on Mars and in future Mars sample-return missions.
Author
Contamination; Extraterrestrial Life; Mars (Planet); Mars Sample Return Missions; Meteorites; Organic Compounds; Exobiology; SNC Meteorites

19990020879 NASA Johnson Space Center, Houston, TX USA
Mineralization of Bacteria in Terrestrial Basaltic Rocks: Comparison With Possible Biogenic Features in Martian Meteorite Allan Hills 84001
Thomas-Keprta, K. L., Lockheed Martin Corp., USA; McKay, D. S., NASA Johnson Space Center, USA; Wentworth, S. J., Lockheed Martin Corp., USA; Stevens, T. O., Battelle Pacific Northwest Labs., USA; Taunton, A. E., Arkansas Univ., USA; Allen, C. C., Lockheed Martin Corp., USA; Gibson, E. K., Jr., NASA Johnson Space Center, USA; Romanek, C. S., Savannah River Ecology Lab., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 53-54; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The identification of biogenic features altered by diagenesis or mineralization is important in determining whether specific features in terrestrial rocks and in meteorites may have a biogenic origin. Unfortunately, few studies have addressed the formation of biogenic features in igneous rocks, which may be important to these phenomena, including the controversy over possible biogenic features in basaltic martian meteorite ALH84001. to explore the presence of biogenic features in igneous rocks, we examined microcosms growing in basaltic small-scale experimental growth chambers or microcosms. Microbial communities were harvested from aquifers of the Columbia River Basalt (CRB) group and grown in a microcosm containing unweathered basalt chips and groundwater (technique described in. These microcosms simulated natural growth conditions in the deep subsurface of the CRB, which should be a good terrestrial analog for any putative martian subsurface ecosystem that may have once included ALH84001. Here we present new size measurements and photomicrographs comparing the putative martian fossils to biogenic material in the CRB microcosms. The range of size and shapes of the biogenic features on the CRB microcosm chips overlaps with and is similar to those on ALH84001 chips. Although this present work does not provide evidence for the biogenicity of ALH84001 features, we believe that, based on criteria of size, shape, and general morphology, a biogenic interpretation for the ALH84001 features remains plausible.
Author
Bacteria; Basalt; Fossils; Geochemistry; Igneous Rocks; Mars (Planet); Microorganisms; Sediments; SNC Meteorites

19990020880 Lunar and Planetary Inst., Houston, TX USA
Ancient Martian Life in Allan Hills 84001? Status of Some Current Controversies
Treiman, A. H., Lunar and Planetary Inst., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 54-56; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Four lines of evidence were taken to suggest that ALH84001 contained traces of ancient martian life preserved in its carbonate mineral masses: [1] abundance of organic compounds Polycyclic aromatic hydrocarbons (PAHs), [2] disequilibrium mineral assemblages, [3] morphology of submicrometer magnetite crystals, and [4] presence of objects comparable in size and shape to

bacteria. This evidence is predicated on the carbonate globules having formed at temperatures conducive to life. Here, I review evidence on carbonate formation temperature, martian origin of organic compounds, and bacteria-shaped objects.
Author
Mars (Planet); Mineral Deposits; Exobiology; Extraterrestrial Life; Polycyclic Aromatic Hydrocarbons; Carbonates; Temperature; Magnetite; Bacteria

19990020885 NASA Johnson Space Center, Houston, TX USA
Terrestrial Biomarkers for Early Life on Earth as Analogs for Possible Martian Life Forms: Examples of Minerally Replaced Bacteria and Biofilms From the 3.5 - 3.3-Ga Barberton Greenstone Belt, South Africa
Westall, F., NASA Johnson Space Center, USA; McKay, D. S., NASA Johnson Space Center, USA; Gibson, E. K., NASA Johnson Space Center, USA; deWit, M. J., Cape Town Univ., South Africa; Dann, J., Cape Town Univ., South Africa; Gerneke, D., Cape Town Univ., South Africa; deRonde, C. E. J., Institute of Geological and Nuclear Sciences Ltd., New Zealand; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 61-62; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The search for extraterrestrial life and especially martian life hinges on a variety of methods used to identify vestiges of what we could recognize as life, including chemical signatures, morphological fossils, and biogenic precipitates. Although the possibility of extant life on Mars (subsurface) is being considered, most exploration efforts may be directed toward the search for fossil life. Geomorphological evidence points to a warmer and wetter Mars early on in its history, a scenario that encourages comparison with the early Earth. For this reason, study of the early terrestrial life forms and environment in which they lived may provide clues as to how to search for extinct martian life. As a contribution to the early Archean database of terrestrial microfossils, we present new data on morphological fossils from the 3.5-3.3-Ga Barberton greenstone belt (BGB), South Africa. This study underlines the variety of fossil types already present in some of the oldest, best-preserved terrestrial sediments, ranging from minerally replaced bacteria and bacteria molds of vaRious morphologies (coccoid, coccobacillus, bacillus) to minerally replaced biofilm. Biofilm or extracellular polymeric substance (EPS) is produced by bacteria and appears to be more readily fossilisable than bacteria themselves. The BGB fossils occur in shallow water to subaerial sediments interbedded with volcanic lavas, the whole being deposited on oceanic crust. Penecontemporaneous silicification of sediments and volcanics resulted in the chertification of the rocks, which were later subjected to low-grade metamorphism (lower greenschist).
Author
Bacteria; Extraterrestrial Life; Fossils; Lava; Structural Properties (Geology); Biogeochemistry; Colonies; Morphology

19990021038 San Diego Univ., Biology Dept., San Diego, CA USA
Investigations of the Effects of Altered Vestibular System Function on Hindlimb Anti-Gravity Muscles
Lowery, Mary Sue, San Diego Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Exposure to different gravitational environments, both the microgravity of spaceflight and the hypergravity of centrifugation, result in altered vestibulo-spinal function which can be reversed by reacclimation to earth gravity (2). Control of orientation, posture, and locomotion are functions of the vestibular system which are altered by changes in gravitational environment. Not only is the vestibular system involved with coordination and proprioception, but the gravity sensing portion of the vestibular system also plays a major role in maintaining muscle tone through projections to spinal cord motoneurons that control anti-gravity muscles. I have been involved with investigations of several aspects of the link between vestibular inputs and muscle morphology and function during my work with Dr. Nancy Daunton this summer and the previous summer. We have prepared a manuscript for submission (4) to Aviation, Space, and Environmental Medicine based on work that I performed last summer in Dr. Daunton's lab. Techniques developed for that project will be utilized in subsequent experiments begun in the summer of 1998. I have been involved with the development of a pilot project to test the effects of vestibular galvanic stimulation (VGS) on anti-gravity muscles and in another project testing the effects of the ototoxic drug streptomycin on the otolith-spinal reflex and anti-gravity muscle morphology.
Author
Research; Vestibules; Gravitation; Muscular Tonus; Muscular Function; Aerospace Medicine; Detection

19990021053 Washington Univ., School of Fisheries, Seattle, WA USA

Ecological Support of Larval Fish During Multigenerational Studies on Space Station

Taub, Frieda B., Washington Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Live, microscopic food is required by larval Zebrafish, Danio rerio, which are candidates for the Aquatic Habitat of the Space Station Biological Research Project (SSBRP). Zebrafish have proven to be convenient research animals, and their embryology and genetics are extensively documented. Their ability to mature at 3 months of age, and the transparent eggs which hatches in 2 days, are attractive attributes for space research. Among the goals of the SSBRP Aquatic Habitat is the ability to study three generations, with the objective of maintaining adults, their offspring, and the maintaining of these offspring through maturity and spawning. For Zebrafish, it is anticipated that sexually mature fish (PI) would be delivered to Space Station and spawned in space. The challenge would be it to provide appropriate microscopic foods for the offspring (FI), and 3 months later for the next generation (F2); if these were raised to maturity and bred, live foods would be required at approximately 6 months. In laboratories where Zebrafish are traditionally reared, the larval foods are the protozoan Parameciwn micromultinucleatwn and later brine shrimp Artemia nauplii. Under normal laboratory conditions, the rearing of these foods are relatively easy, although time consuming because of the food organisms must be separated from their rearing medium which is discarded. A freshwater food chain that would ensur-e healthy on- orbit research animals is needed. ne food chain should (a) be reared in conditions that are compatible with the larval fish (water chemistry, pH, temperature and light), (b) assist in maintaining water quality (by removing ammonia, nitrate, phosphate, carbon dioxide, and bacteria) and (c) be convenient for the space crew (minimize handling and waste production). Derived from text

Ecology; Fishes; Embryology; Spaceborne Experiments; Artemia; Food Chain; Fresh Water; Organisms

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AEROSPACE MEDICINE

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

19990019298 Princeton Univ., Dept. of Ecology and Evolutionary Biology, NJ USA

From Individuals to Epidemics

Levin, Simon A., Princeton Univ., USA; Durrett, R., Cornell Univ., USA; Phil. Trans R. Soc. Lond. B; 1996; Volume 351, pp. 1615-1621; In English

Contract(s)/Grant(s): NAG5-6422; NSF DMS-93-01070; NSF BIR-94-23339; NAGw-4688; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Heterogeneous mixing fundamentally changes the dynamics of infectious diseases; finding ways to incorporate it into models represents a critical challenge. Phenomenological approaches are deficient in their lack of attention to underlying processes; individual-based models, on the other hand, may obscure the essential interactions in a sea of detail. The challenge then is to find ways to bridge these levels of description, starting from individual-based models and deriving macroscopic descriptions from them that retain essential detail, and filter out the rest. In this paper, attempts to achieve this transformation are described for a class of models where non-random mixing arises from the spatial localization of interactions. In general, the epidemic threshold is found to be larger owing to spatial localization than for a homogeneous mixing population. An improved estimate of the dynamics is developed by the use of moment equations, and a simple estimate of the threshold in terms of a 'dyad heuristic'. For more general models in which local infection is not described by mass action, the connection with related partial differential equations is investigated. Author

Infectious Diseases; Heterogeneity; Heuristic Methods; Phenomenology

19990019377 NASA Langley Research Center, Hampton,VA USA

Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 485

Feb. 22, 1999; 23p; In English

Report No.(s): NASA/SP-1999-7011/SUPPL485; NAS 1.21:7011/SUPPL485; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This supplemental issue of Aerospace Medicine and Biology, A Continuing Bibliography with Indexes (NASA/SP-1999-7011) 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. The NASA CASI price code table, addresses of organizations, and document availability information are included before the abstract section. Two indexes-subject and author are included after the abstract section.
CASI
Aerospace Medicine; Bibliographies; Bioastronautics; Biological Effects; Exobiology; Indexes (Documentation)

19990019766 Johns Hopkins Univ., Baltimore, MD USA
Structural Indices of Stress Fracture Susceptibility in Female Military Recruits ***Final Report, 22 Sep. 1995 - 21 Sep 1998***
Beck, Thomas J.; Oct. 1998; 32p; In English
Report No.(s): AD-A356178; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Six hundred-ninety three female U.S. Marine Corps recruits were studied with anthropometry and dual energy x-ray absorptiometry (DXA) scans of the thigh and lower leg prior to recruit training. A total of 37 stress fractures were confirmed. Female data were combined with an earlier study of 626 male Marine recruits including 38 stress fracture cases. Bone structural geometry, cortical dimensions, thigh lean mass and muscle cross-sectional area were derived from DXA data. Measurements were compared within sex between pooled fracture cases and controls. Fracture cases in both sexes were less physically fit, and had smaller thigh muscles compared to controls. After correction for body size, section moduli (Z) and bone strength indices of the femur and tibia were smaller in fracture cases of both sexes but patterns differed. Compared to controls, female cases had thinner cortices and lower BMD. Male cases had narrower bones but similar cortical thickness and BMD. In both sexes, differences suggest poor skeletal adaptation to training in fracture cases due to inadequate prior conditioning. Lower stress fracture rates in African Americans compared to whites or Hispanics suggest stronger bones. Ethnic differences in bone and muscle indices of fracture susceptibility were studied within sex, using pooled data compared among ethnic groups. African Americans of both sexes showed longer leg bones, narrower pelves, larger tibia Z's, leaner thighs and larger thigh muscles than other groups, although initial fitness levels were similar (males) or worse (female's). Differences suggest genetically stronger skeletal mechanics in African Americans, compared to other groups. Results imply that stress fracture susceptibility and bone strength have both environmentally plastic and genetic components.
DTIC
Physical Fitness; Musculoskeletal System; X Ray Analysis; Anthropometry; Females; Ethnic Factors

19990021027 Arkansas Univ. for Medical Sciences, Dept. of Biopharmaceutical Sciences, Little Rock, AR USA
Virtual Reality Simulation of the Effects of Microgravity in Gastrointestinal Physiology
Compadre, Cesar M., Arkansas Univ. for Medical Sciences, USA; Oct. 1998; 4p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The ultimate goal of this research is to create an anatomically accurate three-dimensional (3D) simulation model of the effects of microgravity in gastrointestinal physiology and to explore the role that such changes may have in the pharmacokinetics of drugs given to the space crews for prevention or therapy. to accomplish this goal the specific aims of this research are: 1) To generate a complete 3-D reconstructions of the human GastroIntestinal (GI) tract of the male and female Visible Humans. 2) to develop and implement time-dependent computer algorithms to simulate the GI motility using the above 3-D reconstruction.
Author
Virtual Reality; Simulation; Microgravity; Gastrointestinal System; Three Dimensional Models

19990021037 Bowling Green State Univ., School of HEPR - Kinesiology, OH USA
High Salt Diets, Bone Strength and Mineral Content of Mature Femur After Skeletal Unloading
Liang, Michael T. C., Bowling Green State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

It is known that high salt diets increase urinary calcium (CA) loss, but it is not known whether this effect weakens bone during space flight. The Bone Hormone Lab has studied the effect of high salt diets on Ca balance and whole body Ca in a space flight model (2,8). Neither the strength nor mineral content of the femurs from these studies has been evaluated. The purpose of this study was to determine the effect of high salt diets (HiNa) and skeletal unloading on femoral bone strength and bone mineral content (BMC) in mature rats.
Author
Bone Mineral Content; Calcium; Minerals; Diets

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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.

19990019114 Civil Aeromedical Inst., Oklahoma City, OK USA
Performance of a Portable Oxygen Breathing System at 25,000 Feet Altitude
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; Nov. 1998; 11p; In English
Report No.(s): AD-A357729; 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.
DTIC
Oxygen Breathing; Oxygen Masks; Altitude; Portable Life Support Systems

19990019179 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
A Reliability Model of a Man-Machine System with Human Errors and its Applications
Liu, Chih-Ming, National Tsing Hua Univ., Taiwan, Province of China; Wang, An-Hsiang, Oriental Inst. of Tech., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 149-158; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A continuous-time Markov chain model, which considers the concept of human errors and recovery factors, is proposed for analyzing the reliability of a man-machine system. The model can be applied to general systems which involve man-machine interactions. Both the reliability and the mean time between breakdowns of a system can be predicted by using this model. An inspection system, a conveyer line system, a cellular manufacturing system, and an automatic assembly machine are used to demonstrate the application of the reliability model. During the design stage of a man-machine system, the model can provide reliability evaluation information to aid in the choice of different alternatives for man-machine interaction. During the operating stage of a system, the model can also provide reliability information to improve system reliability.
Author
Human Factors Engineering; Man Machine Systems; Reliability Analysis; Errors

19990019563 NASA Marshall Space Flight Center, Huntsville, AL USA
Comparison of Human Modeling Tools for Efficiency of Prediction of EVA Tasks
Dischinger, H. Charles, Jr., NASA Marshall Space Flight Center, USA; Loughead, Tomas E., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; NASA University Research Centers Technical Conference 1998, 22-26 Feb. 1998, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Design of ExtraVehicular Activity (EVA) interfaces for International Space Station is important to successful assembly. This is highlighted by the recent rise in the estimate of time required for EVA during the assembly to 900 hours. The traditional method of evaluating EVA design is examination of mockups in neutral buoyancy testing. While effective, this is costly. Any tools for streamlining this process have positive cost and schedule implications for Station design. The human modelling software package Jack has been shown to be a useful tool in computer-aided design of space hardware requiring actuation in EVA. The package has been used to aid in the design of flight hardware for a Station Assembly Mission; evaluation was based on comparison of the computer simulations with neutral buoyancy simulations. When used to predict the feasibility of tasks, the software was found to be effective for reach and visibility evaluation. Some limitations have been encountered in prediction of work clearances. Another

human simulator is currently being evaluated using the same hardware and comparisons to the same Neutral Buoyancy simulations. Preliminary results for ERGO, which is derived from robotics software, indicate similar strengths and weaknesses.
Author
Applications Programs (Computers); Buoyancy; Computerized Simulation; Extravehicular Activity

19990021031 Alaska Univ., Dept. of Aviation Technology, Anchorage, AK USA
F18 Life Support: APECS and EDOX Cockpit Integration
Herrick, Paul, Alaska Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Two systems are currently being integrated into the F18 Hornet support aircraft at NASA Dryden Flight Research Center (DFRC). The first system is the Aircrew Personal Environmental Control System (APECS). The system is designed to increase aircrew performance by combating heat stress in the cockpit. The second system is the Extended Duration Oxygen System (EDOX). This system will provide additional redundancy and oxygen system duration to the F18 without extensive modification to the current system.
Author
Life Support Systems; F-18 Aircraft; Environmental Control

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MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

19990019484 NASA Lewis Research Center, Cleveland, OH USA
The Space-Time Conservation Element and Solution Element Method: A New High-Resolution and Genuinely Multidimensional Paradigm for Solving Conservation Laws, 1, The Two Dimensional Time Marching Schemes
Chang, Sin-Chung, NASA Lewis Research Center, USA; Wang, Xiao-Yen, Minnesota Univ., USA; Chow, Chuen-Yen, Colorado Univ., USA; December 1998; 124p; In English
Contract(s)/Grant(s): RTOP 538-03-11
Report No.(s): NASA/TM-1998-208843; E-11456; NAS 1.15:208843; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A new high resolution and genuinely multidimensional numerical method for solving conservation laws is being, developed. It was designed to avoid the limitations of the traditional methods. and was built from round zero with extensive physics considerations. Nevertheless, its foundation is mathmatically simple enough that one can build from it a coherent, robust. efficient and accurate numerical framework. Two basic beliefs that set the new method apart from the established methods are at the core of its development. The first belief is that, in order to capture physics more efficiently and realistically, the modeling, focus should be placed on the original integral form of the physical conservation laws, rather than the differential form. The latter form follows from the integral form under the additional assumption that the physical solution is smooth, an assumption that is difficult to realize numerically in a region of rapid chance. such as a boundary layer or a shock. The second belief is that, with proper modeling of the integral and differential forms themselves, the resulting, numerical solution should automatically be consistent with the properties derived front the integral and differential forms, e.g., the jump conditions across a shock and the properties of characteristics. Therefore a much simpler and more robust method can be developed by not using the above derived properties explicitly.
Author
Space-Time Functions; Conservation; Shock Waves; Relativity

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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.

19990019381 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
The Tera Multithreaded Architecture and Unstructured Meshes *Final Report*
Bokhari, Shahid H., University of Engineering and Technology, Pakistan; Mavriplis, Dimitri J., Institute for Computer Applications in Science and Engineering, USA; December 1998; 23p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1998-208953; NAS 1.26:208953; ICASE-IR-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Tera Multithreaded Architecture (MTA) is a new parallel supercomputer currently being installed at San Diego Supercomputing Center (SDSC). This machine has an architecture quite different from contemporary parallel machines. The computational processor is a custom design and the machine uses hardware to support very fine grained multithreading. The main memory is shared, hardware randomized and flat. These features make the machine highly suited to the execution of unstructured mesh problems, which are difficult to parallelize on other architectures. We report the results of a study carried out during July-August 1998 to evaluate the execution of EUL3D, a code that solves the Euler equations on an unstructured mesh, on the 2 processor Tera MTA at SDSC. Our investigation shows that parallelization of an unstructured code is extremely easy on the Tera. We were able to get an existing parallel code (designed for a shared memory machine), running on the Tera by changing only the compiler directives. Furthermore, a serial version of this code was compiled to run in parallel on the Tera by judicious use of directives to invoke the ”full/empty” tag bits of the machine to obtain synchronization. This version achieves 212 and 406 Mflop/s on one and two processors respectively, and requires no attention to partitioning or placement of data issues that would be of paramount importance in other parallel architectures.

Author

Parallel Computers; Supercomputers; Unstructured Grids (Mathematics); Architecture (Computers); Multiprocessing (Computers)

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COMPUTER PROGRAMMING AND SOFTWARE

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

19990019253 Boise State Univ., Dept. of Geosciences, Idaho, ID USA

Program Developments for Modeling Groundwater Flow in Three-Dimensional Heterogeneous Aquifers with MODFLOW and MODFLOWP ***Final Report***

Huang, Kangle; Clemo, Tom; Barrash, Warren; Nov. 1998; 40p; In English; Original contains color plates

Contract(s)/Grant(s): DAAH04-96-1-0318; DAAH04-94-G-0271

Report No.(s): AD-A358000; BSU-CGISS-97-02; ARO-35802.3-RT-RSP; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents: (1) a number of stand alone utilities to assist with input to MODFLOW and (2) code modifications internal to MODFLOW and MODFLOWP. These were developed to improve ease of use of MODFLOW and MODFLOWP for modeling groundwater flow in three dimensional heterogeneous systems. Several utilities to assist with input to MODFLOW are specifically designed for use with the Groundwater Modeling System (GMS) pre and post-processor package. New features for MODFLOW include routines for: (1) assignment of material blocks and material types to these blocks within a given three dimensional grid mesh; (2) generation of the Block Centered Flow (BCF) file for heterogeneous aquifers with material properties assigned to blocks, and with internal calculation of leakage and thickness factored parameters (T,S); (3) distribution of pumping rate for individual model layers for a well that draws from or injects into multiple layers; (4) calculation of weighted drawdown for an observation well screened over multiple layers; and (5) customizing the drawdown output file to contain data for a specified number of observation wells, rather than every node in the domain. For MODFLOWP, the program has been modified to: (1) simplify input by making the PAR file free format; (2) allow the user to easily change the number and combination of parameters for estimation in a given run by modifying one line rather than regenerating the PAR file; (3) automatically calculate ROFFs, COFFs, and TOFFs for observation wells; (4) notify the user during program execution when lower or upper parameter ranges are exceeded; and (5) provide monitoring of run time.

DTIC

Information Systems; Aquifers; Ground Water; Water Flow; Hydrology Models; Three Dimensional Models; Three Dimensional Flow; Applications Programs (Computers); Computer Programs

19990019316 Massachusetts Univ., Dept. of Computer Science, Amherst, MA USA

Distributed Processing for Rapid ReconstructiOn of Terrain Models ***Final Report, 16 Jun. 1997 - 15 Jun. 1998***

Schultz, Howard J., Massachusetts Univ., USA; Riseman, Edward M., Massachusetts Univ., USA; Oct. 06, 1998; 22p; In English

Contract(s)/Grant(s): DAAG55-97-1-0328

Report No.(s): AD-A357877; ARO-36897.1-MA-SDI; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The project goals are to develop high performance computing techniques for rapid mapping of terrain and cultural sites to support a diverse set of capabilities for battlefield awareness. With the recent increase in the variety and resolution of image sources, there is an increasing need to rapidly generate specialized map products. to meet these requirements, the University of Massachusetts is developing parallel and distributed processing techniques. The first year research effort focused on mechanisms and strategies for using distributed processing techniques across a heterogeneous set of computer architectures, and parallel processing techniques for processing very large data sets. Several studies were conducted using the PVM (parallel virtual machine) library support. We successfully applied the technique to a complex perceptual grouping algorithm used in site model reconstruction. In addition, we began work on developing out-of-core algorithms that advantage multiprocessor servers to efficiently process very large data sets (images greater than 30,000 x 30,000 pixels). These algorithms circumvent the highly inefficient operating system virtual memory and paging algorithms. initial bench match studies have shown that the efficiency of these out-of-core techniques is independent of the image size.
DTIC
Distributed Processing; Parallel Processing (Computers); Algorithms; Architecture (Computers); Data Processing

19990019385 General Instrument Corp., Rohnert Park, CA USA
Soft-Decision Decoding of Binary Linear Block Codes Based on an Iterative Search Algorithm
Lin, Shu, Hawaii Univ., USA; Kasami, Tadao, Osaka Univ., Japan; Moorthy, H. T., General Instrument Corp., USA; IEEE Transactions on Information Theory; May 1997; ISSN 0018-9448; Volume 43, No. 3, pp. 1030-1040; In English; Information Theory, Sep. 1995, Whistler, British Columbia, Canada; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): NAG5-931; NAG5-2938; NSF NCR-94-15374; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
This correspondence presents a suboptimum soft-decision decoding scheme for binary linear block codes based on an iterative search algorithm. The scheme uses an algebraic decoder to iteratively generate a sequence of candidate codewords one at a time using a set of test error patterns that are constructed based on the reliability information of the received symbols. When a candidate codeword is generated, it is tested based on an optimality condition. If it satisfies the optimality condition, then it is the most likely (ML) codeword and the decoding stops. If it fails the optimality test, a search for the ML codeword is conducted in a region which contains the ML codeword. The search region is determined by the current candidate codeword and the reliability of the received symbols. The search is conducted through a purged trellis diagram for the given code using the Viterbi algorithm. If the search fails to find the ML codeword, a new candidate is generated using a new test error pattern, and the optimality test and search are renewed. The process of testing and search continues until either the MEL codeword is found or all the test error patterns are exhausted and the decoding process is terminated. Numerical results show that the proposed decoding scheme achieves either practically optimal performance or a performance only a fraction of a decibel away from the optimal maximum-likelihood decoding with a significant reduction in decoding complexity compared with the Viterbi decoding based on the full trellis diagram of the codes.
Author
Decoders; Algorithms; Iteration; Binary Codes; Decoding

19990019449 Kestrel Inst., Palo Alto, CA USA
Planware: Domain-Specific Synthesis of High-Performance Schedulers ***Final Report, Jan. 1995 - Jun. 1997***
Blaine, Lee; Gilham, Limei; Lin, Jumbo; Smith, Douglas R.; Westfold, Stephen; Oct. 1998; 18p; In English
Contract(s)/Grant(s): F30602-95-C-0036; AF Proj. 5581
Report No.(s): AD-A358076; AFRL-IF-RS-TR-1998-200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The technology aggregated in Planware represents part of a significant long term investment in knowledge based software engineering formulated and guided by AFRL/IFTD. It includes search theories from artificial and methodology for rigorous statement and formally verified manipulation of specifications from the formal methods area with the goal of achieving a software engineering paradigm that supports the economic, life long evolution of complex systems. Planware is a domain specific generator of high performance scheduling software, currently being developed at Kestrel Institute. Architecturally, Planware is an extension of the Specware system with domain independent and domain dependent parts. The domain independent part includes a general algorithm design facility (including mechanisms to synthesize global search and constraint propagation algorithms), as well as support for theorem proving and witness finding. The domain dependent part includes scheduling domain knowledge and architecture representations, and other domain specific refinement knowledge that relates the scheduling domain to general algorithm design and data type refinement. Using Planware, the user interactively specifies a problem and then the system automatically

generates a formal specification and refines it. Various transportation schedulers have been generated, and with satisfactory performance.
DTIC
Knowledge Based Systems; Scheduling; Software Engineering

19990019552 Rockwell Collins, Inc., Advanced Technology Center, Cedar Rapids, IA USA
Detecting Mode Confusion Through Formal Modeling and Analysis ***Final Report***
Miller, Steven P., Rockwell Collins, Inc., USA; Potts, James N., Rockwell Collins, Inc., USA; Jan. 1999; 69p; In English
Contract(s)/Grant(s): NAS1-19704; RTOP 522-33-31-01
Report No.(s): NASA/CR-1999-108971; NAS 1.26:208971; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Aircraft safety has improved steadily over the last few decades. While much of this improvement can be attributed to the introduction of advanced automation in the cockpit, the growing complexity of these systems also increases the potential for the pilots to become confused about what the automation is doing. This phenomenon, often referred to as mode confusion, has been involved in several accidents involving modern aircraft. This report describes an effort by Rockwell Collins and NASA Langley to identify potential sources of mode confusion through two complementary strategies. The first is to create a clear, executable model of the automation, connect it to a simulation of the flight deck, and use this combination to review of the behavior of the automation and the man-machine interface with the designers, pilots, and experts in human factors. The second strategy is to conduct mathematical analyses of the model by translating it into a formal specification suitable for analysis with automated tools. The approach is illustrated by applying it to a hypothetical, but still realistic, example of the mode logic of a Flight Guidance System.
Author
Human Factors Engineering; Detection; Man Machine Systems; Flight Control; Methodology; Computer Programs

19990019605 Fukui Univ., Faculty of Engineering, Japan
Making a Modeling Tool with X-Window for the 3D Ray Tracer POV-Ray
Tamai, Yasuaki, Fukui Univ., Japan; Aoki, Hideki, Fukui Univ., Japan; Takada, Takahiro, Fukui Univ., Japan; Hasegawa, Takemitsu, Fukui Univ., Japan; Sato, Yoshio, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 309-321; In Japanese; Original contains color illustrations; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We construct a modeling tool with X-window on WS for the 3D ray tracer POV-Ray which is a free software provided by the POV-Ray team in USA. The tool we construct is a user-friendly interface to the POV-Ray used to draw and paint 3D graphic images on computers, such as PC and WS. Although such tool has been available on PC, there is no tool available on WS. Our tool requires only mouse operations to facilitate the use of the POV-Ray.
Author
Models; Fabrication; Computer Aided Design

19990019636 Fukui Univ., Faculty of Engineering, Japan
Performance Measurement and Improvement of Distributed Computing Environment
Nishino, Junji, Fukui Univ., Japan; Odaka, Tomohiro, Fukui Univ., Japan; Ogura, Hisakazu, Fukui Univ., Japan; Kubo, Takenori, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 357-371; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes an approach to measure the performance of the distributed computing environment that consists of workstations, personal computers and X terminals. All computers are connected by local area network one another. to measure the total performance, we collect the log data of cpu performance, memory system performance, disk system performance, and network performance. We show the measurement and analysis method of these data, and discuss some approaches to improve the performance of the distributed computing environment.
Author
Personal Computers; Data Storage; Performance Tests

19990019652 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Admissibility of Fixpoint Induction over Partial Types
Crary, Karl; Oct. 1998; 29p; In English
Contract(s)/Grant(s): F30602-95-1-0047; N00014-95-1-0985
Report No.(s): AD-A356258; CMU-CS-98-164; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Partial types allow the reasoning about partial functions in type theory. The partial functions of main interest are recursively computed functions, which are commonly assigned types using fixpoint induction. However, fixpoint induction is valid only on admissible types. Previous work has shown many types to be admissible, but has not shown any dependent products to be admissible. Disallowing recursion on dependent product types substantially reduces the expressiveness of the logic; for example, it prevents much reasoning about modules, objects and algebras. In this paper I present two new tools, predicate-admissibility and monotonicity, for showing types to be admissible. These tools show a wide class of types to be admissible; in particular, they show many dependent products to be admissible. This alleviates difficulties in applying partial types to theorem proving in practice. I also present a general least upper bound theorem for fixed points with regard to a computational approximation relation, and show an elegant application of the theorem to compactness.
DTIC
Computer Programming; Theorems; Fixed Points (Mathematics); Theorem Proving

19990019661 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
A Framework for Programming Embedded Systems: Initial Design and Results
Thrun, Sebastian; Oct. 1998; 48p; In English
Contract(s)/Grant(s): DAAE-98-C-L032
Report No.(s): AD-A356045; CMU-CS-98-142; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes CES, a prototype of a new programming language for robots and other embedded systems, equipped with sensors and actuators. CES contains two new ideas, currently not found in other programming languages: support of computing with uncertain information, and support of adaptation and teaching as a means of programming. These innovations facilitate the rapid development of software for embedded systems, as demonstrated by two mobile robot applications.
DTIC
Programming Languages; Robots; Artificial Intelligence; Computer Programming

19990019665 NASA Goddard Space Flight Center, Greenbelt, MD USA
Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop
Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996; 420p; In English; 21st; Software Engineering, 5-6 Dec. 1996, Greenbelt, MD, USA; Sponsored by NASA Goddard Space Flight Center, USA; Also announced as 19990019666 through 19990019681
Report No.(s): NASA/TM-1998-208617; SEL-96-002; NAS 1.15:208617; No Copyright; Avail: CASI; A18, Hardcopy; A04, 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; Structured Programming; Systems Engineering; Conferences

19990019666 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Improvement Cycle: Analyzing Our Experience
Pajerski, Rose, NASA Goddard Space Flight Center, USA; Waligora, Sharon, Computer Sciences Corp., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 3-25; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

NASA's Software Engineering Laboratory (SEL), one of the earliest pioneers in the areas of software process improvement and measurement, has had a significant impact on the software business at NASA Goddard. At the heart of the SEL's improvement program is a belief that software products can be improved by optimizing the software engineering process used to develop them and a long-term improvement strategy that facilitates small incremental improvements that accumulate into significant gains. As a result of its efforts, the SEL has incrementally reduced development costs by 60%, decreased error rates by 85%, and reduced cycle time by 25%. In this paper, we analyze the SEL's experiences on three major improvement initiatives to better understand the cyclic nature of the improvement process and to understand why some improvements take much longer than others.
Author
Computer Programming; Computer Programs; Software Engineering; Reverse Engineering; Programming Environments; Object-Oriented Programming

19990019667 NASA Goddard Space Flight Center, Greenbelt, MD USA

Evolving the Reuse Process at the Flight Dynamics Division (FDD) Goddard Space Flight Center

Condon, S., Computer Sciences Corp., USA; Seaman, C., Maryland Univ., USA; Basili, Victor, Maryland Univ., USA; Kraft, S., NASA Goddard Space Flight Center, USA; Kontio, J., Maryland Univ., USA; Kim, Y., Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 27-58; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents the interim results from the Software Engineering Laboratory's (SEL) Reuse Study. The team conducting this study has, over the past few months, been studying the Generalized Support Software (GSS) domain asset library and architecture, and the various processes associated with it. In particular, we have characterized the process used to configure GSS-based attitude ground support systems (AGSS) to support satellite missions at NASA's Goddard Space Flight Center. to do this, we built detailed models of the tasks involved, the people who perform these tasks, and the interdependencies and information flows among these people. These models were based on information gleaned from numerous interviews with people involved in this process at various levels. We also analyzed effort data in order to determine the cost savings in moving from actual development of AGSSs to support each mission (which was necessary before GSS was available) to configuring AGSS software from the domain asset library. While characterizing the GSS process, we became aware of several interesting factors which affect the successful continued use of GSS. Many of these issues fall under the subject of evolving technologies, which were not available at the inception of GSS, but are now. Some of these technologies could be incorporated into the GSS process, thus making the whole asset library more usable. Other technologies are being considered as an alternative to the GSS process altogether. In this paper, we outline some of issues we will be considering in our continued study of GSS and the impact of evolving technologies.
Author

Software Engineering; Computer Programs; Computer Programming; Aerodynamics; Software Reuse

19990019668 Maryland Univ., Inst. for Advanced Computer Studies, College Park, MD USA

Studies on Reading Techniques

Basili, Victor, Maryland Univ., USA; Caldiera, Gianluigi, Maryland Univ., USA; Lanubile, Filippo, Maryland Univ., USA; Shull, Forrest, Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 59-74; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Software reading is a key technical activity that aims at achieving whatever degree of understanding is needed to accomplish a particular objective. The various work documents associated with software development (e.g., requirements, design, code, and test plans) often require continual understanding, review and modification throughout the development life cycle. Thus software reading, i.e., the individual analysis of textual software work products, is the core activity in many software engineering tasks: verification and validation, maintenance, evolution, and reuse.
Derived from text

Computer Programming; Computer Programs; Reading

19990019669 American Telephone and Telegraph Co., Operations and Service Management, Bridgewater, NJ USA

Software Development Technology Evaluation: Proving Fitness-for-Use with Architectural Styles

Cusick, James, American Telephone and Telegraph Co., USA; Tepfenhart, William M., American Telephone and Telegraph Co., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 77-97; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A cursory glance at a few trade journals will indicate -hat hundreds if not thousands of development tools are available on the market. Today, the boom in Internet technologies, dozens of new tools enter the market place each month. Faced with this situation we were asked to define how to choose the best tools for use in the development of hundreds of AT&T's business applications. Starting in early 1995 we began a revitalization of the software tool assessment practices of AT&T and especially AT&T's Network Services Division (NSD). These efforts are discussed in this paper.
Derived from text

Computer Programming; Software Engineering; Computer Networks

19990019670 Q-Labs. Software Engineering G.m.b.H., Kaiserlautern, Germany

Systematic Process Improvement in a Multi-Site Software Development Project

Hientz, Horst, Q-Labs. Software Engineering G.m.b.H., Germany; Smith, G., Q-Labs. Software Engineering G.m.b.H., Germany; Gustavsson, A., Q-Labs. Software Engineering G.m.b.H., Germany; Isacsson, P., Q-Labs. Software Engineering G.m.b.H., Germany; Mattsson, C., Q-Labs. Software Engineering G.m.b.H., Germany; Software Engineering Laboratory Series: Proceedings

of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 99-114; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper reports on the application of the PERFECT Improvement Approach and specifically goal-oriented measurement via GQM in a large multi-site software development project. Successful and persistent implementation of an Experience Factory and the GQM approach in a large multi-site project organization is a challenging task and needs to be based on a sound and operational methodological support to face all the practical problems and resistance which occur in the course of a software process improvement programme. In the paper we present both measures and experiences of applying goal oriented measurement as well as experiences from introducing systematic process improvement based on measurement.

Author

Computer Programming; Computer Programs; Software Engineering; Software Reuse; Object-Oriented Programming

19990019671 Norwegian Univ. of Science and Technology, Div. of Computer Science, Trondheim, Norway

An Empirical Study of Process Conformance

Sorumgard, Sivert, Norwegian Univ. of Science and Technology, Norway; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 115-132; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

An experiment was carried out at the Norwegian University of Science and Technology (NTNU) in order to investigate a concept called process conformance. The experiment was based on previous experiments carried out at the Software Engineering Laboratory (SEL). The purpose of the experiments compare two variants of a process and see whether the type of process had an impact on the level of process conformance. Another goal was to investigate the correlation between the degree of conformance and deviation in product quality. The results obtained so far indicate some evidence that process conformance and product quality deviation are correlated. The process type had no apparent impact on conformance.

Author

Computer Programming; Research and Development; Software Engineering; Systems Engineering; Computer Programs; Reverse Engineering

19990019672 American Telephone and Telegraph Co., Middletown, NJ USA

Using a Unified Object Topology to Uncover COTS Integration Challenges and Assembly Affinities

Tepenhart, William M., American Telephone and Telegraph Co., USA; Cusick, James, American Telephone and Telegraph Co., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 135-154; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Large corporations are attempting to cut development costs by relying on integrating several COTS to achieve partial or complete business solutions. That the benefits are not turning out as expected is slowly becoming a recognized issue. In this paper, we address some of the reasons why integration of COTS is a challenge.

Author

Organizations; Topology; Fault Trees; Dimensions

19990019673 Virginia Univ., Dept. of Computer Science, Charlottesville, VA USA

Product Development With Massive Components

Sullivan, Kevin J., Virginia Univ., USA; Knight, John C., Virginia Univ., USA; Cockrell, Jake, Virginia Univ., USA; Zhang, Shengtong, Virginia Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 155-174; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The problem faced by many of today's software engineers is to build and maintain broad families of large systems in a cost-effective and timely manner. Because the market demands rapid creation and modification of systems in response to a spectrum of evolving requirements, extensive flexibility in systems is required. This situation has two implications: first, basic system demands have to be met quickly; and, second, responses to requested variations have to be rapid and effective. System development and modification cycle time must be shortened significantly. One approach to cycle-time improvement that has been studied extensively is software reuse. Current reuse techniques include system synthesis using application-generator technologies and component-based development techniques. The latter has been effected in several ways, including subroutine libraries, templates, and a variety of class and framework mechanisms.

Derived from text

Software Reuse; Subroutine Libraries (Computers); Systems Engineering; Product Development

19990019674 Raytheon Co., Tewksbury, MA USA

Technology Evolution: COTS Transition at Raytheon 1983-1996, Pt. 1

Lydon, Tom, Raytheon Co., USA; Fischer, Laurie, Raytheon Co., USA; Gardner, Karl, Raytheon Co., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 175-201; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Raytheon RES Software Engineering Laboratory is a large software development organization consisting of about 1200 engineers. It has been independently rated as an SEI Level 3 site for four years and won the IEEE Software Process Achievement Award in 1995. The Raytheon process relies extensively on the use of integrated engineering tools to achieve process control. Data on 84 tools, 25 Raytheon-developed and 59 COTS, over the period 1983-1996 shows that the number of tools used in software engineering has grown from an average of about 4 tools per engineer in 1986 (not including standard host editors or compilers provided with the OS) to about 12 tools per engineer in 1996. Furthermore, over this period there was a definite, systematic swing from Raytheon-developed tools which were predominant from 1984-1990, to COTS tools which have been predominant since 1990. The current mix is about 3 Raytheon tools and 9 COTS tools in use per software engineer. There are pros and cons to the use of COTS tools. Overall costs have initially gone up, but they are still expected to go down in the future, though this is not certain. Standardization is one method of controlling overall costs. Productivity and quality both appear to improve with the use of COTS tools, but this improvement data is also a result of other factors such as process initiatives, training, and better hardware (workstations). There are regular births and deaths of tools, and this ”churning” must be managed. The data suggest that the overall use of tools will level off over the next few years at about 13 tools per engineer, 2 Raytheon and 11 COTS. COTS is not a panacea, but they are here to stay. This paper is the initial portion of a study of overall COTS tool costs. Data on the use of Raytheon-developed and COTS tools is included, but life cycle cost data has not yet been collected. The second portion of this study will be completed early in 1997.

Author

Software Engineering; Computer Programming; Life Cycle Costs; Productivity; Standardization

19990019675 Linkoeping Univ., Dept. of Computer and Information Science, Sweden

Identification of Failure-Prone Modules in Two Software System Releases

Ohlsson, Niclas, Linkoeping Univ., Sweden; Wohlin, Claes, Linkoeping Univ., Sweden; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 205-216; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents a case study of fault and failure data from two consecutive releases of a large telecommunication system. In this context it is important to have clear interpretations of errors, faults and failures. Thus, we would like to make the following distinction between them. Errors are made by humans, which may result in faults in the software. The faults may manifest themselves as failures during operation. Thus, faults can be interpreted as defects in the software and failures are the actual malfunction in an operational environment. In this paper we have used fault-prone modules to denote the modules that account for the highest number of faults disclosed during testing, while failure-prone modules is used to denote the modules accounting for the highest number of faults disclosed during the first office application and in operation. The general objective of the study is to investigate methods of identifying failure-prone software modules. Furthermore, the goal is to use the knowledge acquired to improve the software development process in order to improve software quality in the future.

Derived from text

Computer Systems Performance; Computer Programming; Computer Programs; Software Engineering; System Failures; Telecommunication

19990019676 City Univ., Centre for Software Reliability, London, UK

Predicting Software Quality Using Bayesian Belief Networks

Neil, Martin, City Univ., UK; Fenton, Norman, City Univ., UK; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 217-230; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In the absence of an agreed measure of software quality the density of defects has been a very commonly used surrogate measure. As a result there have been numerous attempts to build models for predicting the number of residual software defects. Typically, the key variables in these models are either size and complexity metrics or measures arising from testing information. There are, however, serious statistical and theoretical difficulties with these approaches. Using Bayesian Belief Networks we can over-

come some of the more serious problems by taking account of all the diverse factors implicit in defect prevention, detection and complexity.
Author
Belief Networks; Mathematical Models; Computer Techniques; Probability Theory; Neural Nets; Bayes Theorem

19990019677 Naval Postgraduate School, Monterey, CA USA
Data Collection Demonstration and Software Reliability Modeling for a Multi-Function Distributed System
Schneidewind, Norman F., Naval Postgraduate School, USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 231-259; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Popular software reliability models treat software as a single entity and model the failure process in accordance with this perspective. However in a MFDS, with multiple clients and servers, this approach is not applicable. Consequently a software reliability model was developed that takes into account the fact that not all software defects and failures result in the failures in a client-server system. In this model there are critical clients and servers: clients and servers with critical functions (e.g., network communication) that must be kept for to survive. There are also non-critical clients and servers with non-critical functions (e g., e-mail). These clients and also act as backups for critical clients and servers, respectively. The system does not fail unless all nw-cn@ clients had and one or more clients had, or all non-critical servers had and one or more critical servers fail.
Derived from text
Client Server Systems; Computer Systems Performance; Reliability Analysis; Software Reliability

19990019678 Syracuse Univ., NY USA
Operational Test Readiness Assessment of an Air Force Software System: A Case Study
Goel, Amrit L., Syracuse Univ., USA; Hermann, Brian G., Air Force Operational Test and Evaluation Center, USA; McCane, Randy, Air Force Operational Test and Evaluation Center, USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 261-305; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a new methodology that was developed to assess operational test readiness of an Air Force software system under development over a period of several years. The evaluation is primarily based on an analysis of the open and closed problem reports. Other factors such as test completeness and requirements stability are also considered, but mostly in an implicit way. The methodology is objective, has a sound mathematical foundation and can be employed for evaluation of any large software system. AFOTEC Software Maturity Evaluation Guide provides details of the data needs and assessment approach to be used for Air Force Systems. The key criterion is to determine whether the unresolved severity 1 and 2 failures can be resolved prior the scheduled OT&E (Operational Test and Evaluation) start date. The approach taken in the AFOTEC Guide is to estimate the time required for resolution based on the current unresolved failures and an average closure rate. This methodology extends and builds upon the current AFOTEC approach by (i) considering the as yet undetected faults in the system, and (ii) using two different estimated fault closure rates. An equivalent problem in commercial applications is to determine readiness for beta test, readiness for release, or readiness for first customer ship. Several studies over the past twenty years have attempted to address this problem for both defense and commercial systems. Most of these have proposed using a decision rule in conjunction with some software failure model to predict software readiness. Others have proposed approaches based on minimizing a predefined cost function.
Derived from text
Computer Programming; Computer Programs; Software Engineering; Systems Engineering

19990019679 Maryland Univ., Dept. of Computer Science, College Park, MD USA
Risk Knowledge Capture in the Riskit Method
Kontio, Jyrki, Maryland Univ., USA; Basili, Victor R., Maryland Univ., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 309-333; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes how measurement data and experience can be captured for risk management purposes. The approach presented is a synthesis of the Riskit risk management method and the Experience Factory. In this paper we describe the main goals for risk knowledge capture and derive a classification of information based on those goals. We will describe the Riskit method

and its integration with the Experience Factory. We will also outline the initial experiences we have gained from applying the proposed approach in practice.
Author
Management Methods; Risk; Operations Research; Reliability; Strategy

19990019680 NASA Goddard Space Flight Center, Greenbelt, MD USA
Requirement Metrics for Risk Identification
Hammer, Theodore, NASA Goddard Space Flight Center, USA; Huffman, Lenore, NASA Goddard Space Flight Center, USA; Wilson, William, NASA Goddard Space Flight Center, USA; Rosenberg, Linda, NASA Goddard Space Flight Center, USA; Hyatt, Lawrence, NASA Goddard Space Flight Center, USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 335-351; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Software Assurance Technology Center (SATC) is part of the Office of Mission Assurance of the Goddard Space Flight Center (GSFC). The SATC's mission is to assist National Aeronautics and Space Administration (NASA) projects to improve the quality of software which they acquire or develop. The SATC's efforts are currently focused on the development and use of metric methodologies and tools that identify and assess risks associated with software performance and scheduled delivery. This starts at the requirements phase, where the SATC, in conjunction with software projects at GSFC and other NASA centers is working to identify tools and metric methodologies to assist project managers in identifying and mitigating risks. This paper discusses requirement metrics currently being used at NASA in a collaborative effort between the SATC and the Quality Assurance Office at GSFC to utilize the information available through the application of requirements management tools.
Derived from text
NASA Programs; Project Management; Quality Control; Software Engineering

19990019681 Naval Research Lab., Center for High Assurance Computer Systems, Washington, DC USA
Applying the SCR Requirements Specification Method to Practical Systems: A Case Study
Bharadwaj, Ramesh, Naval Research Lab., USA; Heitmeyer, Connie, Naval Research Lab., USA; Software Engineering Laboratory Series: Proceedings of the Twenty-First Annual Software Engineering Workshop; Dec. 1996, pp. 353-376; In English; Also announced as 19990019665; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Studies have shown that the majority of errors in software systems are due to incorrect requirements specifications. The root cause of many requirements errors is the imprecision and ambiguity that arise because the software requirements are expressed in natural language. An effective way to reduce such errors is to express requirements in a formal notation. For a number of years, researchers at the Naval Research Laboratory (NRL) have been working on a formal method based on tables to specify the requirements of practical systems. Known as the Software Cost Reduction (SCR) method, this approach was originally formulated to document the requirements of the Operational Flight Program (OFP) for the U.S. Navy's A-7 aircraft. Since SCR's introduction more than a decade ago, many industrial organizations, including Lockheed, Grumman, and Ontario Hydro, have used SCR to specify requirements. Recently, NRL has developed both a formal state machine model to define the SCR semantics and a set of software tools to support analysis and validation of SCR requirements specifications. The tools support consistency and completeness checking, simulation, and model checking.
Derived from text
A-7 Aircraft; Computer Programming; Computer Programs; Natural Language (Computers); Simulation; Software Engineering

19990019692 Old Dominion Univ., Dept. of Electrical and Computer Engineering, Norfolk, VA USA
A Study of Data Compression for Spectral and Hyperspectral Data
Belfore, Lee A., II, Old Dominion Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 48; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Satellite based instrumentation is capable of providing extensive and detailed data for use in weather forecasting and science. The next generation weather satellite will likely deploy Fourier transform spectroscopy (FTS) instrumentation to enhance observing capabilities. The FIS is based on the Michelson interferometer which was used in the nineteenth century by Michelson and Morley in a failed attempt to determine the relative velocity of earth with respect to the ether. by moving one of the mirrors in the interferometer and observing the intensity of the interference patterns through the interferometer as a function of mirror displacement, the Fourier transform of the spectrum can be measured directly. This is true because for each mirror position, one wavelength shows constructive interference while all the rest show destructive interference, assuming that wavelengths at integer multiples are filtered out. The desired spectrum is recovered by taking the inverse Fourier transform of the interferogram. If light is

collected from an astronomical object or earthly specimen, the spectral properties of object can be measured. FTS devices can provide spectral measurements over a broad range of wavelengths and resolutions. Indeed, FTS devices can be constructed to simultaneously collect an array of interferograms over an area, producing an image where each pixel is a spectrum, hence hyperspectral imagery. Indeed, a very large number of bits is necessary to represent an hyperspectral image. This suggests high demands on the satellite electronics to store, process, and downlink the image data. In order to reduce data transmission demands, compression algorithms can be applied to reduce the number of bits that must be transmitted, while retaining the ability to restore the data to an exact replica of the measurements. Unfortunately, the number of bits that must be transmitted after even the most optimistic assumptions for lossless data compression may be insufficient. As a result, lossy data compression algorithms were studied to determine their performance and impact on the measured data. In lossless compression approaches, it was found that spectra compress better than interferograms. However, in order to compute the spectra, a sustained computation rate in the neighborhood of 900 MFLOPS may be necessary to transform the interferograms using the inverse FFT. Using single interferograms and transformed spectra, two lossy compression algorithms were studied: 1) the Rice Algorithm and 2) wavelet compression methodologies. In this study, it was determined that the Lossy Rice algorithm was superior from an information theoretic perspective, resulting in smaller distortions to the data that are being compressed. In addition, two hyperspectral images were available for study. The data forms a three dimensional array, or cube, with two spatial dimensions and one spectral dimension. Different compression performance is achieved depending on how the data is presented to the compression algorithm. Using lossless Rice compression, three cases were investigated with data compressed in units consisting of isospectral images (2D), pixel compression (ID), and spatial/spectral images (2D). It was found that the spatial/spectral images compressed the best, followed by pixel compression, and isospectral images. Finally, it has been observed in the literature and in this study that wavelets can provide a measure of noise suppression to complement compression. This suggests that wavelets may be able to simultaneously provide both data compression and noise suppression resulting in an higher signal quality compared with the original measurements.
Author

Meteorological Satellites; Michelson Interferometers; Satellite Instruments; Weather Forecasting; Emission Spectra; Downlinking; Data Transmission; Data Compression

19990019697 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA

Genetic Algorithm Actuator Placement for Flow Control for Maneuverability

Crossley, William A., Purdue Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 54; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The Aircraft Morphing program is an effort to develop smart devices for aircraft applications, making use of active component technologies. One of the technology areas for this program is Multidisciplinary Design Optimization (MDO), and a focus effort in MDO is to investigate and subsequently develop methods for optimal placement of sensors and actuators for aeroelastic control, flow control and acoustic control. A promising approach for actuator placement is the Genetic Algorithm (GA), a global optimization technique well suited to discrete optimization. Smart devices that can produce a quasi-static shape change in an aircraft wing may be able to provide three-axis flight control; this could eliminate the need for conventional control surfaces. Surfaces like ailerons, flaps, etc., have gaps between the wing and the surfaces that contribute to leakage and protuberance drag and can be a source of aerodynamic noise. The focus of this study was to investigate GA approaches to place discrete actuators on a wing to provide three- axis flight control. The genetic algorithm is a computational representation of natural selection and reproduction observed in biological populations. The mimicry of nature in a GA includes representing points in a design space as if they were individual organisms. Design variables are generally mapped into binary strings that provide the genes of a given design. These strings are then concatenated to form a chromosome representing the traits of an individual design point. The GA works with these binary chromosomes, which allows for discrete optimization. In this application, the binary ” I ” represented an ”on” actuator, while the ”O” represented an ”off ’ actuator. A problem description was developed for a ”three-condition” flight control design, where the number of unique actuators is to be minimized, subject to constraints on the pitch, roll and yaw moments. The first condition is a ”pitch” condition where a limit is placed upon the pitching moment to reflect a pitch capability and limits are placed upon the magnitude of the roll and yaw moments to ensure that the pitching motion is uncoupled from roll and yaw. The other two conditions provide for uncoupled roll and yaw. The genetic algorithm determined actuator placements to meet the pitch condition for a simplified untapered, unswept wing. A 3-D panel code predicted aerodynamic force and moment coefficients for the various actuator placements. Results of this work have illustrated that the GA is suited to the task of actuator placement, and these results have highlighted areas for future research and development of this approach.
Author

Actuators; Aeroelasticity; Control Surfaces; Design Analysis; Flight Control; Multidisciplinary Design Optimization

19990019834 Los Alamos National Lab., Scientific Computing Group, NM USA

Performance Analysis of Large-Scale Applications Based on Wavefront Algorithms

Hoisie, Adolfy, Los Alamos National Lab., USA; Lubeck, Olaf, Los Alamos National Lab., USA; Wasserman, Harvey, Los Alamos National Lab., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 15-20; In English; Also announced as 19990019831

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Much of the previous parallel performance modeling of software-pipelined applications has involved algorithms with one-dimensional recurrences and/or one-dimensional processor decompositions. A key contribution of this paper is the development of an analytic performance model of wavefront algorithms that have recurrences in multiple dimensions and that have been partitioned and pipelined on multidimensional processor grids. We use a ”compact application” called SWEEP3D, a time-independent, Cartesian-grid, single-group, ”discrete ordinates” deterministic particle transport code taken from the DOE Accelerated Strategic Computing Initiative (ASCI) workload. Estimates are that deterministic particle transport accounts for 50-80% of the execution time of many realistic simulations on current DOE systems; this percentage may expand on future 100-TFLOPS systems. Thus, an equally-important contribution of this work is the use of our model to explore SWEEP3D scalability and to show the sensitivity of SWEEP3D to per-processor sustained speed, and MPI latency and bandwidth on future-generation systems. Efforts devoted to improving performance of discrete ordinates particle transport codes extended recently to massively-parallel systems. Research has included models of performance as a function of problem and machine size, as well as other characteristics of both the simulation and the computer system under study. These previous models had limiting assumptions about the computation and/or the target machines. We have introduced a performance model for parallel, multidimensional, wavefront calculations with machine performance characterized using the LogGP framework. The model accounts for overlap in the communication and computation components. The agreement with experimental data is very good under a variety of model sizes, data partitionings, blocking strategies, and on three different parallel architectures. Using our model, we analyzed performance of a deterministic transport code on a hypothetical 100 Tflops future parallel system of interest to ASCI.

Derived from text

Parallel Processing (Computers); Parsing Algorithms; Interprocessor Communication; Message Processing; Discretization (Mathematics); Mathematical Models; Run Time (Computers); Computer Systems Performance; Boltzmann Transport Equation; Transport Theory

19990019838 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Parallelization of ADI Solver FDL3DI Based on New Formulation of Thomas Algorithm

Povitsky, A., Institute for Computer Applications in Science and Engineering, USA; Visbal, M., Air Force Research Lab., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 35-40; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Efficient solution of directionally split banded matrix systems is essential to compact and implicit solvers. When the ADI (Alternating Direction Implicit) schemes are applied to multi-dimensional problems, the operators are separated into one-dimensional components and the scheme is split into two (for 2-D problems) or three (for 3-D problems) steps, each one involving only the implicit operations originating from a single coordinate. A direct solver, known as the Thomas algorithm, which is a version of Gauss Elimination method for banded matrix systems, is used for solution of these systems. Parallelization of the Thomas algorithm is hindered by global spatial data dependencies due to the recurrence of data within a loop. Consequently, processors become idle at the switch from the forward to the backward step of the Thomas algorithm and at the beginning of the computations in the next spatial step. Thus, straightforward parallel implementation of the Thomas algorithm is of the pipelined type and is denoted here as the basic pipelined Thomas algorithm (PTA). There are following reasons for its poor parallelization efficiency: (1) there is no completed data for other computational tasks while processors stay idle; and (2) communications control computational tasks as either the forward step coefficients or the backward step solution must be obtained from the neighboring processors for the beginning of the forward or the backward step computations. In order to avoid pipelining, some parallel Thomas algorithms include the reduction of an O(N(sub tot)) system of equations on P ”slave” processors, the solution of the reduced system of size O(P) on the ”master” processor, broadcast this solution to the ”slaves”, and simultaneously compute the final solution on P processors. This algorithm includes global communications of ”slave-master” type and additional computations on each ”slave” processor. Implementation of internal boundary conditions eliminates far-field data dependencies, allowing band matrix systems to be solved independently on each processor. However, modification of either the finite-difference approximation or the implicitness of the scheme due to interface boundary conditions can deteriorate accuracy, stability and convergence properties relative to the original serial method. We propose a way to reduce parallelization penalty of the basic PTA where the numerical algorithm remains the same as the serial one and only the order of computations is changed. to overcome the first problem with the basic PTA, a new pipelined Thomas algorithm has been developed. This algorithm is designed for parallel solution of banded matrix linear systems.

We called it the Immediate Backward pipelined Thomas Algorithm (IB-PTA). This algorithm provides exactly the same solution as the serial Thomas algorithm. The advantage of the IB-PTA over the basic PTA is that some lines have been completed by the backward step of the Thomas algorithm before the processors are idle. In non-linear and multi-dimensional problems the IB-PTA may be used for other computational tasks while processors are idle from the Thomas algorithm computations in the current direction. to overcome the second problem with the basic PTA and to make the IB-PTA feasible, the scheduling algorithm has been developed. The static schedule of computations and communication has been assigned before processors run the 3-D ADI solver. The advantage of ”control by schedule” over ”control by communications” is that processors do not wait to receive necessary data. Instead, processors compute other tasks and switch to receive data only when these data are available on neighboring processors and necessary in a current processor. Thus, the 3-D ADI solver runs on processors in a time-staggered manner without the idle time of global synchronization, i.e., the first processor completes its computational tasks first at each spatial step. In turn, the optimal number of solved lines per message is greater than that for the basic PTA and, consequently the overall latency time is reduced. A theoretical model of parallelization efficiency of the 3-D ADI code based on the proposed algorithm is presented. Our model is based on the idealized multicomputer parallel architecture model. Low-level hardware details such as memory hierarchies and the topology of the interconnection network are not introduced in the model. This model is used to define the optimal number of solved lines per message, to provide asymptotic analysis, to estimate parallelization efficiency for a large number of processors which are not available yet, and to compare the proposed algorithm with the basic one. First, this model is used for a cubic global domain (equal number of grid nodes in all directions). Then an optimal partitioning for a global domain with unequal number of grid nodes in different directions is obtained by this model. to provide a unified approach for various MIMD computers, results are presented in terms of non-dimensional ratios between communication latency and transfer times to the computation time per grid node. Here we implement this methodology to parallelization of the target code FDL3DI, which is based on the ADI method, so as to provide exactly the same solution as the original serial solver and keep a low parallelization penalty.
Derived from text

Alternating Direction Implicit Methods; Parallel Processing (Computers); Matrices (Mathematics); Scheduling; Gaussian Elimination; Message Processing; Concurrent Processing; Run Time (Computers); Algorithms; Computation

19990019839 Wichita State Univ., Wichita, KS USA

A Compact High-Order Unstructured Grids Method for the Solution of Euler Equations

Agarwal, R. K., Wichita State Univ., USA; Halt, D. W., Ford Motor Co., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 41-47; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Two compact higher-order methods are presented for solving the Euler equations in two dimensions. The flow domain is discretized by triangles. The methods use a characteristic-based approach with a cell-centered finite-volume method. Polynomials of order 0 through 3 are used in each cell to represent the conservation flow variables. Solutions are demonstrated to achieve up to fourth order accuracy. Computations are presented for a variety of fluid flow applications. Numerical results demonstrate a substantial gain in efficiency using compact higher-order elements over the lower-order elements.
Author

Euler Equations of Motion; Ringleb Flow; Finite Volume Method; Unstructured Grids (Mathematics); Two Dimensional Models; Mathematical Models; Computation

19990019841 NASA Goddard Space Flight Center, Greenbelt, MD USA

The SGI/CRAY T3E: Experiences and Insights

Bernard, Lisa Hamet, NASA Goddard Space Flight Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 53-58; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The focus of the HPCC Earth and Space Sciences (ESS) Project is capability computing - pushing highly scalable computing testbeds to their performance limits. The drivers of this focus are the Grand Challenge problems in Earth and space science: those that could not be addressed in a capacity computing environment where large jobs must continually compete for resources. These Grand Challenge codes require a high degree of communication, large memory, and very large I/O (throughout the duration of the processing, not just in loading initial conditions and saving final results). This set of parameters led to the selection of an SGI/Cray T3E as the current ESS Computing Testbed. The T3E at the Goddard Space Flight Center is a unique computational resource within NASA. As such, it must be managed to effectively support the diverse research efforts across the NASA research community yet still enable the ESS Grand Challenge Investigator teams to achieve their performance milestones, for which the system was intended. to date, all Grand Challenge Investigator teams have achieved the 10 GFLOPS milestone, eight of nine have achieved the 50 GFLOPS milestone, and three have achieved the 100 GFLOPS milestone. In addition, many technical papers have been published highlighting results achieved on the NASA T3E, including some at this Workshop. The successes enabled by the NASA T3E computing environment are best illustrated by the 512 PE upgrade funded by the NASA Earth Science Enterprise earlier this

year. Never before has an HPCC computing testbed been so well received by the general NASA science community that it was deemed critical to the success of a core NASA science effort. NASA looks forward to many more success stories before the conclusion of the NASA-SGI/Cray cooperative agreement in June 1999.
Derived from text
Cray Computers; Computer Systems Performance; Systems Management

19990019842 MRJ Technology Solutions, Moffett Field, CA USA
The Metacenter Roadmap
Hultquist, Mary, MRJ Technology Solutions, USA; Jones, James Patton, MRJ Technology Solutions, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 59-63; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

As scientists increasingly take advantage of high performance computing in their research, the computational resources at any given site are not always adequate for the emerging needs of the scientific community. The focus of the NASA Metacenter Project is to provide these resources by linking together multiple supercomputing sites while giving the scientific user a single interface to access the increased computing capabilities.
Author
Supercomputers; Project Management; NASA Programs; Computer Systems Design

19990019843 Universities Space Research Association, CESDIS, Greenbelt, MD USA
The Programming Environment on a Beowulf Cluster
Merkey, Phil, Universities Space Research Association, USA; Becker, Donald, Universities Space Research Association, USA; Hendriks, Erik, Universities Space Research Association, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 65; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

The Beowulf Project at Goddard Space Flight Center is a software development project which focuses on enhancements to the Linux operating system and a software support for high speed networks to support cluster computing. Making this software freely available on the Web contributes to the NASA Beowulf project's goals of providing cost effective, high-performance computational resources in the form of cluster computers built entirely from PC-marketplace COTS components. Several large clusters have been constructed that have obtained sustained performance of 10 Gflops. However, most systems being installed at NASA sites, government labs and universities are modest systems of 16 to 64 processors and are being constructed to address the computational requirements of an increasing diverse community. This talk will focus on the programming environment provided by a Beowulf cluster and will argue that programming a Beowulf cluster requires an equivalent level of effort as programming a vendor supplied MPP. A cluster computer is more tightly coupled than a network of workstations. This enables configurations that are easier to maintain and easier to program. The software for Beowulf clusters is based on the integration of freely available system software and programming tools. As such the programmer is presented with a generic, portable, vendor independent multiprocessor; Beowulf clusters support the two most popular message passing packages PVM and MPI along with BSP and a distributed shared memory package developed at Goddard. Even though MPI and PVM span the space between NOWs and MPPS, key parameters such as processor speed, task granularity, communication latency and bandwidth affect performance tuning and scaling. The system software and programming tools determine the user's perception of the multiprocessor as a single machine. Together these makeup the "programming environment". This talk addresses these different programming models and compares them to their counterparts on a tightly coupled MPP and to a loosely coupled NOW. In addition, the pragmatic issues of program development, portability, debugging, scaling and performance tuning will be discussed. These issues will be considered from an application programmer's perspective with illustrations drawn from experiences obtained by working with the Earth and space sciences applications at Goddard.
Author
Programming Environments; Computer Programming; Computer Systems Performance; Computer Systems Design; Computer Networks

19990019844 Delaware Univ., CAPSL, Newark, DE USA
Multithreaded Programming in EARTH: Meeting the Challenges of High Performance Computing
Heber, Gerd, Delaware Univ., USA; Biswas, Rupak, MRJ Technology Solutions, USA; Gao, Guang R., Delaware Univ., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 67-72; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A key problem in the design and use of modern high performance computer architectures is latency: how many CPU-cycles does it take to fetch a datum from a local or remote (involving a network device) memory, or to synchronize two activities in different nodes? This is a serious issue in getting performance out of large-scale machines with deep memory hierarchies and a large number of processing nodes. Fine-grain multithreaded architectures strive to hide this latency through rapid switching between different threads of computation. Another challenge is to increase the number of instructions which can be issued per cycle in a modern superscalar processor. Superscalar techniques (branch prediction, speculative execution, data/dependence speculation, out-of-order execution, register renaming, etc.) require a tremendous amount of complex hardware and it is questionable whether a sustained issue rate of two instructions per cycle justifies the hardware investments. On the other hand, as pointed out it is also not clear how a compiler can make the best use of these hardware capabilities. In addition to its latency hiding capabilities, multithreading can serve as a basis for a multiple-issue uniprocessor as it has been proposed recently.
Derived from text
Computer Systems Design; Computer Systems Performance; Architecture (Computers); Programming Environments

19990019846 DYNACS Engineering Co., Inc., Brook Park, OH USA
An Experiment in Scientific Code Semantic Analysis
Stewart, Mark E. M., DYNACS Engineering Co., Inc., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 79-83; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper concerns a procedure that analyzes aspects of the meaning or semantics of scientific and engineering code. This procedure involves taking a user's existing code, adding semantic declarations for some primitive variables, and parsing this annotated code using multiple, distributed expert parsers. These semantic parsers are designed to recognize formulae in different disciplines including physical and mathematical formulae and geometrical position in a numerical scheme. The parsers will automatically recognize and document some static, semantic concepts and locate some program semantic errors. Results are shown for a subroutine test case and a collection of combustion code routines. This ability to locate some semantic errors and document semantic concepts in scientific and engineering code should reduce the time, risk, and effort of developing and using these codes.
Author
Computer Programs; Parsing Algorithms; Semantics; Subroutines

19990020947 National Inst. of Standards and Technology, Software Diagnostics and Conformance Testing Div., Gaithersburg, MD USA
Using Model Checking to Generate Tests from Specifications
Ammann, Paul E., George Mason Univ., USA; Black, Paul E., National Inst. of Standards and Technology, USA; Majurski, William, National Inst. of Standards and Technology, USA; Nov. 1998; 18p; In English
Report No.(s): PB99-118812; NISTIR-6166; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The authors apply a model checker to the problem of test generation using a new application of mutation analysis. The authors define syntactic operators, each of which produces a slight variation on a given model. The operators define a form of mutation analysis at the level of the model checker specification. A model checker generates counterexamples which distinguish the variations from the original specification. The counterexamples can easily be turned into complete test cases, that is, with inputs and expected output. The authors define two classes of operators: those that produce test cases from which a correct implementation must differ, and those that produce test cases with which it must agree.
NTIS
Mutations; Error Detection Codes; Specifications

19990020987 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Integrated Test Environment for Distributed Applications
Chu, Huey-Der, Newcastle-upon-Tyne Univ., UK; Dobson, John Edward, Newcastle-upon-Tyne Univ., UK; Feb. 1998; 32p; In English
Report No.(s): PB99-118556; TRS-621; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a statistics-based integrated test environment (SITE) for testing distributed applications. to address two crucial issues in software testing, when to stop testing and how good the software is after testing, SITE provides automatic support for test execution, test development, test failure analysis, test measurement, test management and test planning.
NTIS
Program Verification (Computers); Software Engineering; Statistical Tests; Distributed Processing

19990020988 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Graphical System for Parallel Software Development
Allen, R. S., Newcastle-upon-Tyne Univ., UK; Jul. 1998; 172p; In English
Report No.(s): PB99-118549; TRS-640; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

This thesis investigates techniques for the graphical specification of parallel programs, using an architecture-independent graph-based notation representing the design of the program, combined with conventional sequential languages. Automatic code generation is used to translate the graph program into executable code suitable for different parallel architectures. to overcome the differing performance characteristics of parallel architectures, methods for the graphical adjustment of granularity are proposed and investigated, and an encompassing parallel design environment is presented.
NTIS
Software Engineering; Parallel Programming; Graphical User Interface; Programming Languages; Computer Graphics

19990020989 Newcastle Polytechnic, Dept. of Computing Science, Newcastle-upon-Tyne, UK
Integration of Requirements Analysis and Safety Analysis for Safety-Critical Software
deLemos, R., Newcastle Polytechnic, UK; Saeed, A., Newcastle Polytechnic, UK; Anderson, T., Newcastle Polytechnic, UK; May 1998; 38p; In English
Report No.(s): PB99-118523; TRS-630; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, the authors present an approach for integrating the activities of requirements analysis and safety analysis. The aim of safety analysis is to determine the risk associated with requirements specifications and assess whether this is acceptable within the context of system risk. The advantage of conducting the safety analysis during the early phases of software development is that safety related errors are less likely to propagate through to subsequent phases of development. The applicability of the proposed approach is demonstrated by conducting the safety analysis of an example based on a train set crossing. The example illustrates how the approach to safety analysis supports verification within a formal model of the train set system and how the validation of the formal model is performed.
NTIS
Computer Programming; Software Engineering; Systems Engineering; Safety

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990019499 NASA, Washington, DC USA
NASA Year 2000 (Y2K) Program Plan ***Final Report***
Jun. 15, 1998; 28p; In English
Report No.(s): PB98-165095; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA initiated the Year 2000 (Y2K) program in August 1996 to address the challenges imposed on Agency software, hardware, and firmware systems by the new millennium. The Agency program is centrally managed by the NASA Chief Information Officer, with decentralized execution of program requirements at each of the nine NASA Centers, Headquarters and the Jet Propulsion Laboratory. The purpose of this Program Plan is to establish Program objectives and performance goals; identify Program requirements; describe the management structure; and detail Program resources, schedules, and controls. Project plans are established for each NASA Center, Headquarters, and the Jet Propulsion Laboratory.
Derived from text
NASA Programs; Goals; Project Planning; Firmware

19990019511 North Carolina Univ., Dept. of Computer Science, Chapel Hill, NC USA
Mechanisms for Scalable Object Sharing in MIMD Multiprocessing Systems ***Final Report, 15 May 1995 - 14 May 1998***
Anderson, James H.; Jul. 09, 1998; 6p; In English
Contract(s)/Grant(s): DAAH04-95-1-0323
Report No.(s): AD-A357996; ARO-34162.17-MA-Y1P; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this project, object sharing schemes for both real time and non-real time concurrent systems have been investigated. A particular focus has been uniprocessor and shared memory multiprocessor systems with processors that are multiprogrammed (many processes executing on the same processor). Much of the work in this project has been concerned with lock free and wait free shared object implementations. Such implementations are not lock based, and therefore are immune to performance problems

associated with process preemptions in multiprogrammed systems. A variety of new algorithmic techniques for efficiently implementing concurrent objects have been developed and tested in this project. In addition, research has been conducted on schedulability tests for use in real time systems in which the proposed object sharing techniques are used.
DTIC
Real Time Operation; Multiprogramming; Multiprocessing (Computers); Algorithms

19990019517 Brown Univ., Providence, RI USA
Algorithms for Image Compression, Distributed Communication Networks and Distributed Resource Allocation ***Final Report, 15 Jun. 1995 - 30 Jun. 1998***
Gidas, Basilis; Ghosh, Sumit; Sep. 30, 1998; 14p; In English
Contract(s)/Grant(s): DAAH04-95-1-0101
Report No.(s): AD-A357863; ARO-34383.5-MA-FRI; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
During the period of the grant, 6/15/95-6/30/98, we investigated problems in major areas: (1) Image Analysis Tasks, including image interpretation, object recognition, and tracking; (2) Distributed communication networks and distributed resource allocation. In the former area, we developed and explored three paradigms: hierarchical compositional models; deformable templates for a host of applications including medical tasks; and HMM/deformable templates for tracking and recognition of moving objects. In the later area, we developed a novel scheme for managing buffer overflows; a new framework for network security; and a mathematical framework for synthesizing distributed algorithms.
DTIC
Data Processing; Algorithms; Image Analysis; Communication Networks; Distributed Processing

19990019585 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Beagle: A Resource Allocation Protocol for Advanced Services Internet
Fisher, Allan; Steenkiste, Peter; Oct. 1998; 18p; In English
Contract(s)/Grant(s): N66001-96-C-8528
Report No.(s): AD-A356038; CMU-CS-98-150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
There is an emerging class of multi-party, multimedia, multi-flow applications (e.g distributed, interactive simulation) that have a high level structure that imposes dependencies between resource allocations for flows within the application. These applications are also capable of making intelligent decisions on how resource allocation should be controlled within the application. The development of such applications is enabled by an Internet that is evolving towards providing ubiquitous, value added, customizable services. Resource management mechanisms can exploit the high level structure of applications to achieve better quality for applications and improved resource efficiency for the network. This paper describes a resource allocation protocol that allows this class of applications to optimize resource allocation using high level application domain knowledge. The Beagle protocol uses an application mesh as the basic unit of resource allocation. The application mesh is a logical entity that encapsulates all the computation and communication resources that are allocated to an application at end points and inside the network. Beagle provides support for allocating computational resources and for delegates; downloadable code fragments that can be used to customize resource management during runtime. Beagle provides a way for applications to optimize resource allocation by expressing a wide range of sharing policies to share resources amongst its flows. Beagle also provides support for aggregation of resource allocation at various granularities. This paper discusses the design of the Beagle components, describes a prototype implementation and presents preliminary performance evaluation results.
DTIC
Resource Allocation; Protocol (Computers); Internets; Encapsulating

19990019641 Wisconsin Univ., Dept. of Computer Sciences, Madison, WI USA
Blizzard and Paradyn: Infrastructure and Scalable Tools for Multi-Paradigm Parallel Computers ***Final Report, 30 Aug. 1994 - 8 Jan. 1998***
Miller, Barton P.; Larus, James R.; Hill, Mark D.; Wood, David A.; Apr. 03, 1998; 14p; In English
Contract(s)/Grant(s): F33616-94-1-1526; AF Proj. B550
Report No.(s): AD-A356313; AFRL-SN-WP-TR-1998-1110; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Blizzard and Paradyn project has built and distributed software infrastructure and tools for developing and studying multiple paradigm, parallel programs on existing and future parallel computers. The Blizzard shared memory substrate and Paradyn performance tools enable researchers to develop and evaluate parallel applications languages, compilers, and run time systems for current and future machines. We use this infrastructure to evaluate innovative hardware ideas and influence the direction of future machines. Tempest is an interface between user level software and a system on which to implement communication, includ-

ing transparent shared memory, extensible shared memory, message passing, and hybrid forms. Applications or compilers are not limited to a single hardware provided paradigm. Blizzard is an implementation of the Tempest interface for existing message passing machines. This software only solution performs well enough that Blizzard programs compete with native software. Paradyn is based on a new, inherently scalable dynamic instrumentation facility for detailed profiling of long running, very large parallel programs. Paradyn monitors instrumentation cost and automatically controls its dynamic instrumentation. Paradyn supports an interface for high level parallel languages presenting performance data at the message level, allowing a programmer to peel back layers to understand low level operations in terms of high level features.
DTIC
Parallel Processing (Computers); Computer Systems Programs; Architecture (Computers); Applications Programs (Computers)

19990019646 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Analyzing Threats to Army Tactical Internet Systems, *from Nov. 1997 - Apr. 1998*
Haworth, Robert L.; Oct. 1998; 71p; In English
Contract(s)/Grant(s): DAAB07-98-C-E601
Report No.(s): AD-A356285; ARL-CR-423; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The risk faced by the Army Tactical Internet (ATI) is a function of four elements: vulnerabilities, threats, operational impact, and safeguards (countermeasures). It is clear that the vulnerability of the U.S. information infrastructure is growing more acute. Not only are more activities becoming dependent on information systems, but these information systems are becoming more open to outsiders and, in the process, adopting technologies that make them less secure. Security technologies are themselves advancing, but the sophistication, availability, and ease of use of hacker tools is advancing faster. The consequences of any attack on the ATI include the compromise of information, deception, and denial/loss. Impact is determined by the operational context in which the damage occurs. The degree of potential damage to ATI systems will guide operational users, in conjunction with materiel developers, in selecting appropriate safeguards. The number and type(s) of safeguards employed should balance operational integrity, systems security, and cost concerns in a risk-managed environment.
DTIC
Computer Information Security; Internets; Information Systems; Data Processing

19990019651 Naval Postgraduate School, Monterey, CA USA
The Use and Run-Time Overhead of CORBA in MSHN Project
Duman, Alpay; Sep. 1998; 92p; In English
Report No.(s): AD-A356260; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The goal of the Management System for Heterogeneous Networks (MSHN) is to support the execution of multiple, disparate, adaptive applications in a dynamic, distributed heterogeneous environment. MSHN consists of multiple eventually replicated, distinct distributed components that themselves execute in a heterogeneous environment. This thesis answers the question: Is the performance of the Common Object Request Broker Architecture (CORBA) sufficient to support MSHN's inter-component communication? This research focuses on the applicability of communication mechanisms from the CORBA 2.2 specification to MSHN. After a careful literature search, we identified four mechanisms for further examination: the Static Invocation Interface (SII), the Dynamic Invocation Interface (DII), the Typed Event Service and the Untyped Event Service. Our rationale for selecting these mechanisms includes scalability, flexibility, extensibility, portability, maintainability, and manageability for the MSHN system. We implemented a prototype of MSHN's communication infrastructure using these four mechanisms, and measured their run-time performance. The overhead added by CORBA for distributed component communication of MSHN system varied from a low of 10.6 milliseconds per service request to a high of 279.1 milliseconds per service request on UltraSparc10 boxes with Solaris 2.6 Operating System and connected via 100 Mbits/sec Ethernet. We therefore conclude that using CORBA mechanisms will not only substantially decrease the amount of time required to implement MSHN, but if used appropriately they will not substantially degrade performance.
DTIC
Distributed Processing; Object-Oriented Programming; Computer Networks; Management Systems; Architecture (Computers)

19990019653 New Jersey Inst. of Tech., Dept. of Electrical Engineering, Newark, NJ USA
Design of the Communications Interface for a Very High Performance Computer
Zydallis, Jesse B.; Oct. 14, 1998; 84p; In English
Report No.(s): AD-A356247; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
PetaFLOPS computing power is the newest goal of Federal Government agencies, in the increasingly active supercomputer field. to obtain this performance goal by the year 2007, sophisticated parallel processing designs are required. to effectively create

network interfaces/routers for interprocessor communications in such computer systems, it requires optimal hardware and software codesigns. An interface is presented for the NJIT New Millennium Computing Point Design, a system that targets 100 Tera-FLOPS performance by the year 2005. The router handles store and forward switching and wormhole routing for the system.
DTIC
Parallel Processing (Computers); Computer Networks; Human-Computer Interface; Interprocessor Communication; Computer Programs

19990019724 Norfolk State Univ., VA USA
Storage Area Networking at ASD, NASA Langley Research Center
Shah, Shantilal N., Norfolk State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 84; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The project was to study different technologies available on the market in Storage Area Networking. Six different options were studied. They are: 1) Fibre Channel Arbitrator Loop (FC-AL); 2) Switched Fabric (Fibre channel network with switches); 3) Gigabit Ethernet; 4) Hippi-800 (Serial Hippi with Fibre channel); 5) Hippi-6400 (GSN); and 6) ATM. The existing storage area networking consists of two SGI storage devices, two Sun storage devices and 11 TB tape drive for archival purpose. The existing optimal transfer rate between different storage area is 9 MBps. Due to increased demand of the users and 10 to 50 fold expected increase in data storage, the desired optimal rate of data transfer is about 100 MBps. Two vendors made the presentation and one of them, DataDirect, installed the net working for trial basis. Other vendor ODS/ESSENTIAL is also planning to install their networking equipment in a near future for trial basis. Based on findings and comparisons of above technologies with respect to transfer rate and cost, a conclusion was reached that either Switched Fabric or the Hippi-800 was the best storage area networking solution for this installation.
Author
Computer Networks; Data Storage; Data Transmission; Fibers; Switches

19990019845 MRJ Technology Solutions, Moffett Field, CA USA
An Evaluation of Automatic Parallelization Tools
Frumkin, Michael, MRJ Technology Solutions, USA; Hribar, Michelle, MRJ Technology Solutions, USA; Jin, Haoqiang, MRJ Technology Solutions, USA; Waheed, Abdul, MRJ Technology Solutions, USA; Yan, Jerry, MRJ Technology Solutions, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 73-78; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Porting applications to new high performance parallel and distributed computing platforms is a challenging task. Since writing parallel code by hand is time consuming and costly, ideally, porting codes would be automated by using some parallelization tools and compilers. In this paper, we evaluate three parallelization tools and compilers: 1) CAPTools: an interactive computer aided parallelization tool that generates message passing code; 2) the Portland Group's HPF compiler; and 3) using compiler directives with the native FORTRAN77 compiler on the SGI Origin2OOO. We use the NAS Parallel Benchmarks and a computational fluid dynamics application, ARC3D.
Author
Computer Systems Performance; Parallel Processing (Computers); Compilers; Parallel Programming

19990019851 NASA Ames Research Center, Moffett Field, CA USA
Parallelizing OVERFLOW: Experiences, Lessons, Results
Jespersen, Dennis C., NASA Ames Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 95-100; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The computer code OVERFLOW is widely used in the aerodynamic community for the numerical solution of the Navier-Stokes equations. Current trends in computer systems and architectures are toward multiple processors and parallelism, including distributed memory. This report describes work that has been carried out by the author and others at Ames Research Center with the goal of parallelizing OVERFLOW using a variety of parallel architectures and parallelization strategies. This paper begins with a brief description of the OVERFLOW code. This description includes the basic numerical algorithm and some software engineering considerations. Next comes a description of a parallel version of OVERFLOW, OVERFLOW/PVM, using PVM (Parallel Virtual Machine). This parallel version of OVERFLOW uses the manager/worker style and is part of the standard OVERFLOW distribution. Then comes a description of a parallel version of OVERFLOW, OVERFLOW/MPI, using MPI (Message

Passing Interface). This parallel version of OVERFLOW uses the SPMD (Single Program Multiple Data) style. Finally comes a discussion of alternatives to explicit message-passing in the context of parallelizing OVERFLOW.
Author
Parallel Processing (Computers); Distributed Memory; Message Processing; Architecture (Computers); Parallel Programming; Applications Programs (Computers); Navier-Stokes Equation

19990019852 NASA Ames Research Center, Moffett Field, CA USA
Performance and Application of Parallel OVERFLOW Codes on Distributed and Shared Memory Platforms
Djomehri, M. Jahed, Calspan Corp., USA; Rizk, Yehia M., NASA Ames Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 103; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

The presentation discusses recent studies on the performance of the two parallel versions of the aerodynamics CFD code, OVERFLOW_MPI and _MLP. Developed at NASA Ames, the serial version, OVERFLOW, is a multidimensional Navier-Stokes flow solver based on overset (Chimera) grid technology. The code has recently been parallelized in two ways. One is based on the explicit message-passing interface (MPI) across processors and uses the _MPI communication package. This approach is primarily suited for distributed memory systems and workstation clusters. The second, termed the multi-level parallel (MLP) method, is simple and uses shared memory for all communications. The _MLP code is suitable on distributed-shared memory systems. For both methods, the message passing takes place across the processors or processes at the advancement of each time step. This procedure is, in effect, the Chimera boundary conditions update, which is done in an explicit ”Jacobi” style. In contrast, the update in the serial code is done in more of the ”Gauss-Sidel” fashion. The programming efforts for the _MPI code is more complicated than for the _MLP code; the former requires modification of the outer and some inner shells of the serial code, whereas the latter focuses only on the outer shell of the code. The _MPI version offers a great deal of flexibility in distributing grid zones across a specified number of processors in order to achieve load balancing. The approach is capable of partitioning zones across multiple processors or sending each zone and/or cluster of several zones into a single processor. The message passing across the processors consists of Chimera boundary and/or an overlap of ”halo” boundary points for each partitioned zone. The MLP version is a new coarse-grain parallel concept at the zonal and intra-zonal levels. A grouping strategy is used to distribute zones into several groups forming sub-processes which will run in parallel. The total volume of grid points in each group are approximately balanced. A proper number of threads are initially allocated to each group, and in subsequent iterations during the run-time, the number of threads are adjusted to achieve load balancing across the processes. Each process exploits the multitasking directives already established in Overflow.
Author
Parallel Processing (Computers); Parallel Programming; Distributed Memory; Applications Programs (Computers); Computer Systems Performance; Run Time (Computers)

19990019853 Sierra Software, Inc., Moffett Field, CA USA
Multi-Level Parallelism (MLP): A Simple Highly Scalable Approach to Parallelism
Taft, James R., Sierra Software, Inc., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 105-110; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

High Performance Computing (HPC) platforms are continually evolving toward systems with larger and larger CPU counts. For the past several years these systems almost universally utilize standard off-the shelf microprocessors for the heart of their design. Virtually all hardware vendors have adopted this design approach as it dramatically reduces costs for building large systems. Unfortunately, systems built from commodity parts usually force researchers to embark upon large code conversion efforts in order to take advantage of any potentially high levels of performance. Historically, this has been a daunting and often unsuccessful task. For those who have attempted it, the effort often consumed many man-years of effort. Codes used in heavy production environments were often deemed to be impossible to convert before the effort was even begun. Recent developments at the NASA AMES Research Center’s NAS Division have demonstrated that the new generation of NUMA based Symmetric Multi-Processing systems (SMPs), such as the Silicon Graphics Origin 2000, can successfully execute legacy vector oriented CFD production codes at sustained rates far exceeding processing rates possible on dedicated 16 CPU Cray C90 systems. This high level of performance is achieved via shared memory based Multi-Level Parallelism (MLP). This programming approach is distinct from the message passing paradigm of MPI (Message Passing Interface). It offers parallelism at both the fine and coarse grained level, with communication latencies that are approximately 50-100 times lower than typical MPI implementations on the same platform. Such latency reductions offer the promise of performance scaling to very large CPU counts. The method draws on, but is also distinct from, the newly defined OpenMP specification, which uses compiler directives to support a limited subset of multi-level parallel operations. The NAS MLP method is general, and applicable to a large class of NASA CFD codes. The MLP methodology

and techniques are described below. The method is discussed in general terms, followed by discussion of the technique as applied to the OVERFLOW CFD code. Finally, performance results are presented for a 35 million point problem executed on Origin 2000 systems varying in size from 8 to 256 CPUs. Over 20 GFLOPS was ultimately obtained.
Author
Multiprocessing (Computers); Parallel Programming; Central Processing Units; Microprocessors; Applications Programs (Computers); Run Time (Computers); Computer Systems Performance

19990019862 Lockheed Martin Aeronautical Systems, Marietta, GA USA
Development and Validation of a Fast, Accurate and Cost-Effective Aeroservoelastic Method on Advanced Parallel Computing Systems
Goodwin, Sabine A., Lockheed Martin Aeronautical Systems, USA; Raj, P., Lockheed Martin Aeronautical Systems, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 157-162; In English; Also announced as 19990019831
Contract(s)/Grant(s): NAS2-14092; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Progress to date towards the development and validation of a fast, accurate and cost-effective aeroelastic method for advanced parallel computing platforms such as the IBM SP2 and the SGI Origin 2000 is presented in this paper. The ENSAERO code, developed at the NASA-Ames Research Center has been selected for this effort. The code allows for the computation of aeroelastic responses by simultaneously integrating the Euler or Navier-Stokes equations and the modal structural equations of motion. to assess the computational performance and accuracy of the ENSAERO code, this paper reports the results of the Navier-Stokes simulations of the transonic flow over a flexible aeroelastic wing body configuration. In addition, a forced harmonic oscillation analysis in the frequency domain and an analysis in the time domain are done on a wing undergoing a rigid pitch and plunge motion. Finally, to demonstrate the ENSAERO flutter-analysis capability, aeroelastic Euler and Navier-Stokes computations on an L-1011 wind tunnel model including pylon, nacelle and empennage are underway. All computational solutions are compared with experimental data to assess the level of accuracy of ENSAERO. As the computations described above are performed, a meticulous log of computational performance in terms of wall clock time, execution speed, memory and disk storage is kept. Code scalability is also demonstrated by studying the impact of varying the number of processors on computational performance on the IBM SP2 and the Origin 2000 systems.
Author
Applications Programs (Computers); Parallel Processing (Computers); Navier-Stokes Equation; Euler Equations of Motion; Computation; Transonic Flow; Body-Wing Configurations; Run Time (Computers)

19990019874 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Robust and Scalable Software Library for Parallel Adaptive Refinement on Unstructured Meshes
Lou, John Z., Jet Propulsion Lab., California Inst. of Tech., USA; Norton, Charles D., Jet Propulsion Lab., California Inst. of Tech., USA; Cwik, Thomas A., Jet Propulsion Lab., California Inst. of Tech., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 241-246; In English; Also announced as 19990019831
Contract(s)/Grant(s): NAS7-100; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The design and implementation of Pyramid, a software library for performing parallel adaptive mesh refinement (PAMR) on unstructured meshes, is described. This software library can be easily used in a variety of unstructured parallel computational applications, including parallel finite element, parallel finite volume, and parallel visualization applications using triangular or tetrahedral meshes. The library contains a suite of well-designed and efficiently implemented modules that perform operations in a typical PAMR process. Among these are mesh quality control during successive parallel adaptive refinement (typically guided by a local-error estimator), parallel load-balancing, and parallel mesh partitioning using the ParMeTiS partitioner. The Pyramid library is implemented in FORTRAN 90 with an interface to the Message-Passing Interface (MPI) library, supporting code efficiency, modularity, and portability. An EM waveguide filter application, adaptively refined using the Pyramid library, is illustrated.
Author
Grid Generation (Mathematics); Unstructured Grids (Mathematics); Subroutine Libraries (Computers); Software Development Tools; Parallel Processing (Computers)

19990019877 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Portability and Cross-Platform Performance of an MPI-Based Parallel Polygon Renderer
Crockett, Thomas W., Institute for Computer Applications in Science and Engineering, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 251-256; In English; Also announced as 19990019831
Contract(s)/Grant(s): NAS1-18605; NAS1-19480; NAS1-97046; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Visualizing the results of computations performed on large-scale parallel computers is a challenging problem, due to the size of the datasets involved. One approach is to perform the visualization and graphics operations in place, exploiting the available parallelism to obtain the necessary rendering performance. Over the past several years, we have been developing algorithms and software to support visualization applications on NASA's parallel supercomputers. Our results have been incorporated into a parallel polygon rendering system called PGL. PGL was initially developed on tightly-coupled distributed-memory message-passing systems, including Intel's iPSC/860 and Paragon, and IBM's SP2. Over the past year, we have ported it to a variety of additional platforms, including the HP Exemplar, SGI Origin2OOO, Cray T3E, and clusters of Sun workstations. In implementing PGL, we have had two primary goals: cross-platform portability and high performance. Portability is important because (1) our manpower resources are limited, making it difficult to develop and maintain multiple versions of the code, and (2) NASA's complement of parallel computing platforms is diverse and subject to frequent change. Performance is important in delivering adequate rendering rates for complex scenes and ensuring that parallel computing resources are used effectively. Unfortunately, these two goals are often at odds. In this paper we report on our experiences with portability and performance of the PGL polygon renderer across a range of parallel computing platforms.
Author
Parallel Computers; Scientific Visualization; Distributed Memory; Interprocessor Communication; Software Engineering; Computation

19990019878 Pratt and Whitney Aircraft, East Hartford, CT USA
Parallel Visualization Co-Processing of Overnight CFD Propulsion Applications
Edwards, David E., Pratt and Whitney Aircraft, USA; Haimes, Robert, Massachusetts Inst. of Tech., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 257-262; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

An interactive visualization system pV3 is being developed for the investigation of advanced computational methodologies employing visualization and parallel processing for the extraction of information contained in large-scale transient engineering simulations. Visual techniques for extracting information from the data in terms of cutting planes, iso-surfaces, particle tracing and vector fields are included in this system. This paper discusses improvements to the pV3 system developed under NASA's Affordable High Performance Computing project.
Author
Parallel Processing (Computers); Scientific Visualization; Computerized Simulation; Computer Techniques

19990021028 San Diego Univ., Mathematics and Computer Science Dept., San Diego, CA USA
Educational Applications on the World Wide Web: An Example Using Amphion
Friedman, Jane, San Diego Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

There is a great deal of excitement about using the internet and the World Wide Web in education. There are such exciting possibilities and there is a wealth and variety of material up on the web. There are however many problems, problems of access and resources, problems of quality -- for every excellent resource there are many poor ones, and there are insufficiently explored problems of teacher training and motivation. For example, Wiesenmayer and Meadows report on a study of 347 West Virginia science teachers. These teachers were enrolled in a week-long summer workshop to introduce them to the internet and its educational potential. The teachers were asked to review science sites as to overall quality and then about their usefulness in their own classrooms. The teachers were enthusiastic about the web, and gave two-thirds of the sites high ratings, and essentially all the rest average ratings. But alarmingly, over 80% of these sites were viewed as having no direct applicability in the teacher's own classroom. This summer I was assigned to work on the Amphion project in the Automated Software Engineering Group under the leadership of Michael Lowry. I wished to find educational applications of the Amphion system, which in its current implementation can be used to create fortran programs and animations using the SPICE libraries created by the NAIF group at JPL. I wished to find an application which provided real added educational value, which was in line with educational curriculum standards and which would serve a documented need of the educational community. The application selected was teaching about the causes of the seasons -- at the approximately the fourth, fifth, sixth grade level. This topic was chosen because it is in line with national curriculum standards. The fourth, fifth, sixth grade level was selected to coincide with the grade level served by the Ames Aerospace Encounter, which services 10,000 children a year on field trips. The hope is that eventually the Ames Aerospace Encounter could be used as a test bed for the lessons developed. The topic is one which is difficult to teach and the necessity for new methods

is documented in the educational literature. Current educational standards indicate that seasons should be part of the elementary school curriculum.
Derived from text
Applications Programs (Computers); Software Engineering; Ratings; Motivation; Internets; Education

19990021049 San Francisco State Univ., Dept. of Electrical Engineering, CA USA
Simulation of Ames Backbone Network
Shahnasser, Hamid, San Francisco State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The networking demands of Ames Research Center are dramatically increasing. More and more workstations are requested to run video and audio applications on the network. These applications require a much greater bandwidth than data applications. The existing ARCLAN 2000 network bandwidth is insufficient, due to the use of FDDI as its backbone, for accommodating video applications. Operating at a maximum of 100 Mbps, FDDI can handle only a few workstations running multimedia applications. The ideal solution is to replace the current ARCLAN 2000 FDDI backbone with an ATM backbone. ATM has the capability to handle the increasing traffic loads on the ARCLAN 2000 that results from these new applications. As it can be seen from Figure 1, ARCLAN 2000 have a total of 32 routers (5 being core routers) each connected to the FDDI backbone via a 100 Mbps link. This network serves 34 different locations by using 34 hubs that are connected to secondary routers. End users are connected to the secondary routers with 10 Mbps links.
Author
Networks; Traffic; Simulation; Bandwidth

19990021057 NASA Goddard Space Flight Center, Greenbelt, MD USA
Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference
Harrington, James L., Jr., NASA Goddard Space Flight Center, USA; Brown, Robin L., NASA Goddard Space Flight Center, USA; Shukla, Pooja, NASA Goddard Space Flight Center, USA; May 1998; 548p; In English; 7th; Minority University-Space Interdisciplinary Network, 8-10 Oct. 1997, New York, NY, USA; Also announced as 19990021058 through 19990021064
Contract(s)/Grant(s): NSF CDA-97-26118
Report No.(s): NASA/CP-1998-206859; Rept-98E01271; NAS 1.55:206859; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

Seventh annual conference proceedings of the Minority University-SPace Interdisciplinary Network (MU-SPIN) conference. MU-SPIN is cosponsored by NASA Goddard Space Flight Center and the National Science Foundation, and is a comprehensive educational initiative for Historically Black Colleges and Universities, and minority universities. MU-SPIN focuses on the transfer of advanced computer networking technologies to these institutions and their use for supporting multidisciplinary research.
Author
Conferences; Universities; Education

19990021061 Tennessee State Univ., Teaching and Learning Dept., Nashville, TN USA
Explorers of the Universe: Metacognitive Tools for Learning Science Concepts
Alvarez, Marino C., Tennessee State Univ., USA; Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference; May 1998, pp. 305-311; In English; Also announced as 19990021057
Contract(s)/Grant(s): NGT5-40054; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Much of school learning consists of rote memorization of facts with little emphasis on meaningful interpretations. Knowledge construction is reduced to factual knowledge production with little regard for critical thinking, problem solving, or clarifying misconceptions. An important role of a middle and secondary teacher when teaching science is to aid students' ability to reflect upon what they know about a given topic and make available strategies that will enhance their understanding of text and science experiments. Developing metacognition, the ability to monitor one's own knowledge about a topic of study and to activate appropriate strategies, enhances students' learning when faced with reading, writing and problem solving situations. Two instructional strategies that can involve students in developing metacognitive awareness are hierarchical concept mapping, and Vee diagrams. Concept maps enable students to organize their ideas and reveal visually these ideas to others. A Vee diagram is a structured visual means of relating the methodological aspects of an activity to its underlying conceptual aspect in ways that aid learners in meaningful understanding of scientific investigations.
CASI
Education; Schools; Students; Learning Theory; Learning

19990021062 Texas Univ., Regional Collaboratives for Excellence in Science Teaching, Austin, TX USA

Using HTML as a Collaborative Work Tool for Middle School Students

Giza, Brian, Texas Univ., USA; Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference; May 1998, pp. 395-402; In English; Also announced as 19990021057; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

As the gulf between technology haves and have-nots increases, educators benefit from understanding how the most common tool of internet collaboration, Hypertext Markup Language, may be used in their own classrooms. A classroom which may have computers, but lack a direct internet connection, can still use HTML off-line as a collaborative work tool, preparing students and educators for an increasingly on-line world. This document summarizes the training approach taken by the Texas Regional Collaboratives in educator professional development for the use of HTML in schools.

Author

Computers; Document Markup Languages; Education; Internets; Students; World Wide Web; Protocol (Computers); Hypertext

19990021064 Norfolk State Univ., Dept. of Computer Science, VA USA

Electronic Publishing on Multiple Media

Kung, Mou-Liang, Norfolk State Univ., USA; Hendricks, Wallace, Norfolk State Univ., USA; Koopman, Sue, Norfolk State Univ., USA; Delk, Eric, Norfolk State Univ., USA; Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference; May 1998, pp. 457-458; In English; Also announced as 19990021057; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

HyperText Markup Language (HTML) produces eye-pleasing documents for delivery through the World Wide Web. When an HTML document needs to be produced in another format, extensive editing is required, one for each desired medium, Ideally, a document should only be created once and published many times, on as many different media as required. Standard Generalized Markup Language (SGML) is a method to accomplish this publishing ideal. SGML is known for its power, but it is also complex. The World Wide Web Consortium (W3C) recently published a working draft of a new meta-language, eXtensible Markup Language (XML), which is a trimmed down version of XML. SGML/XML was used to publish the Norfolk State University catalog and other hypermedia courseware.

CASI

Document Markup Languages; Electronic Publishing; Hypertext

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.

19990019142 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

A New Sliding Mode Position Controller for the Induction Motor using Feedback Linearization

Chen, Jenn-Yih, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Wang, Wen-Jieh, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 211-219; In English

Contract(s)/Grant(s): NSC86-2213-E-011-045; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new sliding mode control algorithm to control the position of the induction motor is presented in this paper. The feedback linearization theory is used to decouple the rotor position and the flux amplitude. The new sliding mode position controller with an adaptive law used to estimate the load torque disturbances of the induction motor is proposed, to eliminate the chattering effects associated with the classical sliding mode controller. The overall position control system is verified to be stable and robust to the motor mechanical parameter variations and external load disturbances. Experimental results are presented to confirm the characteristics of the proposed sliding mode position controller.

Author

Feedback Control; Induction Motors; Controllers; Stability; Modal Response

19990019174 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

H-Infinity-Norm Performance Robustness Analysis of a Linear Parametric Uncertain System

Wen, Cheng, National Taiwan Univ., Taiwan, Province of China; Fong, I.-Kong, Lung-Hwa Junior Coll. of Technology and Commerce, Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 203-209; In English

Contract(s)/Grant(s): NSC84-2213-E-002-082; NSC85-2213-E-002-039; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper considers the performance robustness analysis problem of uncertain linear systems with output feedback. When there are uncertain parameters in all matrices of the state-space model of the controlled system, a bound on these parameters is found such that the H-norm performance index of the closed-loop system is kept below a prespecified value. The proposed analysis method is based on the matrix nonsingularity robustness analysis approach and several algebraic conditions about the H-norm. It is shown that the bound can be computed from structured singular values of certain composite matrices. An example is provided to illustrate the results.

Author

Matrices (Mathematics); Reliability Analysis; Robustness (Mathematics); Matrix Materials; Feedback Control

19990019180 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China

A Design Method for Control Systems Possessing Integrity and Robust Stability

Huang, Junn-Chung, National Taiwan Univ., Taiwan, Province of China; Chang, Fan-Ren, National Taiwan Univ., Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 139-147; In English

Contract(s)/Grant(s): NSC86-2213-E-002-017; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A control law that keeps a closed-loop system asymptotically stable against arbitrary sensor failures is proposed. Systems which have such a property are said to possess integrity, and this is an inherent property of MIMO systems. The synthesis method of the linear state feedback controller and the associated upper bound for tolerable perturbations are derived utilizing the properties of the spectral radius and matrix inequalities. Compared with existing integrity design approaches, the computation load for solving the tedious matrix Lyapunov or Riccati-type equation is reduced. In addition, this design approach is further extended to an uncertain system and to retain the stability characteristics of the given open loop system. In both cases, tolerable perturbation bounds are all expressed explicitly such that the closed-loop system still possesses integrity. The simplicity and effectiveness of this method are demonstrated with two numerical examples.

Author

Feedback Control; Control Theory; MIMO (Control Systems); Stability; Perturbation; Riccati Equation

19990019267 Princeton Univ., Dept. of Ecology and Evolutionary Biology, NJ USA

Ecosystems and the Biosphere as Complex Adaptive Systems

Levin, Simon A., Princeton Univ., USA; Ecosystems; 1998, pp. 1-7; In English; Sponsored in part by the Andrew W. Mellon Foundation

Contract(s)/Grant(s): N00014-92-J-1527; NAG5-6422; ASF 97-3-5; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Ecosystems are prototypical examples of complex adaptive systems, in which patterns at higher levels emerge from localized interactions and selection processes acting at lower levels. An essential aspect of such systems is nonlinearity, leading to historical dependency and multiple possible outcomes of dynamics. Given this, it is essential to determine the degree to which system features are determined by environmental conditions, and the degree to which they are the result of self-organization. Furthermore, given the multiple levels at which dynamics become apparent and at which selection can act, central issues relate to how evolution shapes ecosystems properties, and whether ecosystems become buffered to changes (more resilient) over their ecological and evolutionary development or proceed to critical states and the edge of chaos.

Author

Complex Systems; Adaptation; Biosphere; Ecosystems

19990019402 Missouri Univ., Rolla, MO USA

Nonlinear and Distributed Control of Smart Structures Using Artificial Neural Networks ***Final Report***

Rao, Vittal S.; Acar, Levent; Batra, Romesh C.; Jun. 1998; 23p; In English

Contract(s)/Grant(s): DAAH04-93-G-0214

Report No.(s): AD-A357842; ARO-32109.52-MASM; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This interdisciplinary research program is focused on designing and implementing robust controllers on smart structures. The primary research objectives are: (1) structural modeling of smart structures incorporating both material and geometric nonlinearities, (2) development of controllers using conventional and neural network based algorithms, and (3) distributed control techniques using spatially distributed sensors and actuators. We have investigated modeling techniques for structures that account for the material and geometric nonlinearities, continuity of tractions across interlaminates, hysteric behavior of the FZTs, interaction between the PZTs and the substrate, orthotropic nature of the PZTs, anisotropic properties of composite plates, and the inertia forces. A structural identification method based on the measurement of eigenvalues and eigenvectors of the structure has been developed and verified using experimental results. We have successfully designed and implemented multiobjective robust controllers as smart structures. Practical considerations and limitations of the controller implementation using neural network hardware are also investigated.
DTIC
Neural Nets; Artificial Intelligence; Nonlinearity; Research; Robustness (Mathematics); Models; Algorithms; Control Systems Design; Smart Structures

19990019456 Pennsylvania State Univ., Dept. of Statistics, University Park, PA USA
Pattern Classification Using Genetic Algorithms: Determination of H
Bandyopadhyay, S.; Murthy, C. A.; Pal, S. K.; May 1998; 24p; In English
Contract(s)/Grant(s): DAAH04-96-1-0082
Report No.(s): AD-A358030; ARO-35518.29-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A methodology based on the concept of variable string length GA (VGA) is developed for determining automatically the number of hyperplanes for modeling the class boundaries in GA classifier. The genetic operators and fitness function are newly defined to take care of the variability in chromosome length. It is proved that the said method is able to arrive at the optimal number of misclassifications after sufficiently large number of iterations, and will need minimal number of hyperplanes for this purpose. Experimental results on different artificial and real life data sets demonstrate that the classifier, using the concept of variable length chromosome, can automatically evolve an appropriate value of H, and also provide performance better than those of the fixed length version. Its comparison with another approach using VGA is provided.
DTIC
Algorithms; Neural Nets; Pattern Recognition; Bayes Theorem; Genetic Algorithms; Classifications

19990019459 Utah Univ., Mechanical Engineering Dept., Salt Lake City, UT USA
Preview-Based Stable-Inversion for Output Tracking
Zou, Qing-Ze, Utah Univ., USA; Devasia, Santosh, Utah Univ., USA; 1999; 22p; In English
Contract(s)/Grant(s): NAG2-1042; NSF CMS-98-13080; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Stable Inversion techniques can be used to achieve high-accuracy output tracking. However, for nonminimum phase systems, the inverse is non-causal - hence the inverse has to be pre-computed using a pre-specified desired-output trajectory. This requirement for pre-specification of the desired output restricts the use of inversion-based approaches to trajectory planning problems (for nonminimum phase systems). In the present article, it is shown that preview information of the desired output can be used to achieve online inversion-based output tracking of linear systems. The amount of preview-time needed is quantified in terms of the tracking error and the internal dynamics of the system (zeros of the system). The methodology is applied to the online output tracking of a flexible structure and experimental results are presented.
Author
Trajectory Planning; Flexible Bodies; Inversions; Trajectory Optimization

19990019460 NASA Ames Research Center, Moffett Field, CA USA
Recovery Guidance Satisfying Input and State Constraints: Rate Saturating Actuator Example
Devasia, Santosh, NASA Ames Research Center, USA; Meyer, George, NASA Ames Research Center, USA; Journal of Guidance, Control, and Dynamics; September 1998; Volume 21, No. 5, pp. 733-741; In English
Contract(s)/Grant(s): NCC2-8018; NAG2-1042; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
When a fixed regulator is used to stabilize a desired state trajectory (guidance law), large initial tracking errors can lead to input saturation, which can result In performance deterioration. A method to modify the guidance law for recovering state-trajectory tracking (without violating input and state constraints) is presented. Although it may he feasible to find such a satisfactory recovery guidance maneuver for a given initial tracking error, online development of recovery guidance maneuvers may not be computationally tractable. A technique is developed to use precomputed recovery guidance maneuvers (precomputed for a finite

set of initial tracking errors) to generate recovery guidance maneuvers for other initial errors. The technique is applied to an illustrative example with a rate-limited servoactuator, and simulation results are presented.
Author
Actuators; Regulators; Trajectory Control; Dynamics; Trajectories; Guidance (Motion)

19990019473 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Sensor-Based Collision Avoidance: Theory and Experiments
Seraji, Homayoun, Jet Propulsion Lab., California Inst. of Tech., USA; Steele, Robert, Jet Propulsion Lab., California Inst. of Tech., USA; Ivlev, Robert, Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Robotic Systems; 1996; ISSN 0741-2223; Volume 13, No. 9, pp. 571-586; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new on-line control strategy for sensor-based collision avoidance of manipulators and supporting experimental results are presented in this article. This control strategy is based on nullification of virtual forces applied to the end-effector by a hypothetical spring-plus-damper attached to the object's surface. In the proposed approach, the real-time arm control software continuously monitors the object distance measured by the arm-mounted proximity sensors. When this distance is less than a preset threshold, the collision avoidance control action is initiated to inhibit motion toward the object and thus prevent collision. This is accomplished by employing an outer feedback loop to perturb the end-effector nominal motion trajectory in real-time based on the sensory data. The perturbation is generated by a proportional-plus-integral (PI) collision avoidance controller acting on the difference between the sensed distance and the preset threshold. This approach is computationally very fast, requires minimal modification to the existing manipulator positioning system, and provides the manipulator with an on-line collision avoidance capability to react autonomously and intelligently. A dexterous RRC robotic arm is instrumented with infrared proximity sensors and is operated under the proposed collision avoidance strategy. Experimental results are presented to demonstrate end-effector collision avoidance both with an approaching object and while reaching inside a constricted opening.
Author
Robot Arms; Monitors; Collision Avoidance; Controllers

19990019500 Utah Univ., Dept. of Mechanical Engineering, Salt Lake City, UT USA
Approximated Stable Inversion for Nonlinear Systems with Nonhyperbolic Internal Dynamics
Devasia, Santosh, Utah Univ., USA; 1999; 12p; In English
Contract(s)/Grant(s): NAG2-1042; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A technique to achieve output tracking for nonminimum phase nonlinear systems with non- hyperbolic internal dynamics is presented. The present paper integrates stable inversion techniques (that achieve exact-tracking) with approximation techniques (that modify the internal dynamics) to circumvent the nonhyperbolicity of the internal dynamics - this nonhyperbolicity is an obstruction to applying presently available stable inversion techniques. The theory is developed for nonlinear systems and the method is applied to a two-cart with inverted-pendulum example.
Author
Inversions; Nonlinear Systems; Blocking; Dynamical Systems; Dynamic Stability

19990019582 Fukui Univ., Faculty of Engineering, Japan
A Proposition of Modified Repetitive Control Method with Corrected Period: Application to Weft Inserting Motion Control of Repier Weaving Machine
Sugimoto, Hidehiko, Fukui Univ., Japan; Zhang, Yi-Kun, Fukui Univ., Japan; Washida, Kazuo, Fukui Univ., Japan; Shirakawa, Yoshiyuki, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 275-283; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The application of repetitive control method to weft inserting motion control of repier weaving machine was studied. It was found that the conventional modified repetitive control method is invalid as the repetitive control method. In this paper the problem of conventional repetitive control method is discussed, and a new modified repetitive control method is proposed, in which the dead time in the repetitive controller is shorter dm the repetitive period of the reference signal. The simulation results of the weft inserting motion control are shown, by comparison it was proved that the proposed scheme has superior follow-up control precision.
Author
Research; Control Simulation; Procedures

19990019586 Harvard Univ., Cambridge, MA USA

Early Scene Analysis: Rapid Processing of Contours, Surfaces, and Objects in Human Vision ***Final Report, 1 Mar. 1994 - 30 Sep. 1997***

Vavanagh, Patrtick; Sep. 1997; 6p; In English

Contract(s)/Grant(s): 2313; Proj-PE61102F

Report No.(s): AD-A356037; AFOSR-94-0189; AFRL-SR-BL-TR-98-0709; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

How does the human brain represent objects? How does it recognize them so rapidly? We have been able to show how 2-D information is built up from the parallel analysis of a set of visual attributes and how this information contacts memory in order to construct 3-D representations of the visual scene. We have demonstrated a simplified early contact with memory, occuring prior to any part-based or contour analysis an yet capable of guiding recognition. We have described a motion phenomenon which reveals the nature of image segmentation in a very direct manner. We have discovered a new technique to probe the dimensions of high-level shape recognition and we have described a new level of object description in terms of volumes which subsumes earlier work on contours and surfaces. Finally, work on shading and shadows is contributing to a new approach to rapid line labeling in images.

DTIC

Image Processing; Computer Vision; Scene Analysis

19990019587 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

Learning Evaluation Functions for Global Optimization

Boyan, Justin Andrew; Aug. 01, 1998; 217p; In English

Report No.(s): AD-A356034; CMU-CS-98-152; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In complex sequential decision problems such as scheduling factory production, planning medical treatments, and playing backgammon, optimal decision policies are in general unknown, and it is often difficult, even for human domain experts, to manually encode good decision policies in software. The reinforcement learning methodology of value function approximation (VFA) offers an alternative: systems can learn effective decision policies autonomously, simply by simulating the task and keeping statistics on which decisions lead to good ultimate performance and which do not. This thesis advances the state of the art in VFA in two ways. First, it presents three new VFA algorithms, which apply to three different restricted classes of sequential decision problems: Grow Support for deterministic problems, ROUT for acyclic stochastic problems, and Least Squares TD(lambda) for fixed policy prediction problems. Each is designed to gain robustness and efficiency over current approaches by exploiting the restricted problem structure to which it applies. Second, it introduces STAGE, a new search algorithm for general combinatorial optimization tasks. STAGE learns a problem specific heuristic evaluation function as it searches. The heuristic is trained by supervised linear regression or Least Squares TD(lambda) to predict, from features of states along the search trajectory, how well a fast local search method such as hill climbing will perform starting from each state. Search proceeds by alternating between two stages: performing the fast search to gather new training data, and following the learned heuristic to identify a promising new start state. STAGE has produced good results (in some cases, the best results known) on a variety of combinatorial optimization domains, including VLSI channel routing, Bayes net structure finding, bin packing, Boolean satisfiability, radiotherapy treatment planning, and geographic cartogram design.

DTIC

Neural Nets; Artificial Intelligence; Decision Support Systems; Stochastic Processes; Heuristic Methods; Bayes Theorem; Combinatorial Analysis

19990019604 Fukui Univ., Faculty of Engineering, Japan

Position Control and Explicit Force Control of Constrained Motions of a Manipulator for Grinding Tasks

Asakura, Toshiyuki, Fukui Univ., Japan; Minami, Mamoru, Fukui Univ., Japan; Dong, Lixin, Xian Jiaotong Univ., China; Huang, Yumei, Xian Jiaotong Univ., China; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 255-263; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

On the basis of a detailed analysis of the grinding process, motions of the constrained dynamic system of a grinding robot is modeled in this report. In the model, the constrained generalized forces are included and expressed as an obvious function of the state and input generalized forces. Thereafter, a control law is presented by taking the advantage of the redundancy of input generalized forces to the constrained forces. A controller is then constructed without involving any force feedback sensors. Simu-

lations have been done for justification the feasibility of the controller by taking an articulated planar two-link manipulator as an example. Results show the effectiveness of the controller.
Author
Control Theory; Feasibility Analysis; Manipulators

19990019660 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Learning to Extract Symbolic Knowledge from the World Wide Web
Craven, Mark; McCallum, Andrew; PiPasquo, Dan; Mitchell, Tom; Freitag, Dayne; Sep. 01, 1998; 53p; In English
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A356047; CMU-CS-98-122; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The World Wide Web is a vast source of information accessible to computers, but understandable only to humans. The goal of the research described here is to automatically create a computer understandable knowledge base whose content mirrors that of the World Wide Web. Such a knowledge base would enable much more effective retrieval of Web information, and promote new uses of the Web to support knowledge based inference and problem solving. Our approach is to develop a trainable information extraction system that takes two inputs. The first is an ontology that defines the classes (e.g., Company, Person, Employee, Product) and relations (e.g., Employed.By, Produced.By) of interest when creating the knowledge base. The second is a set of training data consisting of labeled regions of hypertext that represent instances of these classes and relations. Given these inputs, the system learns to extract information from other pages and hyperlinks on the Web. This paper describes our general approach, several machine learning algorithms for this task, and promising initial results with a prototype system that has created a knowledge base describing university people, courses, and research projects.
DTIC
Information Retrieval; Information Systems; Knowledge Based Systems; Machine Learning; World Wide Web; Data Management

19990019840 NASA Lewis Research Center, Cleveland, OH USA
A Neural Network Aero Design System for Advanced Turbo-Engines
Sanz, Jose M., NASA Lewis Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 49; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche; Abstract Only; Abstract Only

An inverse design method calculates the blade shape that produces a prescribed input pressure distribution. by controlling this input pressure distribution the aerodynamic design objectives can easily be met. Because of the intrinsic relationship between pressure distribution and airfoil physical properties, a Neural Network can be trained to choose the optimal pressure distribution that would meet a set of physical requirements. Neural network systems have been attempted in the context of direct design methods. From properties ascribed to a set of blades the neural network is trained to infer the properties of an 'interpolated' blade shape. The problem is that, especially in transonic regimes where we deal with intrinsically non linear and ill posed problems, small perturbations of the blade shape can produce very large variations of the flow parameters. It is very unlikely that, under these circumstances, a neural network will be able to find the proper solution. The unique situation in the present method is that the neural network can be trained to extract the required input pressure distribution from a database of pressure distributions while the inverse method will still compute the exact blade shape that corresponds to this 'interpolated' input pressure distribution. In other words, the interpolation process is transferred to a smoother problem, namely, finding what pressure distribution would produce the required flow conditions and, once this is done, the inverse method will compute the exact solution for this problem. The use of neural network is, in this context, highly related to the use of proper optimization techniques. The optimization is used essentially as an automation procedure to force the input pressure distributions to achieve the required aero and structural design parameters. A multilayered feed forward network with back-propagation is used to train the system for pattern association and classification.
Author
Neural Nets; Interpolation; Pressure Distribution; Structural Design; Turbine Blades; Flow Characteristics; Optimization; Shapes

19990021059 Texas Univ., Dept. of Computer Science, El Paso, TX USA
From Theory to Practice: The UTEP Robot in the AAAI 96 Robot Contest
Son, T., Texas Univ., USA; Morales, D., Texas Univ., USA; Baral, Chitta, Texas Univ., USA; Nogueira, M., Texas Univ., USA; Floriano, Luis, Texas Univ., USA; Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference; May 1998, pp. 241-253; In English; Also announced as 19990021057; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

In this paper we describe the control aspects of Diablo, the University of Texas at El Paso (UTEP) mobile robot participant in event one of the American Association for Artificial Intelligence (AAAI) 96 robot contest, where Diablo consistently scored

285 out of a total of 295 points. The main goal of this paper will be to show how the agent theories, based on action theories, developed at UTEP was used in the building of Diablo.
Author
Artificial Intelligence; Robots; Robot Control; Robotics; Position Sensing

19990021103 Oklahoma State Univ., Stillwater, OK USA
Multiresolution, Multi-Scale Target Identification and Tracking using the Anisotropic Diffusion Pyramid ***Final Report, 1 Sep. 1995 - 31 Aug. 1998***
Acton, Scott T.; Oct. 20, 1998; 47p; In English
Contract(s)/Grant(s): DAAH04-95-1-0255
Report No.(s): AD-A358151; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A three year ARO Young Investigator project has resulted in a novel target identification and tracking system based on multi-resolution, multi-scale image processing methods. Through this research effort, two nonlinear image processing methods have been developed and utilized in target tracking: the anisotropic diffusion pyramid and the morphological pyramid. Coarse-to-fine target searches are implemented within the image pyramids, providing a 100X improvement in computational expense over standard correlation-based approaches. Several improvements in tracking robustness have been achieved, including a lOX improvement in target localization over standard linear processing methods. A noise-resilient morphological diffusion method has been designed, and diffusion techniques that converge rapidly to locally monotonic signals have been developed, yielding a significant advance in nonlinear diffusion-based image processing. Further improvements to the diffusion technique have included the incorporation of multigrid methods and the generalization to multispectral imagery for multisensor tracking applications. These advances in theory have been validated with a new tracking simulator, in which several visible-wavelength and infrared image sequences have been used for testing. During the last three years, the ARO-funded project has supported 10 graduate students at Oklahoma State University and has led to over 20 refereed publications.
DTIC
Image Processing; Target Recognition; Infrared Imagery; Multisensor Applications; Tracking (Position)

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990019129 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
On the Poles of Riemannian Manifolds and Alexandrov Spaces of Curvature Bounded Below
Sugahara, Kunio, Osaka Kyoiku Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 221-231; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A point P of a complete Riemannian manifold M is said to be a pole if the exponential mapping exp(sub p): T(sub p) M maps to M is a diffeomorphism. Maeda defined a constant that measures how a Riemannian manifold expands at infinity, and showed that the constant restricts the size of the set of poles in case of nonnegative curvature. The main purpose of this paper is to give a similar estimate for Riemannian manifolds and Alexandrov spaces of curvature bounded below. The Alexandrov space is a locally compact and complete length space with Toponogov's comparison property. The length space is a metric space such that the distance d(p, q) of any two points p and q is realized by the length of a minimizing curve that connects them. Such a minimizing curve is called a geodesic as in Riemannian geometry.
Derived from text
Riemann Manifold; Curvature; Measure and Integration

19990019130 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
Circuit Chasing Technique for a Distance-Regular Graph with C2r+1=1
Hiraki, Akira, Kyushu Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 197-219; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The circuit chasing technique is a very powerful argument for the study of distance-regular graphs. But so far it works only for the distance-regular graphs with intersection numbers of special types. In fact, the method which we used to prove our theorem did not work. The difficulty we encountered for our particular case was that we could not determine the profile in the next step while chasing the circuit in consideration. to eliminate this difficulty, we add extra circuits to the circuit in consideration to get the desired information of the distance relation between vertices. In this paper, we introduce another application of the circuit chas-

ing technique. That is chasing not only a circuit but also a set of circuits of special type at the same time. The argument developed in this paper is more powerful than the ordinary circuit chasing technique and gives us a lot of information.
Derived from text
Circuits; Graph Theory

19990019131 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
Classification of Association Schemes with at Most Ten Vertices
Nomiyama, Eiji, Kyushu Electric Power Co., Inc., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 163-195; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Association schemes provide a fundamental framework for the study of algebraic combinatorics. They are deeply related to codes, designs, groups and finite geometry. Recently, it has been noticed that they are also related to some questions in topology. In this paper we classify association schemes with at most ten vertices, where these association schemes are not necessarily commutative. We would like to classify association schemes in general, but this is obviously too difficult. Therefore, we classify these association schemes be restricting the number of vertices that are present at any given time.
Derived from text
Set Theory; Matrices (Mathematics); Apexes

19990019132 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
Dimensions in a Separable Metric Space
Tamashiro, Masakazu, Kyushu Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 143-162; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

It often occurs that a Borel finite measure plays an important role in estimating the Hausdorff dimension of a Borel set of the Euclidian space. In particular, in the Euclidean space and homogeneous (in the sense of Coifman and Weiss) space, Frostman's theorem and Tricot's theorem hold and those facts imply the equivalence among dimensions and several indices of a finite Borel measure. But it is not known whether Frostman's theorem and Tricot's theorem can be extended to general metric space or not. The aim of this paper is to analyze systematically the several fractional dimensions of a subset and a finite Borel measure and establish new relations among them in a general separable metric space. As an application, we prove that Frostman's and Tricot's theorems are equivalent.
Author
Dimensions; Metric Space; Borel Sets; Measure and Integration

19990019133 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
The Busemann Total Excess of Complete Open Alexandrov Surfaces
Senanayake, Vernon K., Kyushu Univ., Japan; Kubo, Yoshiko, Japan Women's Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 135-142; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An Alexandrov space X with curvature bounded below is a length space with the property that Alexandrov-Toponogov comparison theorem holds for all small geodesic triangles. Such a 2-dimensional Alexandrov space X is a topological manifold but it does not admit a usual differentiable structure. Many interesting properties about Alexandrov space with or without boundary of dimension n greater than or equal to 2 whose curvature is bounded below have been investigated by Burago, Gromov and Perelman, Otsu and Shioya and others. In Shiohama and Tanaka extended some of Riemannian results to Alexandrov surfaces and established almost similar results on the structure of cut loci and geodesic spheres without assuming almost any differentiability in Alexandrov spaces. On the other hand, Busemann introduced the notion of angular measure at each point of a Busemann G-surface. He also introduced the notion of the excess of a small geodesic triangle which corresponds to the curvature integral over a small geodesic triangle on a Riemann 2-manifold. With these notions, Busemann proved the Gauss-Bonnet theorem for Busemann G-surfaces as well as the Cohn-Vossen theorem for complete noncompact Busemann G-surfaces. The purpose of this paper is to prove these results for Alexandrov, surfaces. For an Alexandrov surface with curvature bounded below an angle between two geodesics emanating from a point is naturally defined. In connection with the total curvature of a complete open smooth surface, the Busemann total excess epsilon(X) of a complete non-compact Alexandrov surface shall be defined applying Busemann's idea to Alexandrov surfaces. However we cannot apply Busemann's idea directly to an Alexandrov surface X, for X may admit a non empty singular set Sing(X). An interior point x a member of X is by definition a singular point if and only if the space of directions Sigma(sub x) at x is a circle with length L(Sigma(sub x)) is less than 2pi. by using Busemann excess Machigashira has already

showed the fundamental relation between the excess and the Euler characteristic of a bounded domain D on an Alexandrov surface.
Derived from text
Curves (Geometry); Differential Geometry

19990019151 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
Stable Complete and Noncompact Hypersurfaces with Constant Mean Curvature
Cheng, Qing-Ming, International Centre for Theoretical Physics, Italy; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 59-66; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper reviews and investigates the definitions of weak stability and strong stability for hypersurfaces with constant mean curvature H (which may be zero) of an n-dimensional manifold in the Euclidean space.
CASI
Differential Geometry; Hyperspaces; Curvature

19990019152 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
SK Groups of Manifolds with Boundary
Koshikawa, Hiroaki, Chiba Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 140-6116; Volume 49, No. 1, pp. 47-57; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Karras-Kreck-Neumann-Ossa studied a cutting and pasting of closed smooth manifolds; SK-groups. The singular SK-groups SK(sub n) (X) for topological space X was also studied. K. Komiya considered the SK-groups SK(sub m,n) for a pair of an m-dimensional closed smooth manifold and an n-dimensional closed smooth submanifold of it. In this paper we shall first treat smooth manifolds with boundary and generaly define the oriented singular SK-groups SK(sub n)(X,A) for a pair (X,A) of arcwise connected spaces. Also we can analogously define unoriented singular SK-groups SK(sub n, sup 0)(X,A). The functorial properties are naturally well-defined and SK(sub n) is a covariant functor from the homotopy category of pair of topological spaces to the category of abelian groups. We see Euler characteristic is relative SK-invariant. The signature is also relative SK-invariant by the Wall non-additivity theorem of the signature.
Derived from text
Manifolds (Mathematics); Topology; Group Theory

19990019153 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
On an Estimate of the Rank of Elliptic Curves by Multiplication-by-m Map
Sato, Hisayoshi, Kyushu Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 35-46; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper discusses the homomorphism for multiplication-by-m map, and rank estimation of elliptical curves. These curves are defined over a number field of finite degree.
CASI
Ellipses; Multiplication; Homomorphisms; Curves (Geometry)

19990019154 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
A Hypergeometric Integral Attached to the Configuration of the Mirrors of the Reflection Group S(sub n+2) Acting on P(sub n)
Cho, Koji, Kyushu Univ., Japan; Mimachi, Katsuhisa, Kyushu Univ., Japan; Yoshida, Masaaki, Kyushu Univ., Japan; Graduate School of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 11-34; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we present functions defined by an integral of a certain hypergeometric type. Geometric and analytic properties of the functions are studied. Symmetry with respect to the permutation group S(sub n+2) is emphasized. Sections of this paper includes: Hyperplane arrangements in P(sup n) and in P(sub n); Twisted (co)homologies (specifically basis of twisted homologies, and basis of twisted cohomologies); System of differential equations; Intersection numbers; and Solutions given by power series.
Derived from text
Hypergeometric Functions; Integrals; Homology; Hyperplanes

19990019173 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan

Surfaces Whose Affine Normal Images are Curves

Opozda, Barbara, Warsaw Univ., Poland; Sasaki, Takeshi, Kyushu Univ., Japan; Graduate School of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 1-10; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we complete a local description of non-degenerate surfaces whose affine normal images are curves without critical points. We prove that, except for the case of planar curves, such surfaces with non-diagonalizable shape operators do not exist. On the other hand we prove that there exist surfaces with affine normal being a nowhere planar curve and with a diagonalizable shape operator. Such surfaces are characterized by a system of two differential equations.

Derived from text

Curves (Geometry); Differential Geometry; Vector Spaces

19990019182 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan

The Terwilliger Algebras of Group Association Schemes

Banni, Eiichi, Kyushu Univ., Japan; Munemasa, Akihiro, Kyushu Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 93-102; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Terwilliger algebra of an association scheme was introduced by Paul Terwilliger in order to study, P and Q-polynomial association schemes. The purpose of this paper is to discuss in detail properties of the Terwilliger algebra of the group association scheme of a finite group. We shall give bounds on the dimension of the Terwilliger algebra, and define triple regularity.

Derived from text

Algebra; Group Theory; Regularity

19990019183 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan

A Quantum Analogue of the Hypergeometric System E3,6

Nakatani, Minobu, Kobe Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 67-91; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper, we will discuss a quantum analogue of G(sub 3,6) and the associated hypergeometric functions, relying Noumi's work. In the first section, we recall the definition of the equations of type (k, n) and the hypergeometric function F(sub 3,6). Furthermore we give a short preview of this paper. In the second section, we define a noncommutative algebra generated by quantum analogues of the Plucker coordinates of the G(sub 3,6) and compute the representation of U(sub q)(gl(6)) on it. Furthermore we define a localization of this noncommutative algebra and two types of decomposition of it. In the third section, we translate the action of U(sub q)(gl(6)) on the above localization to that on the commutative algebra. by defining two isomorphisms of vector spaces, associated with the decompositions, between the localization and commutative algebras, we exhibit the action of U(sub q)(gl(6)) in terms of usual q-difference operators. In the fourth section, we define the Casimir operators and, in the fifth section, we considered the q-hypergeometric functions of type (3,6). In the last section, we compute the contiguity relations and, in view of these relations, propose to define the q-hypergeometric systems. Furthermore we define another system of q-difference equations, which has q-hypergeometric functions as solutions.

Derived from text

Hypergeometric Functions; Lie Groups; Vector Spaces

19990019317 Kentucky Univ., Lexington, KY USA

Alternating Direction Implicit Orthogonal Spline Collocation Methods for Solving Initial/Boundary Value Problems *Final Report*

Bialecki, Bernard, Kentucky Univ., USA; Fairweather, Graeme, Kentucky Univ., USA; Nov. 11, 1998; 10p; In English; Prepared in cooperation with Colorado School of Mines, Golden, CO and Mississippi State Univ., MS.

Contract(s)/Grant(s): DAAH04-94-G-0344

Report No.(s): AD-A357879; ARO-33843.11-MA-DPS; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary focus of this project was on the analysis and development of new parallel algorithms for the solution of linear and nonlinear initial/boundary value problems (IBVPs) in two space variables. Parabolic, second order hyperbolic, biharmonic, and Schrodinger type problems were considered. The new algorithms, which are alternating direction implicit (ADI) orthogonal spline collocation (OSC) methods employing C1 piecewise polynomial spaces of arbitrary order, have been implemented and their efficacy was demonstrated on test problems taken from the literature. Rigorous stability and convergence analyses of the methods were also carried out.
DTIC
Boundary Value Problems; Hyperbolic Differential Equations; Algorithms; Alternating Direction Implicit Methods; Schroedinger Equation

19990019380 Engineous Software, Inc., Morrisville, NC USA
Evaluation of Methods for Multidisciplinary Design Optimization (MDO), Phase 1
Kodiyalam, Srinivas, Engineous Software, Inc., USA; Sep. 1998; 90p; In English
Contract(s)/Grant(s): RTOP 509-10-11-01
Report No.(s): NASA/CR-1998-208716; L-6317; NAS 1.26:208716; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The NASA Langley Multidisciplinary Design Optimization (MDO) method evaluation study seeks to arrive at a set of guidelines for using promising MDO methods by accumulating and analyzing computational data for such methods. The data are collected by conducting a series of reproducible experiments. This report documents all computational experiments conducted in Phase I of the study. This report is a companion to the paper titled Initial Results of an MDO Method Evaluation Study by N. M. Alexandrov and S. Kodiyalam (AIAA-98-4884).
Author
Multidisciplinary Design Optimization; Computer Aided Design; Design Analysis

19990019382 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Construction of Three Dimensional Solutions for the Maxwell Equations *Final Report*
Yefet, A., New Jersey Inst. of Tech., USA; Turkel, E., Tel-Aviv Univ., Ramat-Aviv, Israel; December 1998; 8p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-1998-208954; NAS 1.26:208954; ICASE-IR-34; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We consider numerical solutions for the three dimensional time dependent Maxwell equations. We construct a fourth order accurate compact implicit scheme and compare it to the Yee scheme for free space in a box.
Author
Maxwell Equation; Numerical Analysis

19990019467 Tokai Univ., School of Science, Tokyo, Japan
A Theorem on the Jump Number Problem for a Neural Network Approach
Odahara, Ikuya, Toshiba Research and Development Center, Japan; Minezaki, Toshiya, Tokai Univ., Japan; Narushima, Hiroshi, Tokai Univ., Japan; Proceedings of the School of Science of Tokai University; Mar. 1994; ISSN 0563-6795; Volume 29, pp. 81-89; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A Hopfield network model has been widely used to solve combinatorial optimization problems, such as the traveling salesman problem. In this paper, we proposed a presentation of solution and proved the necessary theorems to solve the jump number problem on the network, which is one of NP-complete problems. We show a result of computer simulation of a network to illustrate the efficiency of the theorems.
Author
Mathematical Models; Neural Nets; Theorems

19990019481 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
3D Characteristics *Final Report*
Holt, Maurice, California Univ., USA; December 1998; 8p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-1998-208958; NAS 1.26:208958; ICASE-98-54; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Contributions to the Method of Characteristics in Three Dimensions, which previously received incomplete recognition, are reviewed. They mostly follow from a fundamental paper by Rusanov which led to several developments in Russia, described by Chushkin.
Author
Three Dimensional Models; Three Body Problem
Report No.(s): 19990019633 Fukui Univ., Faculty of Engineering, Japan

Approximate Solutions for the Traveling Salesman Problem

Hatta, Kunihiko, Fukui Univ., Japan; Hasegawa, Takemitsu, Fukui Univ., Japan; Sato, Yoshio, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 323-331; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We propose two methods for computing an approximate solution of the Traveling Salesman Problem, which is one of the well-known problems difficult to solve. One of the present two methods is a scheme using Voronoi diagram while another one is based on the combination of the method of divide and conquer and the genetic algorithm. Numerical results are included to illustrate the performance of our methods.
Author
Approximation; Procedures; Computation; Algorithms

19990019635 Fukui Univ., Faculty of Engineering, Japan

Object-Oriented Representation and Solving Method of Arithmetic Word Problems

Nakashima, Ken, Fukui Univ., Japan; Nishino, Junji, Fukui Univ., Japan; Odaka, Tomohiro, Fukui Univ., Japan; Ogura, Hisakazu, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 343-355; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In the field of the natural language processing, it is important to understand the semantics of sentences correctly and to represent it appropriately. We are trying to represent the semantics of arithmetic word problems at the elementary school level. These problems are composed with regular and simple sentences, so it is relatively easy to understand the semantics of problems. In this paper, we model the solving process of arithmetic word problems by human being and we propose the representation and the solving method which uses the model.
Author
Object-Oriented Programming; Arithmetic; Natural Language Processing

19990019637 Fukui Univ., Faculty of Engineering, Japan

Studies on the Diamagnetic Effects, Part 2, Recalculation and Examination of the Induced Magnetic Field Distribution Patterns Nearby a Benzene Ring

Takahashi, Ichiro, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 425-432; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Our new approximate calculation technique in the complete elliptic integrals is applied to the induced magnetic field distribution patterns nearby a benzene ring, based on the Johnson-Bovey equation. Comparisons with past similar calculations are also discussed.
Author
Research; Diamagnetism; Procedures; Magnetic Field Configurations; Elliptic Functions

19990021056 California Polytechnic State Univ., Mathematics Dept., San Luis Obispo, CA USA

Making the Learning of Mathematics More Meaningful

Ward, Robin A., California Polytechnic State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In the early 1980's, the National Commission on Excellence in Education responded to the call for reform in the teaching and learning of mathematics. In particular, the Commission developed a document addressing the consensus that all students need to learn more, and often different, mathematics and that instruction in mathematics must be significantly revised. In a response to these calls for mathematics education reform, the National Council of Teachers of Mathematics (NCTM) developed its Curriculum and Evaluation Standards (1989) with a two-fold purpose: 1) to create a coherent vision of what it means to be mathematically literate in a world that relies on calculators and computers, and 2) to create a set of standards to guide the revisions of school mathematics curriculum.
Author
Education; Computers; Calculators

65
STATISTICS AND PROBABILITY

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

19990019765 California Univ., Dept. of Computer Engineering, Santa Barbara, CA USA
Filtering with Levy Noise ***Final Report, 1 Jul. 1996 - 30 Sep. 1996***
Ahn, Hyungsok; Oct. 01, 1998; 2p; In English
Contract(s)/Grant(s): N00014-96-1-1062
Report No.(s): AD-A356164; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report investigates a problem of extracting a signal from observations corrupted by additive noise, possibly heavy-tailed. More specifically, it is assumed that the observation noise is a Levy process, while the signal is Gaussian.
DTIC
Random Noise; Filtration; Signal Processing; Observation; Linear Filters

19990021030 State Univ. of East Tennessee, Dept. of Computer and Information Sciences, Johnson City, TN USA
Testing and Troubleshooting Automatically Generated Source Code
Henry, Joel, State Univ. of East Tennessee, USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Tools allowing engineers to model the real-time behavior of systems that control many types of NASA systems have become widespread. These tools automatically generate source code that is compiled, linked, then downloaded into computers controlling everything from wind tunnels to space flight systems. These tools save hundreds of hours of software development time and allow engineers with thorough application area knowledge but little software development experience to generate software to control the systems they use daily. These systems are verified and validated by simulating the real-time models, and by other techniques that focus on the model or the hardware. The automatically generated source code is typically not subjected to rigorous testing using conventional software testing techniques. Given the criticality and safety issues surrounding these systems, the application of conventional and new software testing and troubleshooting techniques to the automatically generated will improve the reliability of the resulting systems.
Author
Real Time Operation; Program Verification (Computers); Maintenance; Safety; Simulation

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990019187 Adroit Systems, Inc., Fairborn, OH USA
Event Sequence Analysis of the Air Intelligence Agency Information Operations Center Flight Operations ***Interim Report, Mar. 1997 - Apr. 1998***
Larsen, Glen J., Adroit Systems, Inc., USA; Apr. 1998; 30p; In English
Contract(s)/Grant(s): F41624-94-D-6000; AF Proj. 7184
Report No.(s): AD-A357589; AFRL-HE-WP-TR-1998-0057; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report applies Event Sequence Analysis, methodology adapted from aircraft mishap investigation, to an investigation of the performance of the Air Intelligence Agency's Information Operations Center (IOC) Flight Operations crew on duty at the time of the bombing of crew quarters in the Khobar Towers building in Dhahran, Saudi Arabia. The focus of the investigation is the identification of information gathering and information transfer activities that supported the formation of crew member decision making strategies. An assessment is made of the efficacy of these activities and their utility in supporting crew member situation awareness and the formulation of decisions under stress. The events under analysis are classified as tractable, relevant, and informational, in order to identity critical areas of interest. The report includes observations and recommendations for improving information flow (eliminating bottlenecks and duplications of effort), enhancing team performance and eliminating unnecessary stressors.
DTIC
Flight Operations; Information Transfer; Decision Making; Sequencing; Aircraft Accident Investigation

19990019407 Auburn Univ., Dept. of Mechanical Engineering, AL USA
Analysis and Control of Parametrically Excited Dynamical Systems ***Final Report, 15 Aug. 1994 - 14 Aug. 1998***
Sinha, Subhash; Sep. 10, 1998; 9p; In English
Contract(s)/Grant(s): DAAH04-94-G-0337
Report No.(s): AD-A358020; ARO-33153.14-EG-DPS; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary objective of this research is to develop new tools of analysis and control strategies for mechanical systems which can be modeled as a set of differential equations with time-periodic coefficients. These systems include helicopter rotor blades (in forward flight), asymmetric rotor bearing systems high speed reciprocating engines, etc. Analysis is essential for basic understanding of such systems and it is the first step before one can attempt to design or develop an active control technology. In this research techniques have been developed to construct dynamically equivalent time invariant forms of time periodic systems, utilizing the Lyapunov-Floquet (L-F) transformation. These time-invariant forms permit one to employ classical control methods readily available for time-invariant systems. An efficient symbolic technique to compute stability boundaries explicitly in terms of system parameters has been developed. Unlike the traditional averaging and perturbation methods, this approach does not require the time varying parameters to be small. Further, it has been shown that transient response of periodic linear systems with either deterministic or stochastic external excitation can also be efficiently computed using the L-F transformation technique. Control of several rotating time-periodic systems has been studied, utilizing the time-invariant forms constructed via the L-F transformation. For the time-invariant systems classical state-feedback and observer based controllers can be designed and the time-varying controller can be obtain by back transformation. Control of lumped model systems as well as elastic beam models and systems with periodic discontinuities have been considered.
DTIC
Systems Analysis; Rotation; Research; Mathematical Models; Applications of Mathematics; Dynamical Systems

19990019448 Carnegie-Mellon Univ., Dept. of Mathematics, Pittsburgh, PA USA
Controlled Diffusion Approximations for Controlled Queueing Systems ***Final Report, 1 May 1995 - 30 Apr. 1998***
Shreve, Steven E.; Soner, H. M.; Nov. 1998; 4p; In English
Contract(s)/Grant(s): DAAH04-95-1-0226
Report No.(s): AD-A358081; ARO-33014.3-MA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Four problem areas were studied. These are: (1) controlled heavy traffic queueing systems, (2) queueing systems with due dates, (3) backward-forward stochastic differential equations, and (4) Ginzburg-Landau equations and evolving interfaces. In areas (1) and (2), diffusion approximations were obtained for queues in heavy traffic. In (3), connections were established between quasi-linear partial differential equations and diffusion processes constructed via a new class of stochastic differential equations. Finally, (4) provides a study of the partial differential equation characterizing vortices in superconducting material in three dimensions.
DTIC
Control Systems Design; Queueing Theory; Stochastic Processes; Approximation; Partial Differential Equations

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THEORETICAL MATHEMATICS

Includes topology and number theory.

19990019134 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan
Classifying Global Strongly Pseudoconvex Hypersurfaces on Compact Complex Surfaces
Kato, Masahide, Sophia Univ., Japan; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 123-133; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This note is a study of complex manifold of dimension 2 which is minimal, i.e., without exceptional curves of the first kind. We will study a global strongly pseudoconvex hypersurface(GSPH) which is a smooth real hypersurface in S. Here we say that two GSPH's in a compact surface S are concentric if both lift to an infinite cyclic covering.
Derived from text
Manifolds (Mathematics); Hyperspaces; Complex Variables; Analytic Geometry

19990019184 Kyushu Univ., Graduate School of Mathematics, Fukuoka, Japan

Compact Hypersurfaces Determined by a Spectral Variational Principle

Chen, Bang-Yen, Michigan State Univ., USA; Dillen, Franki, Katholieke Univ. te Leuven, Belgium; Verstraelen, Leopold, Katholieke Univ. te Leuven, Belgium; Vrancken, Luc, Katholieke Univ. te Leuven, Belgium; Kyushu Journal of Mathematics; Mar. 1995; ISSN 1340-6116; Volume 49, No. 1, pp. 103-121; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The purpose of this paper is to introduce and to investigate a spectral variational principle which treats some well-known variational minimal principles in a unified way. This work,was initially motivated by the desire of the authors to understand, from spectral theory point of views, two classical variational minimal principles in the spirit of amongst others Hopf and Poincare. In the present paper, using elementary spectral theory, we define the the notion of k-deformations. From which we have the notions of k-minimality and k-stability in a natural way. In the first part of this paper we investigate the general theory of k-deformations, k-minimality and k-stability and provide some basic examples. In the second part we study the simplest case in details, namely, closed curves in the plane. In particularly, we establish a surprising but simple relation between Bessel's functions and the class of closed 2-minimal curves.

Derived from text

Variational Principles; Differential Geometry; Manifolds (Mathematics); Hyperspaces; Spectral Theory

19990019470 Tokai Univ., School of Science, Tokyo, Japan

On Elementary Deformations of Regular Homotopies, 1

Nagase, Teruo, Tokai Univ., Japan; Proceedings of the School of Science of Tokai University; Mar. 1994; ISSN 0563-6795; Volume 29, pp. 13-47; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We work in the piecewise linear category. A map of a closed surface to a 3 manifold is said to be nice provided that its singularities consist of double curves in which two sheets pierce each other, finite points of triple points in which three sheets pierce each other, and branch points from each of which exactly one double curve originates. Elementary deformations are local moves (cf. [Hk]). We have proved in [HN-2] that if two nice maps of a closed surface into the interior of a 3 manifold, are homotopic, then one deforms to the other by a finite sequence of elementary deformations of type 1(sup +/-), 2(sup +/-), 3(sup +/-), 4(sup +/-), 5(sup +/-), and 6. Deformations by ambient isotopies are called elementary deformations of type O. and we always ignore elementary deformations of type 0. Shapiro demonstrated the eversions of 2-spheres in the 3 dimensional Euclidean space using the Boy's surface (cf. [Ph]), and B. Morin without using the Boy's surface. G. K. Francis, B. Morin, and J. Petit examined Morin's eversion and decomposed the eversion into local moves, essentially the same ones with elementary deformations [FM], [MP-1], [MP-2].

Author

Euclidean Geometry; Singularity (Mathematics)

19990019520 Tokai Univ., School of Science, Tokyo, Japan

An Optimal Control Problem of the Perturbed Prey-Predator System

Yosida, Setuzo, Tokai Univ., Japan; Proceedings of the School of Science of Tokai University; Mar. 1994; ISSN 0563-6795; Volume 29, pp. 1-11; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A perturbed prey predator system and its optimal control problem is discussed. Control u is the rate of mixture of the preys and predators. Cost functional is the minus of the sum of populations of the two species. The optimal control u(sup *) is determined, extending the results in which we treated the problem with unperturbed Volterra system.

Author

Optimal Control; Predators

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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.

19990019155 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Discovery of a Sub-Parsec Radio Counterjet in the Nucleus of Centaurus A

Jones, Dayton L., Jet Propulsion Lab., California Inst. of Tech., USA; Murphy, David W., Jet Propulsion Lab., California Inst. of Tech., USA; Meier, David L., Jet Propulsion Lab., California Inst. of Tech., USA; Preston, Robert A., Jet Propulsion Lab., California Inst. of Tech., USA; Tingay, Steven J., Mount Stromlo and Siding Spring Observatory, Australia; Jauncey, David L., Australia Telescope National Facility, Australia; Reynolds, John E., Australia Telescope National Facility, Australia; Tzioumis,

Anastasios K., Australia Telescope National Facility, Australia; McCulloch, Peter M., Tasmania Univ., Australia; Costa, Marco E., Tasmania Univ., Australia; Kemball, Athol J., Council for Scientific and Industrial Research, South Africa; Nicolson, George D., Council for Scientific and Industrial Research, South Africa; Quick, Jonathan F. H., Council for Scientific and Industrial Research, South Africa; King, Edward A., Tasmania Univ., Australia; Lowell, James E. J., Tasmania Univ., Australia; Clay, R. W., Adelaide Univ., Australia; Ferris, Richard H., Australia Telescope National Facility, Australia; Gough, R. G., Australia Telescope National Facility, Australia; Sinclair, M. W., Australia Telescope National Facility, Australia; Ellingsen, S. P., Tasmania Univ., Australia; Jun. 1996; 12p; In English

Report No.(s): JPL-Astrophysics-Preprint-96-006; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A sub-parsec scale radio counterjet has been detected in the nucleus of the ri closest radio galaxy, Centaurus A (NGC 5128), with VLBI imaging at 2.3 and 8.4 GHz. This is one of the first detections of a VLBI counterjet, and provides new constraints on the kinematics of the radio jets emerging from the nucleus of Centaurus A. A bright, compact core is seen at 8.4 GHz, along with a jet extending along position angle 51 deg. The core is completely absorbed at 2.3 GHz. Our images show a much wider gap between the base of the main jet and the counterjet at 2.3 GHz than at 8.4 GHz and also that the core has an ri extraordinarily inverted spectrum. These observations provide evidence that the innermost 0.4-0.8 pc of the source is seen through a disk or torus of ionized gas which is opaque at low frequencies due to free-free absorption.

Author

Spectra; Imaging Techniques; Nucleons; Exploration

19990019171 Nagasaki Univ., Faculty of Engineering, Japan

An Analysis of Junction Growth in Friction Through Image Analyzer

Ura, Akira, Nagasaki Univ., Japan; Moritaka, Hideshiro, Nagasaki Univ., Japan; Reports of the Faculty of Engineering, Nagasaki University; Jan. 1994; ISSN 0286-0902; Volume 24, No. 42, pp. 1-6; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In present paper, the authors have reported a few results obtained from the experiments on the junction growth by observing the junction of the contact point using image analyzer. Aluminium was used as test material because of its soft hardness easy to be deformed plastically. Its shape is conical with an angle 90 deg in order to investigate the effect of deformation on junction growth. The conical specimen was slid against the transparent Pyrex Glass. An apex deformed under a load and also a process of stretch and growth during sliding have been observed through CCD video Camera. Camera followed on the deformation until a contact point stopped stretching continuously without macro slip. The increased area and variation of the contact part taken through CCD camera have been analysed exactly using image analyzer. As a coefficient of friction corresponding to each point deformed could be obtained, we could estimate the values of normal stress p and shear stress, accordingly a relation among those two and yield stress Y of the material property. As the results of the experiments we could determine the value of alpha from the observation. Generally, a is much larger in three dimensional deformation than 3 or 4 in Tresca or Mises theory. Although it is difficult to identify the exact value of alpha experimentally, we could get some values of alpha by measuring the real area of contact part through image analyzer.

Author

Experimentation; Deformation; Shear Stress; Stretching; Transparence; Contact Resistance; Joints (Junctions)

19990019284 Michigan Univ., Ann Arbor, MI USA

Judgments of Natural and Anomalous Trajectories in the Presence and Absence of Motion

Kaiser, Mary Kisteer, Michigan Univ., USA; Proffitt, Dennis R., Virginia Univ., USA; Anderson, Kenneth, Virginia Univ., USA; Journal of Experimental Psychology: Learning, Memory, and Cognition; 1985; ISSN 0278-7393; Volume 11, No. 4, pp. 795-803; In English

Contract(s)/Grant(s): NIMH-T32-MH-16892; NIH-HD-16195; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Recent studies have shown that many people demonstrate erroneous beliefs about motion when asked to predict the trajectories of objects. The present experiments examine whether people can select as correct natural trajectories over anomalous ones when presented with the actual on-going event (motion condition) or static representations of the event (no-motion condition). McCloskey's curved tube problem was used as the event. Results indicate that adults benefit from the motion information in these stimuli, choosing the correct path more often in the motion condition. Men performed better than women in both conditions; this gender effect could not be attributed to formal instruction in physics. Only in the no-motion condition did any men prefer a path which reflected an impetus model of motion. Some women chose a curvilinear path in the motion condition, and in the no- motion condition the curvilinear path was their most often selected alternative. Fifth-grade children demonstrated no effect for gender and their path preferences resembled those of adult males. Children's responses failed to demonstrate a preference for those curvi-

linear paths which reflect an impetus-based approach to the problem. Adults' performance in the no-motion condition was not enhanced by instructions to employ mental imagery of the event.
Author
Trajectories; Education; Human Beings; Judgments

19990021107 Department of the Navy, Washington, DC USA
High Authority Actuator
Kahn, Manford, Inventor; Nov. 13, 1998; 19p; In English
Patent Info.: Filed 13 Nov. 1998; US-Patent-Appl-SN-189,676
Report No.(s): AD-D019154; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
An actuator composed of a plurality of telescoping piezoelectric members which produces a displacement that is the sum of the length of the members is reviewed.
DTIC
Actuators; Piezoelectricity

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ACOUSTICS

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

19990019408 Department of the Navy, Washington, DC USA
Fiber Optic Sound Velocity Profiler
Ruffa, Anthony A., Inventor; Mar. 31, 1998; 5p; In English; Supersedes US-Patent-Appl-SN-838475
Patent Info.: Filed 7 Apr. 97,; US-Patent-Appl-SN-838,475; US-Patent-5,734,623
Report No.(s): AD-D019130; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A fiber optic cable, coated to increase its sensitivity to acoustic pressure, is towed through a medium. The optical fiber contains Bragg grating sensors at regular intervals along its length. A steerable array of transducers sends a pulse of sound in the direction of the optical cable while broadband pulses of light are directed down the optical fiber. The pulses of light are selectively reflected back according to the spacing between the Bragg gratings. The sound pressure field causes a local strain in the fiber, thus changing the grating spacing. The sound velocity profile along the length of the optical cable is computed by measuring the amount of time necessary for successive Bragg gratings to respond to the acoustic pressure associated with the advancing wave front of the acoustic pulse.
DTIC
Fiber Optics; Acoustic Velocity; Sound Waves; Communication Cables; Coatings

19990019441 Department of the Navy, Washington, DC USA
Underwater Measurement Device
Vincent, Harold T., Inventor; Connerney, Robert A., Inventor; Jun. 30, 1998; 9p; In English; Supersedes US-Patent-Appl-SN-912971
Patent Info.: Filed 4 Aug. 97,; US-Patent-Appl-SN-912,971; US-Patent-5,774,421
Report No.(s): AD-D019090; No Copyright; Avail: US Patent and Trademark Office, Microfiche
An underwater measurement device is discussed. The design includes a housing for disposition on a sea bed surface, an opening defined by the housing, a buoy for disposition in the opening and buoyant so as to be floatable out of the opening, a cable interconnecting the housing and the buoy, and a winch in the buoy to pay out and take in the cable to permit the buoy to rise toward the sea surface and be drawn into the housing opening. A sensor is fixed to the buoy. Disposed in the device are communication circuitry for relaying to a remote station signals detected by the sensor, and operative circuitry for receiving instructions from the remote station and in response thereto operating the winch and the sensor.
DTIC
Underwater Acoustics; Detectors; Winches

19990019703 Midwestern State Univ., Wichita Falls, TX USA

Review and Extension of the Definition of the Acoustic Energy in Inhomogeneous Moving Media

Farris, Mark, Midwestern State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 61; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The acoustic energy in a moving inhomogeneous medium is a very useful tool for application to many problems of aeroacoustics such as ducted fans, helicopter rotors and high speed propellers. Intuitively, one expects that some conservation laws hold far an energy quantity. We could then use energy conservation laws to understand and control the noise level of these machines in the near and far fields. The concept of the acoustic energy in a moving medium is particularly useful in active noise control of ducted fan engines because the transducers used for noise control operate in a nonlinear flow regime. ne amount of energy needed by the transducers to affect the radiated noise of these engines can then be calculated precisely. The definition of acoustic energy in moving media is complicated because of the fact that there are three kinds of perturbation that propagate in inhomogeneous moving media. These are acoustic, vortical and entropic perturbations that travel at different speed in the fluid medium. Furthermore, the task of the definition of an acoustic energy expression is difficult because of the interaction between these three perturbation modes and the transfer of the acoustic energy to the mean flow. This investigation involves a review of the current state of the knowledge of the acoustic energy in inhomogeneous moving media. The basic energy conservation law is interpreted in several forms that may prove to be useful in isolating the acoustic energy and its interaction with the background flow.

Author

Acoustic Emission; Aeroacoustics; Conservation Laws; Energy Conservation; Near Fields; Noise Intensity; Noise Reduction; Rotary Wings; Sound Waves

19990019833 NASA Lewis Research Center, Cleveland, OH USA

Automated Development of Accurate Algorithms and Efficient Codes for Computational Aeroacoustics

Goodrich, John W., NASA Lewis Research Center, USA; Dyson, Rodger W., NASA Lewis Research Center, USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 9-14; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The simulation of sound generation and propagation in three space dimensions with realistic aircraft components is a very large time dependent computation with fine details. Simulations in open domains with embedded objects require accurate and robust algorithms for propagation, for artificial inflow and outflow boundaries, and for the definition of geometrically complex objects. The development, implementation, and validation of methods for solving these demanding problems is being done to support the NASA pillar goals for reducing aircraft noise levels. Our goal is to provide algorithms which are sufficiently accurate and efficient to produce usable results rapidly enough to allow design engineers to study the effects on sound levels of design changes in propulsion systems, and in the integration of propulsion systems with airframes. There is a lack of design tools for these purposes at this time. Our technical approach to this problem combines the development of new, algorithms with the use of Mathematica and UNIX utilities to automate the algorithm development, code implementation, and validation. We use explicit methods to ensure effective implementation by domain decomposition for SPMD parallel computing. There are several orders of magnitude difference in the computational efficiencies of the algorithms which we have considered. We currently have new artificial inflow and outflow boundary conditions that are stable, accurate, and unobtrusive, with implementations that match the accuracy and efficiency of the propagation methods. The artificial numerical boundary treatments have been proven to have solutions which converge to the full open domain problems, so that the error from the boundary treatments can be driven as low as is required. The purpose of this paper is to briefly present a method for developing highly accurate algorithms for computational aeroacoustics, the use of computer automation in this process, and a brief survey of the algorithms that have resulted from this work. A review of computational aeroacoustics has recently been given by Lele.

Author

Algorithms; Aeroacoustics; Noise Propagation; Three Dimensional Models; Boundary Conditions; Euler Equations of Motion; Interpolation; Applications Programs (Computers)

19990021022 Virginia Polytechnic Inst. and State Univ., Vibration and Acoustics Labs., Blacksburg, VA USA

Hybrid Active-Passive Systems for Control of Aircraft Interior Noise ***Final Report, 16 Jan. 1998 - 15 Jan. 1999***

Fuller, Chris R., Virginia Polytechnic Inst. and State Univ., USA; 1999; 3p; In English

Contract(s)/Grant(s): NCC1-282

Report No.(s): VPI/SU-FRS-4-26459; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Previous work has demonstrated the large potential for hybrid active-passive systems for attenuating interior noise in aircraft fuselages. The main advantage of an active-passive system is, by utilizing the natural dynamics of the actuator system, the control

actuator power and weight is markedly reduced and stability/robustness is enhanced. Three different active-passive approaches were studied in the past year. The first technique utilizes multiple tunable vibration absorbers (ATVA) for reducing narrow band sound radiated from panels and transmitted through fuselage structures. The focus is on reducing interior noise due to propeller or turbo fan harmonic excitation. Two types of tunable vibration absorbers were investigated; a solid state system based upon a piezoelectric mechanical exciter and an electromechanical system based upon a Motran shaker. Both of these systems utilize a mass-spring dynamic effect to maximize tile output force near resonance of the shaker system and so can also be used as vibration absorbers. The dynamic properties of the absorbers (i.e. resonance frequency) were modified using a feedback signal from an accelerometer mounted on the active mass, passed through a compensator and fed into the drive component of the shaker system (piezoelectric element or voice coil respectively). The feedback loop consisted of a two coefficient FIR filter, implemented on a DSP, where the input is acceleration of tile ATVA mass and the output is a force acting in parallel with the stiffness of the absorber. By separating the feedback signal into real and imaginary components, the effective natural frequency and damping of the ATVA can be altered independently. This approach gave control of the resonance frequencies while also allowing the simultaneous removal of damping from the ATVA, thus increasing the ease of controllability and effectiveness. In order to obtain a ”tuned” vibration absorber the chosen resonant frequency was set to the excitation frequency. In order to minimize sound radiation a gradient descent algorithm was developed which globally adapted the resonance frequencies of multiple ATVA’s while minimizing a cost based upon the radiated sound power or sound energy obtained from an array of microphones.
Derived from text
Noise Reduction; Dynamic Characteristics; Aircraft Noise; Aircraft Compartments; Controllability

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990019278 NASA Langley Research Center, Hampton, VA USA
Assessment and Requirements of Nuclear Reaction Databases for GCR Transport in the Atmosphere and Structures
Cucinotta, F. A., NASA Langley Research Center, USA; Wilson, J. W., NASA Langley Research Center, USA; Shinn, J. L., NASA Langley Research Center, USA; Tripathi, R. K., Hampton Univ., USA; Advanced Space Research; 1998; ISSN 0273-1177; Volume 21, No. 12, pp. 1753-1762; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The transport properties of galactic cosmic rays (GCR) in the atmosphere, material structures, and human body (self-shielding) am of interest in risk assessment for supersonic and subsonic aircraft and for space travel in low-Earth orbit and on interplanetary missions. Nuclear reactions, such as knockout and fragmentation, present large modifications of particle type and energies of the galactic cosmic rays in penetrating materials. We make an assessment of the current nuclear reaction models and improvements in these model for developing required transport code data bases. A new fragmentation data base (QMSFRG) based on microscopic models is compared to the NUCFRG2 model and implications for shield assessment made using the HZETRN radiation transport code. For deep penetration problems, the build-up of light particles, such as nucleons, light clusters and mesons from nuclear reactions in conjunction with the absorption of the heavy ions, leads to the dominance of the charge Z = 0, 1, and 2 hadrons in the exposures at large penetration depths. Light particles are produced through nuclear or cluster knockout and in evaporation events with characteristically distinct spectra which play unique roles in the build-up of secondary radiation’s in shielding. We describe models of light particle production in nucleon and heavy ion induced reactions and make an assessment of the importance of light particle multiplicity and spectral parameters in these exposures.
Author
Assessments; Galactic Cosmic Rays; Nuclear Reactions; Data Bases; Evaporation; Radiation Transport

19990019293 NASA Ames Research Center, Moffett Field, CA USA
Benchmark Full Configuration-Interaction Calculations on HF and NH2
Bauschlicher, Charles W., Jr., NASA Ames Research Center, USA; Langhoff, Stephen R., NASA Ames Research Center, USA; Taylor, Peter R., Eloret Corp., USA; Handy, Nicholas C., University Chemical Labs., UK; Knowles, Peter J., University of Western Ontario, Canada; Journal of Chemical Physics; Aug. 01, 1986; ISSN 0021-9606; Volume 85, No. 3, pp. 1469-1474; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Full configuration-interaction (FCI) calculations are performed at selected geometries for the (sup 1)Sigma(+) state of HCF and the (sup 2)B(sub 1) and (sup 3)A(sub 1) states NH2 using both DZ and DZP Gaussian basis sets. Higher excitations become more important when the bonds are stretched and the SCF reference becomes a poorer zeroth-order description of the wave func-

tion. The CASSCF-MRCI procedure gives excellent agreement with the FCI potentials, especially when corrected with a multireference analog of the Davidson correction.
Author
Configuration Interaction; Excitation; Nitrogen Hydrides; Hydrofluoric Acid

19990019411 Department of the Navy, Washington, DC USA
Thermal Neutron Detector
Copeland, Hugh D., Inventor; Losee, Jon R., Inventor; Mastny, Gary F., Inventor; Mar. 31, 1998; 6p; In English; Supersedes US-Patent-Appl-SN-592905
Patent Info.: Filed 29 Jan. 96,; US-Patent-Appl-SN-592,905; US-Patent-5,734,689
Report No.(s): AD-D019127; No Copyright; Avail: US Patent and Trademark Office, Microfiche

A thermal neutron detector comprises an enclosure containing a helium-xenon gas mixture, an optical fiber, and an electrode arranged to detect ion particles is discussed. The optical fiber detects photons generated by a reaction of the gas mixture with neutrons passing through the enclosure. The reaction also generates ion particles that are detected by the electrode. A coincidence detector generates an output signal corresponding to the correlation of ion detections from the electrode with photon detections from the optical fiber, rejecting signals generated from the electric field that are not correlated with photon detections.
DTIC
Neutron Counters; Thermal Neutrons

19990019469 Tokai Univ., School of Science, Tokyo, Japan
On Possibility of Light Neutralino
Kizukuri, Yoshiki, Tokai Univ., Japan; Proceedings of the School of Science of Tokai University; Mar. 1994; ISSN 0563-6795; Volume 29, pp. 49-57; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A possibility that the mass of the lightest neutralino is smaller than 25 GeV, which is required by the explanation with light scalar top quark for an anomalous production of cc(bar) with large missing energy at TRISTAN, is explored. The LEP constraints on the chargino mass and the branching ratio of the invisible mode are considered to restrict the allowed region in (m(sub H), m(sub 2)) parameter space. It is shown that there still remains a tiny, although non- vanishing, region in the parameter space, in which the lightest neutralino is allowed to be lighter than 25 GeV.
Author
Mass Ratios; Neutrinos

19990019662 Naval Postgraduate School, Monterey, CA USA
Change Detection Analysis With Spectral Thermal Imagery
Behrens, Richard J.; Sep. 1998; 152p; In English
Report No.(s): AD-A356044; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Spectral imagery offers additional information about a scene that can enhance an analyst's ability to conduct change detection. Automation of change detection is required to sift through countless images to identify scenes that have significant intelligence value. Change detection in spectral thermal imagery enables exploitation at night by taking advantage of the emissive characteristics of materials. Data collected from the Spatially Enhanced Broadband Array Spectrograph System (SEBASS) were used to investigate the feasibility of spectral thermal change detection in the long wave infrared (LWIR) region. This study used analysis techniques of differencing, histograms, and principal components analysis to detect spectral changes and investigate the utility of spectral change detection. Many artifacts can influence the sensitivity of change detection methods. Temperature dependence and gross registration errors greatly affect an analysts ability to make use of spectral thermal data for change detection; however, with effort, spectral changes were still detected with these data and suggest that the techniques would be useful once the undesirable characteristics are minimized.
DTIC
Images; Thermal Mapping; Finite Difference Theory; Change Detection; Imagery; Infrared Radiation

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NUCLEAR AND HIGH-ENERGY PHYSICS

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

19990020943 Oak Ridge National Lab., Computational Physics and Engineering Div., TN USA
R-Matrix Analysis of U-235 Neutron Transmission and Cross Sections in the Energy Range 0 to 2.25 keV
Leal, L. C., Oak Ridge National Lab., USA; Derrien, H., Oak Ridge National Lab., USA; Larson, N. M., Oak Ridge National Lab., USA; Wright, R. Q., Oak Ridge National Lab., USA; Nov. 1997; 126p; In English
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): PB99-115131; ORNL/TM-13516; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This document describes a new R-matrix analysis of Uranium 235 cross section data in the energy range from 0 to 2250 eV. The analysis was performed with the computer code SAMMY, that has recently been updated to permit, for the first time, inclusion of both differential and integral data within the analysis process. Fourteen differential data sets and six integral quantities were used in this evaluation: two measurements of fission plus capture, one of fission plus absorption, six of fission alone, two of transmission, and one of eta, plus standard values of thermal cross sections for fission, capture, and scattering, and of K1 and Westcott g-factors for both fission and absorption. An excellent representation was obtained for the high-resolution transmission, fission, and capture cross-section data as well as for the integral quantities. This new evaluation is expected to greatly improve predictability of the criticality safety margins for nuclear systems in which Uranium 235 is presented.
NTIS
Matrices (Mathematics); Uranium 235; Neutron Cross Sections

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OPTICS

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

19990019159 National Optical Astronomy Observatories, Tucson, AZ USA
Review of Fiber Optic Instrumentation at NOAO
Barden, Samuel C., National Optical Astronomy Observatories, USA; Ingerson, Tom E., Cerro Tololo Inter-American Observatory, Chile; Feb. 1998; 5p; In English
Report No.(s): NOAO-Preprint-780; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We give an overview of the current instruments in use and in development at NOAO which utilize fiber optics to transport the light from the telescope to the spectrograph. Two new instruments include a Hydra multi-fiber instrument for the Blanco 4-meter at CTIO and a simple 90-fiber IFU for the WIYN telescope at KPNO.
Author
Fiber Optics; Spectrographs; Images

19990019323 Surface Optics Corp., San Diego, CA USA
Correlation Effects in Multiple Scattering from Random Rough Surfaces *Final Report*
Gu, Zu-Han; Maradudin, Alexel A.; May 15, 1998; 14p; In English; Prepared in cooperation with California Univ., Dept. of Physics and Astronomy, Irvine, CA.
Contract(s)/Grant(s): DAAH04-94-G-0325
Report No.(s): AD-A358015; ARO-32304.12-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The first theoretical studies of angular correlations in the intensity of light scattered from randomly rough metal surfaces, that go beyond the factorization approximation, have been carried out. As a consequence, in addition to the memory and the time-reversed memory effects studied by earlier authors, known as the short-range C(1) correlations, the long-range C(2) correlations and the infinite-range C(3) correlations have been determined. The latter two correlation functions had been studied earlier in the scattering of light from volume disordered systems, but had not yet been studied in rough surface scattering. In addition, a new correlation function, called C(10), of the same order of magnitude as C(1) has been found, as well as another new correlation function, called C(1.5), that, along with C(2), displays peaks associated with the roughness-induced excitation of the surface electromagnetic waves supported by the vacuum-metal interface. The invalidity of the factorization approximation for weakly rough random surfaces has also been established in another set of calculations. Experimental studies of the memory and time-reversed

memory effects have been carried out, as have studies of the effects of localized defects on angular correlations in the intensity of light scattered from random surfaces.
DTIC
Light Scattering; Backscattering; Correlation; Surface Roughness; Numerical Analysis; Factorization; Approximation

19990019440 Department of the Navy, Washington, DC USA
Length and Elongation Sensor
Sansone, Louis E., Inventor; Apr. 07, 1998; 4p; In English; Supersedes US-Patent-Appl-SN-637000, AD-D018293.
Patent Info.: Filed 18 Apr. 96,; US-Patent-5,737,067; US-Patent-Appl-SN-637,000
Report No.(s): AD-D019120; No Copyright; Avail: US Patent and Trademark Office, Microfiche
A length and elongation sensor includes an elastomeric optical wave guide and a time domain reflectometer is reviewed. The elastomeric optical wave guide consists of a urethane outer cladding and an optical gel core. A transparent window is hermetically sealed to the first end of the optical wave guide and a reflective mirror is hermetically sealed to the second end of the optical wave guide. Both ends of the wave guide are then fixedly attached to the unit to be measured. The time domain reflectometer is operative for propagating a light pulse through the optical wave guide and for measuring the round-trip propagation time of the light pulse. Since the velocity of the light pulse is known, the length of the wave guide can easily be determined. The wave guide is stretchable up to 25% of its original length thereby allowing both static and dynamic length measurements of the unit to be measured.
DTIC
Optical Waveguides; Elongation; Length; Optical Measuring Instruments

19990019451 Massachusetts Inst. of Tech., Lab. of Electronics, Cambridge, MA USA
New Developments in Atom Interferometry ***Final Report, 1 Aug. 1995 - 31 Jul. 1998***
Pritchard, David; Jul. 31, 1998; 16p; In English
Contract(s)/Grant(s): DAAH04-95-1-0533
Report No.(s): AD-A357800; ARO-34686.2-PH; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Atom interferometers have proven to be versatile tools, applicable in many different scientific and technical arenas. We have concentrated our efforts in the three major areas of precision measurements of important quantities in atomic physics, basic research into atom interferometric inertial sensors, and investigations of fundamental quantum mechanical principles.
DTIC
Interferometry; Atomic Physics; Optical Equipment; Quantum Theory

19990019584 Fukui Univ., Faculty of Engineering, Japan
Analysis of Mesoscopic Scaled Optical Cavities with Waveguide Structure
Ohtaka, Masato, Fukui Univ., Japan; Santo, Takeshi, Fukui Univ., Japan; Hashimoto, Akihiro, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 293-308; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Photonic band gap and strong photon localization in mesoscopic-scaled optical cavities with periodic or aperiodic waveguide structures have been analyzed through a numerical approach. The approximation method based on the method of separation of variables is applied to 2-dimensional mesoscopic-scaled optical waveguide structures with various index distributions and cavity geometries. The results indicate that for the periodic cavities photonic band gap is broken by higher transverse modes with larger index distributions while strong photon localization is always found even in multi-transverse mode condition for the aperiodic cavities, since photon localization depends only on properties of each resonant mode. From these results, fabrication of photonic band gap device with waveguide structure may be more difficult than those with bulk or layered structure, while that of strong photon localization device will be much easier and more effective. The interaction between localized state and extended state is easily achieved by using multi-transverse mode operation.
Author
Optical Resonators; Optical Waveguides; Photons; Energy Gaps (Solid State)

19990019649 Rice Univ., Dept. of Electrical and Computer Engineering, Houston, TX USA
Research on High Resolution Imaging and Fiber Optical Networks ***Final Report, 1 May 1997 - 31 Jul. 1998***
Young, James F.; Oct. 1998; 19p; In English
Contract(s)/Grant(s): F49620-97-1-0349; AF Proj. 2301
Report No.(s): AD-A356279; AFRL-SR-BL-TR-98-0711; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this grant was to provide support to allow a student working under the preceding grant, F49620-94-1-0017 to transition to new funding and to finish his graduate degree. Both objectives were met. The research program involved two projects. The first focused on the development of extreme ultraviolet (XUV) sources, and their application to the development of high resolution, microscopic imaging techniques. That project came to close shortly after the beginning of this grant. The second project investigated unique approaches to building multiuser optical fiber networks.
DTIC
Extreme Ultraviolet Radiation; Imaging Techniques; Radiation Sources; Fiber Optics

19990019710 Southwest Virginia Community Coll., Engineering Div., Richlands, VA USA
Utilizing Fiber Optics as a Methane Gas Sensor Impartially the Effects of Methane on the Fiber Cladding
Hopkins, Thomas E., Southwest Virginia Community Coll., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 69; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

One reason to measure the level of methane gas is to ensure that the level of gas is not in the explosive range. A second reason to measure the level of methane gas is to ensure the level of gas is not at a level that causes the depletion of oxygen for sustaining life. The present methods of measuring methane gas are using an electrochemical cell or measuring the change of resistance caused by the heating of a noble-metal lament or catalyst bead. The heating is caused by catalytic combustion of a methane-air mixture. Since methane is an explosive gas the instruments used must meet certain criteria for intrinsically safe operation. With the utilization of fiber optic sensors we take advantage of its intrinsically safe characteristics. The mining and petroleum production, land fill monitoring, and waste water treatment plants requires methane gas detection. The detection of the build up of methane gas in utility man-holes and ship voids is required.
Author
Fiber Optics; Electrochemical Cells; Gas Mixtures; Depletion; Combustion; Catalysts

19990019863 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
MOD Tool (Microwave Optics Design Tool)
Katz, Daniel S., Jet Propulsion Lab., California Inst. of Tech., USA; Borgioli, Andrea, Jet Propulsion Lab., California Inst. of Tech., USA; Cwik, Tom, Jet Propulsion Lab., California Inst. of Tech., USA; Fu, Chuigang, Jet Propulsion Lab., California Inst. of Tech., USA; Imbriale, William A., Jet Propulsion Lab., California Inst. of Tech., USA; Jamnejad, Vahraz, Jet Propulsion Lab., California Inst. of Tech., USA; Springer, Paul L., Jet Propulsion Lab., California Inst. of Tech., USA; HPCCP/CAS Workshop Proceedings 1998; Jan. 1999, pp. 165-170; In English; Also announced as 19990019831; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Jet Propulsion Laboratory (JPL) is currently designing and building a number of instruments that operate in the microwave and millimeter-wave bands. These include MIRO (Microwave Instrument for the Rosetta Orbiter), MLS (Microwave Limb Sounder), and IMAS (Integrated Multispectral Atmospheric Sounder). These instruments must be designed and built to meet key design criteria (e.g., beamwidth, gain, pointing) obtained from the scientific goals for the instrument. These criteria are frequently functions of the operating environment (both thermal and mechanical). to design and build instruments which meet these criteria, it is essential to be able to model the instrument in its environments. Currently, a number of modeling tools exist. Commonly used tools at JPL include: FEMAP (meshing), NASTRAN (structural modeling), TRASYS and SINDA (thermal modeling), MACOS/IMOS (optical modeling), and POPO (physical optics modeling). Each of these tools is used by an analyst, who models the instrument in one discipline. The analyst then provides the results of this modeling to another analyst, who continues the overall modeling in another discipline. There is a large reengineering task in place at JPL to automate and speed-up the structural and thermal modeling disciplines, which does not include MOD Tool. The focus of MOD Tool (and of this paper) is in the fields unique to microwave and millimeter-wave instrument design. These include initial design and analysis of the instrument without thermal or structural loads, the automation of the transfer of this design to a high-end CAD tool, and the analysis of the structurally deformed instrument (due to structural and/or thermal loads). MOD Tool is a distributed tool, with a database of design information residing on a server, physical optics analysis being performed on a variety of supercomputer platforms, and a graphical user interface (GUI) residing on the user's desktop computer. The MOD Tool client is being developed using Tcl/Tk, which allows the user to work on a choice of platforms (PC, Mac, or UNIX) after downloading the Tcl/Tk binary, which is readily available on the web. The MOD Tool server is written using Expect, and it resides on a Sun workstation. Client/server communications are performed over a socket, where upon a connection from a client to the server, the server spawns a child which is be dedicated to communicat-

ing with that client. The server communicates with other machines, such as supercomputers using Expect with the username and password being provided by the user on the client.
Derived from text
Computer Aided Design; Applications Programs (Computers); Optical Measuring Instruments; Mathematical Models; Multidisciplinary Design Optimization; Computer Techniques

19990020992 National Inst. of Standards and Technology, Optical Technology Div., Gaithersburg, MD USA
Standard Reference Materials: Transmission Filters with Measured Optical Density at 1064 nm Wavelength: SRMs 2046, 2047, 2048, 2049, 2050, and 2051
Zhang, Zhuomin M., Florida Univ., USA; Gentile, Thomas R., National Inst. of Standards and Technology, USA; Migdall, Alan L., National Inst. of Standards and Technology, USA; Datla, Raju U., National Inst. of Standards and Technology, USA; Nov. 1998; 44p; In English
Report No.(s): PB99-117160; NIST/SP-260-128; CODEN: NSPUE2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Standard Reference Materials (SRMs) 2046-2051 are transmission filters and may be used for calibrating transmittance measurements made using lasers or infrared spectrophotometers, for attenuating the optical power with an accurately known transmittance at a wavelength of 1064 nm, and for characterizing the nonlinearity of detection systems. The external transmittance of these filters has been measured at a wavelength of 1064 nm using a Nd:YAG laser and silicon diode detectors. The uncertainty associated with the measured optical density of each filter has been individually determined. The filters are made of colored glass with uncoated, polished surfaces. The filter plates are 51 mm x 51 mm, with thicknesses ranging from 1 mm to 6.4 mm which correspond to nominal optical densities from 1 to 6.
NTIS
Transmittance; Optical Density; Wavelengths; Optical Filters

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990019314 Toulouse Univ., France
International Conference on Phenomena in Ionized Gases, Volume 1
Dec. 01, 1998; 305p; In English; 23rd; Phenomena in ionized gases, 17-22 Jul. 1997, Toulouse, France
Contract(s)/Grant(s): F61708-97-W0048
Report No.(s): AD-A357740; EOARD-CSP-97-1013-Vol-1; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The Final Proceedings for 23rd International Conference on Phenomena in Ionized Gases, 17 July 1997 - 22 July 1997 kinetic, thermodynamics, and transport phenomena; elementary processes; low pressure glows; coronas, sparks, surface discharges, and high pressure glows; arcs; high frequency discharges; ionospheric magnetospheric, and astrophysical plasmas; plasma diagnostic methods; plasma surface effects; plasma processing; plasma flows; non ideal plasmas; waves and instabilities; non-linear phenomena; particle and laser beam interactions with plasmas; plasma sources of radiation; modeling; plasma for environmental issues; plasma thrusters; surface treatment; high pressure, non-thermal plasmas.
DTIC
Conferences; Ionized Gases; Thermodynamics; Transport Properties; Sparks; Surface Treatment; Plasma Radiation; Plasma Engines; Thermal Plasmas; Space Plasmas; Solar Corona; Aerospace Environments

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SOLID-STATE PHYSICS

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

19990019509 NASA Marshall Space Flight Center, Huntsville, AL USA
Measurement of Interfacial Undercooling in a Dilute Pb-Sn Alloy Near the Regime of Morphological Instability
Sen, S., NASA Marshall Space Flight Center, USA; Dhindaw, B. K., Indian Inst. of Tech., India; Curreri, P. A., NASA Marshall Space Flight Center, USA; Peters, P., NASA Marshall Space Flight Center, USA; Kaukler, W. F., Alabama Univ., USA; Journal

of Crystal Growth; 1998; ISSN 0022-0248; Volume 193, pp. 692-700; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The solid/liquid (s/l) interfacial Seebeck technique was used to measure interfacial undercooling in a Pb-1 wt% Sn alloy. For plane front solidification an undercooling in the range of 0.54-0.57 C was recorded. However, for growth velocities between 6 and 15 pm/s the undercooling increased with increase in velocity. This is in contradiction to the theoretical predictions based on growth at the extremum condition. A modified analytical expression was developed based on the marginal stability criterion to predict undercooling for growth velocities immediately over the limit of morphological stability. Between 6 and 15 microns/s the trend predicted by this modified expression is in qualitative agreement with the experimental results. This model is more consistent with the analysis of Venugopal and Kirkaldy which states that the extremum condition criterion is not applicable in the marginal stability regime. At higher growth velocities between 20 and 50 microns/s where stable cellular growth is expected the undercooling decreased with increase in velocity. The predictions of Burden and Hunt based on extremum criterion agree reasonably well with the experimental results in this velocity range. Finally, the importance of nonequilibrium phase diagram parameters such as partition coefficient and liquidus slope were also evaluated using the experimental undercooling results obtained in this investigation.

Author

Tin Alloys; Cooling; Morphology; Stability; Lead Alloys

19990019565 National Academy of Sciences - National Research Council, Huntsville, AL USA

Stationary Crystal Diffraction with a Monochromatic Convergent X-Ray Source and Application for Macromolecular Crystal Data Collection

Ho, J. X., NASA Marshall Space Flight Center, USA; Snell, E. H., NASA Marshall Space Flight Center, USA; Sisk, R. C., NASA Marshall Space Flight Center, USA; Ruble, J. R., NASA Marshall Space Flight Center, USA; Carter, D. C., NASA Marshall Space Flight Center, USA; Owens, S. M., NASA Marshall Space Flight Center, USA; Gibson, W. M., NASA Marshall Space Flight Center, USA; Acta Crystallographica, Section D; 1997; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

A diffraction geometry utilizing convergent X-rays from a polycapillary optic incident on a stationary crystal is described. A mathematical simulation of the resulting diffraction pattern (in terms of spot shape, position and intensity) is presented along with preliminary experimental results recorded from a lysozyme crystal. The effective source coverage factor is introduced to bring the reflection intensities onto the same scale. The feasibility of its application to macromolecular crystal data collection is discussed.

Author

Crystals; Diffraction; Monochromatization; Convergence; X Ray Sources

19990019571 NASA Marshall Space Flight Center, Huntsville, AL USA

Simultaneous in situ Optical Monitoring Techniques during Crystal Growth of ZnSe by Physical Vapor Transport

Su, C.- H., NASA Marshall Space Flight Center, USA; Feth, S., Hughes STX, Inc., USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 10th; Vapor Growth and Epitaxy (ICVGE 10), 26-31 Jul. 1998, Jerusalem, Israel; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

ZnSe crystals grown in sealed ampoules by the physical vapor transport method were monitored in situ using three techniques, simultaneously. A Michelson interferometer was set-up to observe the growth rate and surface morphological evolution. An interference pattern (interferogram) is formed by the interaction between the reflection of a HeNe laser (632.8 nm wavelength) off the crystal-vapor interface and a reference beam from the same laser. Preliminary results indicate that the rate of growth/thermal-etching can be calculated using analog data acquisition and simple fringe counting techniques. Gross surface features may also be observed using a digital frame grabber and fringe analysis software. The second in situ technique uses optical absorption to determine the partial pressures of the vapor species. The Se2 and Zn vapor species present in the sealed ampoule absorb light at characteristic wavelengths. The optical absorption is determined by monitoring the light intensity difference between the sample and reference beams. The Se2 Partial pressure profile along the length of the ampoule was estimated from the vibronic absorption peaks at 340.5, 350.8, 361.3 and 379.2 nm using the Beer's law constants established in the calibration runs of pure Se. Finally, because the high temperature crystal growth furnace contains windows, in situ visual observation of the growing crystal is also possible. The use of these techniques not only permits in situ investigation of high temperature vapor growth of semiconductors, but also offers the potential for real time feed back on the growing crystal and allows the possibility of actively controlling the growth process.

Author

Optical Control; Procedures; Crystal Growth; Zinc Selenides; Vapor Deposition; Data Acquisition

19990019583 Fukui Univ., Faculty of Engineering, Japan

Nitridation Behavior of GaAs(111)B Surfaces in NH3 Flow and Evaluation of the Nitrided GaAs(111)B as Substrates for MOCVD Growth of InN

Yamauchi, Yasuyuki, Fukui Univ., Japan; Tomohiro, Shin-Ya, Fukui Univ., Japan; Ohkubo, Mitsugu, Fukui Univ., Japan; Hashimoto, Akihiro, Fukui Univ., Japan; Yamamoto, Akio, Fukui Univ., Japan; Memoirs of the Faculty of Engineering, Fukui University; Sep. 1996; ISSN 0429-8373; Volume 44, No. 2, pp. 285-292; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An experimental study has been made of thermal nitridation of GaAs(111)B substrates in NH3 flow and MOCVD growth of InN on the nitrided substrates. Surface of GaAs(111)B is easily nitrided at a temperature higher than 500 C and a single-crystalline GaN layer is formed as a result of the nitridation. A GaN layer has zincblende structure when it is formed at approx. less than 650 C and wurtzite one when formed at approx. greater than 850 C. Using MOCVD method, a single-crystalline InN film is grown on the nitrided GaAs(111)B surface. Crystal structure of InN films grown on GaAs(111)B with a zincblende GaN layer is changed from zincblende to wurtzite when the thickness of InN film is increased from 0.05 to 02 microns, while only wurtzite InN is grown on the substrates with a wurtzite GaN layer independently of the film thickness. An InN film grown on nitrided GaAs(111)B has a excellent surface morphology compared with that grown on a sapphire substrate. This is mainly due to that a columnar fibrous structure, which is the origin for the rough surface of InN films on sapphire, is not found in the films on GaAs(111)B. These results show that nitrided GaAs(111)B substrate is promising as a substrate for the growth of InN.
Author

Nitriding; Gallium Arsenides; Substrates; Metalorganic Chemical Vapor Deposition; Crystal Structure; Ammonia

19990019627 NASA Marshall Space Flight Center, Huntsville, AL USA

Superconductor-Mediated Modification of Gravity? AC Motor Experiments with Bulk YBCO Disks in Rotating Magnetic Fields

Noever, David A., NASA Marshall Space Flight Center, USA; Koczor, Ronald J., NASA Marshall Space Flight Center, USA; Roberson, Rick, Tomorrowtools, USA; 1998; 1p; In English, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have previously reported results using a high precision gravimeter to probe local gravity changes in the neighborhood of large bulk-processed high-temperature superconductors. Podkietnov, et al (Podkietnov, E. and Nieminen, R. (1992) A Possibility of Gravitational Force Shielding by Bulk YBa2 Cu3 O7-x Superconductor, Physica C, C203:441-444.) have indicated that rotating AC fields play an essential role in their observed distortion of combined gravity and barometric pressure readings. We report experiments on large (15 cm diameter) bulk YBCO ceramic superconductors placed in the core of a three-phase, AC motor stator. The applied rotating field produces up to a 12,000 revolutions per minute magnetic field. The field intensity decays rapidly from the maximum at the outer diameter of the superconducting disk (less than 60 Gauss) to the center (less than 10 Gauss). This configuration was applied with and without a permanent DC magnetic field levitating the superconducting disk, with corresponding gravity readings indicating an apparent increase in observed gravity of less than 1 x 10(exp -6)/sq cm, measured above the superconductor. No effect of the rotating magnetic field or thermal environment on the gravimeter readings or on rotating the superconducting disk was noted within the high precision of the observation. Implications for propulsion initiatives and power storage flywheel technologies for high temperature superconductors will be discussed for various spacecraft and satellite applications.
Author

Superconductors (Materials); Atmospheric Pressure; Gravitation; Magnetic Fields; Rotating Disks; Thermal Environments; High Temperature Superconductors

19990019647 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

Electronic Structure of Impurities and Vortices in Short Coherence Length Superconductors ***Annual Report, 1 Jul. 1997 - 30 Jun. 1998***

Flatte, Michael E.; Jul. 01, 1998; 9p; In English

Contract(s)/Grant(s): N00014-96-1-1012

Report No.(s): AD-A356283; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is a report of progress in theoretical calculations of scanning tunneling microscopy spectra near impurities in superconductors. A previously-developed Green's function technique is applied to superconductors with anisotropic gaps, such as d-wave or extended s-wave. Calculations of planar tunneling spectra can reproduce the quite different results from several different groups

with a d-wave gap and a small amount (1%) of impurities. These impurities are believed to be oxygen vacancies. A systematic investigation of the properties of impurity-associated resonance states in the gap has also been done.
DTIC
Superconductivity; Mathematical Models; YBCO Superconductors; Green"S FUNCTIONS; Atomic Structure; Impurities

19990019648 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Electronic Structure of Impurities and Vortices in Short Coherence Length Superconductors ***Final Report, 1 Jul. 1996 - 30 Sep. 1998***
Flatte, Michael E.; Nov. 01, 1998; 181p; In English
Contract(s)/Grant(s): N00014-96-1-1012
Report No.(s): AD-A356282; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This is a final report on theoretical calculation of scanning tunneling microscopy spectra near impurities in superconductors. Calculations have been performed for superconductors with isotropic and anisotropic gaps using a newly developed Green's function technique. This technique provides essentially arbitrary energy resolution and is applicable to strong or weak- coupling superconductors with long or short coherence lengths and arbitrary energy gaps. An analytic model has been developed for impurities in superconductors with either anisotropic or isotropic gaps. Calculation of planar tunneling spectra can reproduce the (quite different) results from several different groups with a d-wave gap and a small amount (1%) of impurities. These impurities are believed to be oxygen vacancies. A systematic investigation of the properties of impurity-associated resonance states in the gap has also been done.
DTIC
YBCO Superconductors; Superconductivity; Mathematical Models; Atomic Structure; Green"S FUNCTIONS; Impurities

19990019809 National Space Development Agency, Tsukuba, Japan
Measurement of Diffusion Coefficient by Shear Cell Method
Yoda, Shinichi, National Space Development Agency, Japan; Masaki, Tadahiko, National Space Development Agency, Japan; Oda, Hirohisa, National Space Development Agency, Japan; Microgravity Science Laboratory (MSL-1); November 1998, pp. 85-92; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Diffusion coefficient is necessary to decide most suitable condition for crystal growth, but diffusion coefficient can not be measured accurately because of thermal convection on the ground. Shear cell method which is modified from long capillary method was used for measurement of diffusion coefficient of tin and lead-tin-telluride in this investigation. Diffusion coefficient of tin at 1000 C was found to be 1.8 x 10(exp -4) sq cm/s from flight experiment result which was performed in MSL-1 mission. Result of lead-tin-telluride varied widely because of crystal segregation.
Author
Crystal Growth; Crystals; Diffusion Coefficient; Free Convection

19990019815 New Century Pharmaceuticals, Inc., Huntsville, AL USA
Highlights from the Protein Crystallization Apparatus for Microgravity (PCAM) Experiments Conducted During MSL-1
Carter, Daniel C., New Century Pharmaceuticals, Inc., USA; Wright, B., New Century Pharmaceuticals, Inc., USA; Chapman, J., New Century Pharmaceuticals, Inc., USA; Miller, T., New Century Pharmaceuticals, Inc., USA; Adcock-Downey, L., New Century Pharmaceuticals, Inc., USA; Declercq, Jean-Paul, Universite Catholique de Louvain, Belgium; Chang, Chong Hwan, Du Pont Pharmaceuticals, Inc., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 158-170; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

PCAM is a facility-based apparatus used for the optimization and production of protein crystals in microgravity for application in structural biology. Crystals produced in the facility also support fundamental crystal growth research with an emphasis on establishing the role of microgravity in the improvements in size and quality. PCAM experiments on MSL-1 supported 10 co-investigator groups studying 13 proteins involving research from academic and industrial laboratories. Highlights from this mission include one of the highest resolution protein structures to be produced as a result of microgravity and the first example of microgravity enablement for a neutron diffraction study.
Author
Gravitational Effects; Microgravity; Protein Crystal Growth; Crystal Growth

19990019816 California Univ., Dept. of Molecular Biology and Biochemistry, Irvine, CA USA

L+1 Report on HHDTC Investigation on MSL-1

Koszelak, S., California Univ., USA; McPherson, Alexander, California Univ., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 172-172a; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Our investigation on MSL-1 was based on an apparatus of our design and construction referred to as the Hand Held Diffusion Test Cell (HHDTC). The device is designed to carry out the crystallization of macromolecules in a microgravity environment, as well as the crystallization of conventional organic molecules. The device employs a methodology known as liquid-liquid diffusion , a process which is initiated in this case by rotating a stopcock to establish continuity between a chamber of about 0.4 ml containing protein with a chamber of about 0.8 ml containing a precipitating agent such as ammonium sulfate in water, or solutions of polyethylene glycol. Complete, multi-chambered cells are organized in sets of eight within Lucite containers so that they can be activated in sets by a hand cranked ganging mechanism. The activation is carried out once microgravity is achieved by a crew member. The cells are also equipped with backlights so that events within can be recorded using a hand held video camera manipulated by a crew member.

Derived from text

Polymethyl Methacrylate; Crystallization; Diffusion; Microgravity

19990019817 Alabama Univ., Birmingham, AL USA

VDA-2 Protein Crystal Growth Experiments MSL-1 ***Final Report***

DeLucas, Lawrence J., Alabama Univ., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 174-183; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The vapor diffusion crystal growth experiments conducted by the Center for Macromolecular Crystal growth at the University of Alabama at Birmingham involved ten macromolecular compounds. The experiments were conducted in the second-generation Vapor Diffusion Apparatus (VDA-2) stored in a Commercial Refrigerator/Incubator Module, at 220 C. The macromolecular compounds included in the experiments were proteinase K complex, human serum albumin, PEP carboxykinase, NAD synthetase complex, 5S rRNA, hyaluronidase, glyceraidehyde-3-phosphate dehydrogenase, lectin KM+, glucoamylase and grass pollen allergen. The VDA-2 experiments were successful in producing diffraction-sized crystals of eight of the ten compounds flown. Five of the macromolecular compounds produced crystals that yielded the best x-ray diffraction data ever collected for these compounds. X-ray diffraction data from the microgravity crystals was used to produce a new three-dimensional structure of one of the compounds and to significantly refine the structures of four additional compounds.

Author

X Ray Diffraction; Vapor Deposition; Phosphates; Microgravity; Diffusion; Diffraction; Crystals; Crystal Growth

19990019822 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany

Dendrite Growth Velocity Measurements in Undercooled Ni and Ni-C Melts in Space ***Final Report***

Barth, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Holland-Moritz, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Herlach, Dieter, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Matson, D. M., Massachusetts Inst. of Tech., USA; Flemings, M. C., Massachusetts Inst. of Tech., USA; Microgravity Science Laboratory (MSL-1); November 1998, pp. 244-251; In English; Also announced as 19990019800; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Under terrestrial processing conditions, convection in the melt shows a major impact on metallic solidification, especially at small crystal growth velocities. Previous studies of dendrite growth in undercooled Ni melts on earth show systematic deviations of experimental data and predictions of dendrite growth theory at small undercoolings. The discrepancy is partly reduced if convection is taken into consideration. The present experimental studies in space aimed to test, under the conditions of reduced convection in microgravity, the predictions of dendrite growth models by measurements of the growth velocities in pure Ni and dilute Ni-0.6 at.% C alloy melts. A comparison of velocity data of the pure metal and the dilute alloy is used to investigate the prediction of marginal stability theory that for growing dendrites, the addition of a strongly partitioning element may lead to an enhancement of the growth velocity. The experiments were performed during the MSL-1-R mission in July 1997 using the electromagnetic levitation facility TEMPUS.

Author

Crystal Growth; Melts (Crystal Growth); Microgravity; Neurons; Solidification; Velocity Measurement

19990020830 NASA Langley Research Center, Hampton, VA USA

The Effect of Microgravity Direction on the Growth of PbSnTe

Fripp, A. L., NASA Langley Research Center, USA; Debnam, W. J., NASA Langley Research Center, USA; Rosch, W. R., National Academy of Sciences - National Research Council, USA; Narayanan, R., Florida Univ., USA; Third USA Microgravity Payload: One Year Report; November 1998, pp. 53-81; In English; Also announced as 19990020826; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

The Space Shuttle Columbia was launched as STS-75 at 2018 GMT (Greenwich Mean Time) on February 22, 1996. One of the two major experiment packages was the Third USA Microgravity Payload (USMP-3), and one of the principal instruments on the USMP was the Advanced Automated Directional Solidification Furnace (AADSF). The AADSF is a multizone directional solidification furnace, and at the time of the USMP-3 flight was capable of processing only one sample per Shuttle mission which, for that flight, was a lead tin telluride (PbSnTe) crystal growth experiment. In the one year since the flight experiment the sample has been retrieved from the spacecraft and analysis has begun. After presenting introductory material on why PbSnTe was chosen as a test material, why microgravity processing was expected to produce desired results, and what we expected to find in conducting these tests, this report discusses the results to date which are far from complete.

Derived from text

Crystal Growth; Furnaces; Lead Tellurides; Microgravity; Tin Tellurides; Spaceborne Experiments; Computational Fluid Dynamics; Finite Volume Method

19990021109 Department of the Navy, Washington, DC USA

Gallium Arsenide Semiconductor Devices Fabricated with Insulator Layer

Santiago, Francisco, Inventor; Chu, Tak-Kin, Inventor; Stumborg, Michael F., Inventor; Boulais, Kevin A., Inventor; Nov. 23, 1998; 32p; In English

Patent Info.: US-Patent-Appl-SN-09,197,440

Report No.(s): AD-D019156; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The paper presents an insulator layer for single crystal gallium arsenide substrates in which the insulator layer is compliantly matched with the substrate and the insulator layer is free of defects causing surface roughness and crystalline defect problems which, otherwise, could impair device performance. to accomplish this, the insulator layer is formed on a gallium arsenide substrate as an integral composite or variegated structure including: (a) a uniform homogenous film of Group IIa metal atoms attached directly onto a gallium arsenide substrate surface in the form of a monolayer, and (b) a single crystal epitaxial film of a Group IIa metal fluoride deposited on the monolayer.

DTIC

Semiconductor Devices; Gallium Arsenides; Epitaxy; Single Crystals; Fabrication; Composite Structures

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.

19990019444 Department of the Navy, Washington, DC USA

Wick-Interrupt Temperature Controlling Heat Pipe

Hyman, Nelson I., Inventor; Jun. 30, 1998; 12p; In English

Patent Info.: Filed 12 Sep. 96,; US-Patent-Appl-SN-712,814; US-Patent-5,771,967

Report No.(s): AD-D019078; No Copyright; Avail: US Patent and Trademark Office, Microfiche

The wick-interrupt temperature controlling heat pipe (WITCH) is a device for controlling the temperature of spacecraft temperature-sensitive, heat dispensing devices. A heat transporting working fluid is conveyed in saturated equilibrium with its vapor across a discontinuous internal capillary liquid wick, within a tubular cylindrical pressure vessel, from a condenser section to an evaporator section located on either side of the discontinuity. When the temperature within the WITCH rises to a predetermined level, a sliding wick located within the internal capillary liquid wick is inserted across the discontinuity by a temperature sensitive control rod, thereby allowing the heat transporting working fluid to circulate from the condenser section wick to the evaporator section wick. In this configuration, the WITCH operates identically to the ”constant-conductance heat pipe” commonly used. When the component’s or heat pipe’s temperature drops to a predetermined level the control rod contracts relative to the heat pipe vessel wall and retracts the sliding wick, again crating a wick discontinuity between the evaporator and condenser sections and thereby interrupting the flow of the heat transporting working fluid and causing evaporator dry-out and curtailment of heat pipe

operation. This ”ON” and ”OFF” heat pipe operation is the means whereby temperature is actively controlled to within a narrow range while heat transport varies over a wide range.
DTIC
Temperature Control; Heat Pipes; Working Fluids; Conductive Heat Transfer; Active Control

80
SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19990019690 Hampton Univ., VA USA
1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program
Marable, William P., Compiler, Hampton Univ., USA; Murray, Deborah B., Compiler, Old Dominion Univ., USA; Dec. 1998; 119p; In English; 34th, 1 Jun. - 7 Aug. 1998, Hampton, VA, USA; Sponsored by American Society for Engineering Education, USA; Also announced as 19990019691 through 19990019729
Contract(s)/Grant(s): NGT1-52181
Report No.(s): NASA/CR-1998-208728; NAS 1.26:208728; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; Abstracts Only; Abstracts Only

Since 1964, the National Aeronautics and Space Administration (NASA) has supported a program of summer faculty fellowships for engineering and science educators. In a series of collaborations between NASA research and development centers and nearby universities, engineering faculty members spend 10 weeks working with professional peers on research. The Summer Faculty Program Committee of the American Society for Engineering Education supervises the programs. The program objectives include: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate and exchange ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of participants' institutions; (4) To contribute to the research objectives of the NASA center. College or university faculty members will be appointed as Research Fellows to spend 10 weeks in cooperative research and study at the NASA Langley Research Center. The Fellow will devote approximately 90 percent of the time to a research problem and the remaining time to a study program. The study program will consist of lectures and seminars on topics of interest or that are directly relevant to the Fellows' research topics. The lecture and seminar leaders will be distinguished scientists and engineers from NASA, education, and industry.
Author
Aeronautical Engineering; NASA Programs; University Program; Conferences

19990019693 Christopher Newport Univ., Dept. of Education, Newport News, VA USA
Assessing the Needs for Resources for Improved Performance of Virginia Students in Mathematics, Science and Technology
Bicouvaris, Mary V., Christopher Newport Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 49; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

This paper assesses the resources needed in Virginia's schools for improved student performance in science, mathematics, and technology and examines the importance of improved instructional materials, the needs in teacher preparation, and the feasibility of developing a cadre of lead teachers in Virginia schools. In addition, this paper examines the need for professional development for teachers, the changes required in instruction and assessment vis-A-vis Virginia's high-stakes testing, and the potential role of regional centers for Mathematics and Science. In approaching this task, a tactical decision was made to not only enumerate the needs of Virginia's schools in the above mentioned areas, but to frame that information both in a historical context and to make evaluative comments based on research and practice. Sources of information for this report include actual research done through surveys and interviews, the examination of official state and national documents, a review of literature on pertinent issues in order to offer a balanced view of each issue, and anecdotal sources based on teachers' actual experiences. This paper, being one of several sources of information for the Virginia Mathematics and Science Coalition may overlap with other reports. Such overlapping, we believe, accentuates the significance and complexity of the type of integration related to the improvement of mathematics and science education for all children. While it offers answers to the questions posed, this paper also raises a number of questions for which there are no easy answers and makes recommendations to the Virginia Mathematics and Science Coalition for future action and research.
Author
Mathematics; Education; Children; Students; Instructors; Information Systems; Learning Curves

19990019707 Christopher Newport Univ., Dept. of Physics and Computer Science, Newport News, VA USA
NASA Educator Workshop (NEW) Abstract
Hale, L. Vincent, Christopher Newport Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 66; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

This summer 20 K-12 grade teachers traded in chalkboards, hall passes, and dismissal bells for wind tunnel tests, flight simulators, and aeronautic-related briefings as they attended a 2 week NASA Educator Workshop (NEW). The objectives of NEW were to share information about NASA resources, programs, and services, to provide an opportunity for the teams of educators to develop and implement an action plan that will support standards-based teaching and learning of science, mathematics, and technology in a problem-based learning (PBL) environment, to strengthen partnership with NASA by sustaining interaction and collaboration, and to provide an opportunity for the teams to exchange ideas.
Derived from text
Research and Development; NASA Programs; Flight Simulators; Education

19990019728 Christopher Newport Univ., Dept. of Physics and Computer Science, Newport News, VA USA
NASA Educator Workshop (NEW) Abstract
Williams, W. B., Jr., Christopher Newport Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 88; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Problem-based learning is an instructional method using a real world problem also known as an ill-structured problem, as the context for an in-depth investigation. Most real life problems are ill-structured, as are all the really important social, political, and scientific problems. When students take ownership of the problem and are empowered to generate solutions, it is rewarding to watch the serious thinking that follows. The participants were immersed in two problems during the 2 weeks. During the first problem, they researched Space Science Missions and developed activities appropriate for future missions. A second PBL introduced week two also addressed NASA's strategic outcome to communicate widely the content, relevancy and excitement of its missions and discoveries to the general population. Further, the PBL scenario addressed the technological challenges being taken up by NASA.
Author
Space Missions; Education; Human Factors Engineering; Knowledge; Learning

19990021025 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
1998 NASA-ASEE-Stanford Summer Faculty Fellowship Program ***Final Report***
Oct. 1998; 142p; In English; Also announced as 19990021026 through 19990021056
Contract(s)/Grant(s): NGT2-52212; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report presents the essential features and highlights of the 1998 Summer Faculty Fellowship Program at Ames Research Center and Dryden Flight Research Center in a comprehensive and concise form. Summary reports describing the fellows' technical accomplishments are enclosed in the attached technical report. The proposal for the 1999 NASA-ASEE-Stanford Summer Faculty Fellowship Program is being submitted under separate cover. of the 31 participating fellows, 27 were at Ames and 4 were at Dryden. The Program's central feature is the active participation by each fellow in one of the key technical activities currently under way at either the NASA Ames Research Center or the NASA Dryden Flight Research Center. The research topic is carefully chosen in advance to satisfy the criteria of: (1) importance to NASA, (2) high technical level, and (3) a good match to the interests, ability, and experience of the fellow, with the implied possibility of NASA-supported follow-on work at the fellow's home institution. Other features of the Summer Faculty Fellowship Program include participation by the fellows in workshops and seminars at Stanford, the Ames Research Center, and other off-site locations. These enrichment programs take place either directly or remotely, via the Stanford Center for Professional Development, and also involve specific interactions between fellows and Stanford faculty on technical and other academic subjects. A few, brief remarks are in order to summarize the fellows' opinions of the summer program. It is noteworthy that 90% of the fellows gave the NASA-Ames/Dryden- Stanford program an "excellent" rating and the remaining 10%, "good." Also, 100% would recommend the program to their colleagues as an effective means of furthering their professional development as teachers and researchers. Last, but not least, 87% of the fellows stated that a continuing research relationship with their NASA colleagues' organization probably would be maintained. Therefore, the NASA-ASEE- Ames/Dryden-Stanford Program has met its goals very well and every effort will be made to continue to do so in the future.
Derived from text
Enrichment; NASA Space Programs; Students

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990019176 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Single Machine Scheduling Problem with Fuzzy Due Date and Processing Time
Liao, Li-Man, National Chin-Yi Inst. of Tech., Taiwan, Province of China; Liao, Ching-Jong, National Taiwan Univ. of Science and Technology, Taiwan, Province of China; Journal of the Chinese Institute of Engineers; Mar. 1998; ISSN 0253-3839; Volume 21, No. 2, pp. 189-196; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper considers a single machine scheduling problem with fuzzy due date and fuzzy processing time. There are n jobs J(sub 1), J(sub 2), ..., J(sub n), to be processed on a single machine. Associated with each job J(sub j), there is a membership function of due date which describes the degree of satisfaction with respect to the completion time of J(sub j). The due date is structured similar to a trapezoidal fuzzy set, and the processing time is described as a triangular fuzzy set. The objective is to maximize the minimum grade of satisfaction over given jobs. In this paper, polynomial-time algorithms with 0(n(sub 2) logG) are proposed to solve the scheduling problem and are illustrated by means of an example.
Author
Algorithms; Fuzzy Sets; Polynomials

19990019691 Christopher Newport Univ., Newport News, VA USA
Functional Management Self-Assessment Report for the NASA Langley Research Center Office of Education
Bailey, Jane M., Christopher Newport Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 47; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

This project facilitated a Langley Research Center Office of Education (LARCOEd) self-study of four specific program areas of the LARC Office of Education: Educational Technology/Distance Learning; Precollege Programs; University Programs; and Special Institutes. The self-assessment process enabled OEd to review its programs, goals, organization, and operation. Though summative in nature, the assessment report serves in a formative capacity by providing a set of recommendations for a self- improvement action plan. The LARC OEd self-assessment team held four bi-weekly meetings to: 1) plan the assessment procedure; 2) design a self-assessment survey; 3) analyze survey results and formulate recommendations; and 4) review and approve the Self-Assessment Summary Report draft. A Self-Assessment Survey was designed to answer questions posed by the NASA Headquarters self-assessment directive. All program managers and key program staff were surveyed (n= 1 5). Fifteen responses were returned for a response rate of 100%. Thirteen members of the support staff were also surveyed, resulting in a response rate of 62%. Survey perceptions were validated by a non-random sampling of FY 1997 EDCATS data compiled from twelve LARC education programs representing 444 program participants. In addition to the survey data, other information used by the assessment team included: EDCATS data for LARC OEd programs; summative evaluation reports; analyses of pertinent Agency, Center, and Program documents; and interview comments from OEd program managers and key program personnel. Ten documents were reviewed to determine the level of integration between LARC education objectives and NASA's education framework. The self-assessment report documents the status of the education function, Center education priorities, key stakeholder issues, major program strengths and weaknesses, and responsiveness to NASA Headquarters' guidance. The Center Oed evaluation processes are identified, the operation, management, and budgeting processes are tracked, and the education organization is outlined. Specific requests for Headquarters assistance and an action plan are delineated in terms of specific recommendations.
Author
University Program; Random Sampling; Surveys; Budgeting

19990019727 Hampton Univ., School of Business, VA USA
Integrated Financial Management Project (IFMP) Training Needs Assessment
VanScoyoc, Kathleen, Hampton Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 87; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

To improve productivity and efficiency of its business and financial operations, NASA has initiated IFMP with the goal of developing and implementing an Integrated Financial Management System (IFMS) that is in compliance with the Federal Joint Financial Management Improvement Program (JFMIP) requirements. The IFMS will be an Agency-wide standardized and integrated computer based system capable of supporting the financial management and business processes at each Center and Headquarters. The fundamental goal of IFMP is to improve the financial management and business processes within the Agency. In

order to accomplish this goal, financial management and business processes must be standardized throughout the Agency. This will allow for an integrated computer application system to process financial and business information, permitting the production of current, accurate and timely financial reports for both internal and external customers. The proposed system is composed of seven modules - Core Financial, Budget Formulation, Time and Attendance, Procurement, Travel, Executive Information System (EIS), and Asset Management - which will allow for integration among and between the various financial and business processes. Training has a significant impact on the successful implementation and acceptance of the IFMS. The requirements include training the entire Langley civil service employee population at various levels, including system operations training and new financial management and business process training. The training responsibility for this major endeavor falls on KPMG as the Contractor providing the new IFMS and Langley's Training Office, as well as the Agency Training Team. The goal of this project is to gather and analyze existing data about the training population and environment in order to assess the training needs and requirements necessary to support the successful implementation of the IFMS at NASA Langley Research Center. The objective is to develop a comprehensive Training Needs Assessment Document which will provide the IFMP Transition Team with an extensive overview of the training requirements related to IFMP. This document contains facts about IFMP at Langley, including implementation, process/function and user information and training requirements. A description of the various categories of employees that comprise the training population is provided to better understand the different training audiences and their relationship with IFMP and the new proposed system. Strategies describing the management of KPMG training by the Langley IFMP Training Team and various options for training the different categories of users, including resources, are presented and discussed. In addition, proposed employee and training data elements are recommended that would be needed to efficiently manage, schedule and track IFMP training activities.
Author
Management Systems; Commerce; Financial Management; User Requirements

19990020956 Newcastle Polytechnic, Dept. of Computing Science, Newcastle-upon-Tyne, UK
Business and Market Models of Brokerage in Network-Based Commerce
Strens, R., Newcastle Polytechnic, UK; Martin, M., Newcastle Polytechnic, UK; Dobson, J., Newcastle Polytechnic, UK; Plagemann, S., Newcastle Polytechnic, UK; Jul. 1998; 22p; In English
Report No.(s): PB99-118531; TRS-633; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Enterprise models, based on the responsibilities and relationships underlying market activities, are used to provide a framework for representing and analyzing the activity of brokerage in network-based commerce. Examples of models are presented that represent new configurations of systems, services and processes. Three distinct phases of brokerage are recognized: rendezvous, transaction and post-sales. The security requirements for transactions in broking are so much greater than those for information provision over the Internet that separate business cases can be made for each.
NTIS
Commerce; Computer Networks; Market Research

19990020991 Federal Trade Commission, Washington, DC USA
Federal Trade Commission Administrative Manual (1998 Edition)
Oct. 1998; 458p; In English
Report No.(s): PB99-117681; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche
This manual provides information on the information and technology services; financial management; human resources management; and administrative services.
NTIS
Financial Management; Human Resources; Information Systems; Resources Management; Personnel Management; Manuals

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.

19990019712 Valdosta State Univ., Dept. of Physics, Astronomy and Geosciences, Valdosta, GA USA
Implementation of Geographic Information Systems for Air Combat Command Bases
Ingham, Mary E., Valdosta State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 71; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Geography and spatial data are playing an ever-increasing role in our evolving information society. Participation in the National Spatial Data Infrastructure initiative, adherence to applicable standardized formats, and appropriate management/leadership are issues facing all agencies. Geographic Information Systems (GIS) are tools which have the capability to store and manipulate large amounts of geospatial data, allowing quick retrieval of information, analysis of various databases, and a graphic display of results. The development of GIS applications to meet the specific needs of Air Force bases is a means to implement base-wide GIS use. Technical support by NASA is enhanced by cooperative agreements with local universities. The inclusion of universities benefits the government by (1) providing cost reduction as contract work is reduced, (2) obtaining high quality work performed by students in educational programs tailored to meet the needs of cutting-edge technology, (3) cultivating labor resources as trained students enter job market, and (4) encouraging civilian support in developing and maintaining data when military personnel relocate. As federal budgets are cut and military bases are undergoing downsizing, it is important to develop new procedures for work. Moody Air Force Base and Valdosta State University in south- central Georgia are the prototype for this project. The Moody/VSU model has been coordinated through NASA's GIS Team and Air Combat Command. Over the past year, the natural resources and infrastructure of Moody AFB have been integrated into a GIS, and a designated GIS lab has been established at the University. Currently, students and base personnel are collecting data utilizing global positioning systems (GPS) to correct and update the GIS databases. This is a valuable initiative which may also prove beneficial to other bases and NASA centers.
Author
Geographic Information Systems; Global Positioning System; Combat; Military Air Facilities

19990019714 Saint Paul's Coll., Lawrenceville, VA USA
Characterizing Digital Library User Behavior from the NASA Technical Report Server Logfiles
Johnson, David William, Saint Paul's Coll., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 73-74; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

This study characterizes the behavior of the users of the NASA Technical Report Server (NTRS), a Digital Library providing Scientific and Technical Information both within NASA and the research community throughout the world. During the months of June and July 1998, programming scripts were written to cull data from the systems log files that focused on user searches. Analysis of this data provides insight into the growth in use, the relative utilization of the several collections accessible, search string complexity and how the user is finding this report server. The NASA Technical Report Server is a World Wide Web report distribution and NASA technical publication service facilitating over 40,000 searches per month. As a Digital Library, NTRS is also interesting because the user has the option of searching several Wide Area Information Server (WAIS) databases simultaneously, attaching to several distributed servers. The design considerations for optimizing NTRS search time are described in Nelson and Maa (1996). Our goals in this study were to follow on their work by profiling the NTRS users' search behavior some number of months after that design was implemented.
Author
Data Bases; Libraries; World Wide Web; Information Retrieval; Information Dissemination; Data Retrieval

19990019715 Norfolk State Univ., Dept. of Computer Science, VA USA
STI Information System Migration to SGML
Kung, Mou-Liang, Norfolk State Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 75; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The research activities included: Gathering background information on STI publishing systems, guidelines and practices; Studying current STI archiving operations; Analyzing current systems and practices; Recommending a specific plan which can help increase the utilization of STI and outlines the strategy to smoothly migrate the current system to a non-intrusive, SGML-based document management system; Documenting the findings in two internal reports; Presenting findings to STI Program Office and ISSD Division Office. We concluded that NASA STI program could benefit from utilizing the now maturing and cost-effective SGML technology to streamline STI processing and make STI more accessible and useful to the public.
Derived from text
Document Markup Languages; Information Systems; Management Systems; Information Management; Information Transfer

19990020990 Newcastle-upon-Tyne Univ., Dept. of Computing Science, Newcastle, UK
Protecting IT Systems from Cyber Crime
Benjamin, R., Newcastle-upon-Tyne Univ., UK; Gladman, B., Newcastle-upon-Tyne Univ., UK; Randell, B., Newcastle-upon-Tyne Univ., UK; Mar. 1998; 40p; In English
Report No.(s): PB99-118515; TRS-631; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
This paper is aimed particularly at readers concerned with major systems employed in medium to large commercial or industrial enterprises. It examines the nature and significance of the various potential attacks, and surveys the defense options available. It concludes that IT owners need to think of the threat in more global terms, and to give a new focus and priority to their defense.
NTIS
Crime; Computer Networks; Computer Information Security

19990021043 Pace Univ., Computer Science Dept., New York, NY USA
Distributed Queries of Large Numerical Data Sets
Nemes, Richard M., Pace Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche
We have extended a previously developed high-level data model, which combines numerical quantities and meta-data into a unified hybrid model, to distributed data. An elegant query language based on SQL is extended further to allow queries against such a distributed hybrid data base. The extension is realized by allowing statements in a non-SQL programming language to be embedded in SQL view definitions.
Author
Query Languages; Data Bases

19990021048 Wisconsin Univ., Dept. of Computer Science, La Crosse, WI USA
User Directed Tools for Exploiting Expert Knowledge in an Immersive Segmentation and Visualization Environment
Senger, Steven O., Wisconsin Univ., USA; Oct. 1998; 5p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche
Volumetric data sets have become common in medicine and many sciences through technologies such as computed x-ray tomography (CT), magnetic resonance (MR), positron emission tomography (PET), confocal microscopy and 3D ultrasound. When presented with 2D images humans immediately and unconsciously begin a visual analysis of the scene. The viewer surveys the scene identifying significant landmarks and building an internal mental model of presented information. The identification of features is strongly influenced by the viewers expectations based upon their expert knowledge of what the image should contain. While not a conscious activity, the viewer makes a series of choices about how to interpret the scene. These choices occur in parallel with viewing the scene and effectively change the way the viewer sees the image. It is this interaction of viewing and choice which is the basis of many familiar visual illusions. This is especially important in the interpretation of medical images where it is the expert knowledge of the radiologist which interprets the image. For 3D data sets this interaction of view and choice is frustrated because choices must precede the visualization of the data set. It is not possible to visualize the data set with out making some initial choices which determine how the volume of data is presented to the eye. These choices include, view point orientation, region identification, color and opacity assignments. Further compounding the problem is the fact that these visualization choices are defined in terms of computer graphics as opposed to language of the experts knowledge. The long term goal of this project is to develop an environment where the user can interact with volumetric data sets using tools which promote the utilization of expert knowledge by incorporating visualization and choice into a tight computational loop. The tools will support activities involving the segmentation of structures, construction of surface meshes and local filtering of the data set. to conform to this environment tools should have several key attributes. First, they should be only rely on computations over a local neighborhood of the

probe position. Second, they should operate iteratively over time converging towards a limit behavior. Third, they should adapt to user input modifying they operational parameters with time.
Derived from text
Data Bases; Two Dimensional Models; Computer Graphics; Construction; Eye (Anatomy); Frustration; Identifying; Illusions; Optical Tracking

19990021060 City Coll. of the City Univ. of New York, Dept. of Computer Science, NY USA
A New Model for the Dissemination of Online Technical Documentation and its Impact on Courseware
Wolberg, George, City Coll. of the City Univ. of New York, USA; Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference; May 1998, pp. 265-276; In English; Also announced as 19990021057; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The use of LATEX, a typesetting markup language, is proposed as a model for dissemination of online technical documentation (OTD). With the introduction of Netscape's Navigator in 1995 there was an explosive growth in the Internet. The current usage of postscript/PDF files, cannot readily support applets, dynamic formatting and user interaction. Any new OTD tool must support formulas, tables, graphics user interaction and query processing, layout for multiple frames and arbitrary window sizes, among other tasks. LATEX is the preferred preparation language because: (1) a majority of technical authors are familiar with LATEX, (2) LATEX is superior at typesetting mathematical formulas, (3) LATEX is used more commonly than any other system, (4) LATEX supports static printed documents, (5) LATEX can be extended to support dynamic(interactive) documents, and (6) LATEX can be mapped into many presentation systems. LATEX is the most structured dialect of TEX, a document formatting system. The i in iTEX and iLATEX stands for interactive. iTEX is reentrant version of TEX which: (1) can process multiple documents in sequence, (2) serve as a browser, (3) format documents for previewing in arbitrary window sizes, (4)it comes with macro facilities, which enable more sophisticated formatting than HTML can achieve. The proposed work on iLATEX will exploit the rich text processing features of LATEX, hyperlinks, scripts, dynamic formatting and plug in features of Netscape, and will furnish image processing courseware and an iLATEX browser. This document is presented in outline form.
CASI
Layouts; Documents; Document Markup Languages; World Wide Web

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ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

19990019172 NASA, Washington, DC USA
NASA Accountability Report, *1 Oct. 1996 - 30 Sep. 1997*
1997; 97p; In English; Original contains color illustrations
Report No.(s): NASA/TM-1998-208207; NAS 1.15:208207; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

NASA is piloting fiscal year (FY) 1997 Accountability Reports, which streamline and upgrade reporting to Congress and the public. The document presents statements by the NASA administrator, and the Chief Financial Officer, followed by an overview of NASA's organizational structure and the planning and budgeting process. The performance of NASA in four strategic enterprises is reviewed: (1) Space Science, (2) Mission to Planet Earth, (3) Human Exploration and Development of Space, and (4) Aeronautics and Space Transportation Technology. Those areas which support the strategic enterprises are also reviewed in a section called Crosscutting Processes. For each of the four enterprises, there is discussion about the long term goals, the short term objectives and the accomplishments during FY 1997. The Crosscutting Processes section reviews issues and accomplishments relating to human resources, procurement, information technology, physical resources, financial management, small and disadvantaged businesses, and policy and plans. Following the discussion about the individual areas is Management's Discussion and Analysis, about NASA's financial statements. This is followed by a report by an independent commercial auditor and the financial statements.
CASI
Federal Budgets; Financial Management; Resources Management; NASA Programs; Project Planning

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LAW, POLITICAL SCIENCE AND SPACE POLICY

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

19990019764 Air Force Academy, CO USA
U.S. National Interests and the Western Hemisphere: Searching for Common Ground
Oct. 1998; 62p; In English
Report No.(s): AD-A356159; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Directorate of Academy Libraries is pleased to present the ninety-fourth issue of the Air Force Academy Libraries' Special Bibliography Series. It was prepared by Ms Frances K Scott, Political Science Bibliographer and Reference Librarian. Most of the books in this very selective bibliography are published in the last ten years: most of the journal articles, report literature, and government documents in the last five. All are available in the Academy's Academic Library.
DTIC
Bibliographies; Politics

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 also 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

19990019695 Christopher Newport Univ., Dept. of Economics, Finance and Real Estate, Newport News, VA USA
Technology-Commercialization-Economic Development Connections
Booker, H. Marshall, Christopher Newport Univ., USA; 1998 NASA-HU American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program; Dec. 1998, pp. 51; In English; Also announced as 19990019690; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The new economy is well underway. The USA has moved quickly from agrarian to industrial to an information high technology/service driven economy. There is little doubt that high technology is the main driving force for economic growth in a regional economy. The Mission and content of this study are described: a) to outline and evaluate the major costs and benefits of technology transfer and application in a major metropolitan area (The Norfolk-Virginia Beach-Newport News, Virginia Metropolitan Statistical Area), b) to increase the understanding of closely related phenomena within the general sphere of economic development, c) to identify and explain the interrelatedness of a broad range of technology transfer mechanisms, collaboration, deployment and utilization activities that are encompassed in that development sphere and d) to develop a series of long range economic outlook scenarios for the area within the scope of those parameters.
Derived from text
Technology Transfer; Information Systems; Economic Development; Commercialization; Learning Curves

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SPACE SCIENCES (GENERAL)

19990019800 NASA Marshall Space Flight Center, Huntsville, AL USA
Microgravity Science Laboratory (MSL-1) ***Final Report***
Robinson, M. B., Compiler, NASA Marshall Space Flight Center, USA; November 1998; 340p; In English; Microgravity Science Laboratory (MSL-1) One Year Science Review, 25-26 Aug. 1998, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA; Also announced as 19990019801 through 19990019830
Report No.(s): NASA/CP-1998-208868; M-900; NAS 1.55:208868; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The MSL-1 payload first flew on the Space Shuttle Columbia (STS-83) April 4-8, 1997. Due to a fuel cell problem, the mission was cut short, and the payload flew again on Columbia (STS-94) July 1-17, 1997. The MSL-1 investigations were performed in a pressurized Spacelab module and the Shuttle middeck. Twenty-nine experiments were performed and represented disciplines such as fluid physics, combustion, materials science, biotechnology, and plant growth. Four accelerometers were used to record

and characterize the microgravity environment. The results demonstrate the range of quality science that can be conducted utilizing orbital laboratories in microgravity.
Author (revised)
Space Transportation System; Spacelab; Microgravity; Gravitational Effects; Spaceborne Experiments; Space Processing; Bioprocessing

19990020826 NASA Marshall Space Flight Center, Huntsville, AL USA
Third USA Microgravity Payload: One Year Report
Currieri, P. A., Compiler, NASA Marshall Space Flight Center, USA; McCauley, D., Compiler, Alabama Univ., USA; Walker, C., Compiler, Universities Space Research Association, USA; November 1998; 178p; In English; 3rd; Microgravity Payload, 10-11 Feb. 1997, Washington, DC, USA; Also announced as 19990020827 through 19990020834; Original contains color illustrations
Report No.(s): NASA/CP-1998-207891; M-864; NAS 1.55:207891; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This document reports the one year science results for the Third United States Microgravity Payload (USMP-3). The USMP-3 major experiments were on a support structure in the Space Shuttle's payload bay and operated almost completely by the Principal Investigators through telescience. The mission included a Glovebox where the crew performed additional experiments for the investigators. Together about seven major scientific experiments were performed, advancing the state of knowledge in fields such as low temperature physics, solidification, and combustion. The results demonstrate the range of quality science that can be conducted utilizing orbital laboratories in microgravity and provide a look forward to a highly productive space station era.
Author
Microgravity; Spaceborne Experiments; Conferences; Space Processing

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ASTRONOMY

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

19990019160 National Optical Astronomy Observatories, Tucson, AZ USA
Flexible Observing Modes Employed at the WIYN Observatory
Sawyer, David G., National Optical Astronomy Observatories, USA; Code, Arthur, Wisconsin Univ., USA; Percival, Jeffrey, Wisconsin Univ., USA; Smith, Paul S., National Optical Astronomy Observatories, USA; Mar. 1998; 7p; In English
Report No.(s): NOAO-Preprint-788; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The WIYN 3.5 meter telescope on Kitt Peak, Arizona is operated by a consortium involving three universities and the National Optical Astronomical Observatories (NOAO) each with their own set of scientific requirements and research objectives. to meet this diversity a variety of operational modes are being used. It is the purpose of this paper to describe the experience acquired so far with queue scheduling, remote observing, consortium-wide coordinated programs, and student involvement. Observing time is block scheduled in such a way that each WIYN member receives their equitable distribution with respect to season and lunation. NOAO provides operations support and receives 40% of the observing time which is made available to the general astronomical community through the same mechanism as for other NOAO facilities. The largest fraction of this time, however, is devoted to queue scheduling. The remaining 60% of the observing time is divided among the three universities in proportion to their contribution to the capital costs of the observatory. Each university has its own approach to assigning observing time and utilizing their blocks. Among the modes employed are traditional on-site, service, and remote observing. The WIYN telescope supports rapid changing of instrumentation and it is common to do multiple-instrument observing during the course of a night. This also expedites the sharing of nights by more than one observer. The flexibility also provides the means to respond to targets of opportunity. In this paper we shall try to evaluate the ways in which this flexibility has been able to enhance scientific return.
Author
Astronomical Observatories; Telescopes; Scheduling; Flexibility; Costs

19990019161 National Optical Astronomy Observatories, Tucson, AZ USA

A New Wide-Field Corrector for the Kitt Peak Mayall 4-m Telescope

Jacoby, George H., National Optical Astronomy Observatories, USA; Liang, Ming, National Optical Astronomy Observatories, USA; Vaughnn, David, National Optical Astronomy Observatories, USA; Reed, Rich, National Optical Astronomy Observatories, USA; Armandroff, Taft, National Optical Astronomy Observatories, USA; Mar. 1998; 15p; In English

Report No.(s): NOAO-Preprint-789; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Kitt Peak Mayall 4-m telescope required a new prime focus corrector having a flat focal plane covering 36 arcmin on a side (51 arcmin diagonal) to accommodate the Mosaic 8K x 8K CCD system. The scientific requirements for the new corrector included atmospheric dispersion compensation (ADC), excellent near-UV efficiency, excellent image quality, and extremely low scattered light and ghosting. The optical system designed to meet these demands exhibits excellent and stable performance through its first year of operation. This paper describes the innovative design and engineering aspects of the corrector. Science verification data are presented to demonstrate some of the attributes of the new corrector.

Author

Telescopes; Optical Equipment; Image Resolution; Design Analysis

19990019471 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Determination of Position of Jupiter From Very-Long Baseline Interferometry Observations of Ulysses

Folkner, W. M., Jet Propulsion Lab., California Inst. of Tech., USA; McElrath, T. P., Jet Propulsion Lab., California Inst. of Tech., USA; Mannucci, A. J., Jet Propulsion Lab., California Inst. of Tech., USA; Astronomical Journal; Sep. 1996; ISSN 0004-6256; Volume 112, No. 3, pp. 1294-1297; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Very-long baseline interferometry (VLBI) observations of the Ulysses spacecraft near its encounter with Jupiter on 1992 February 8 were made to determine the angular position of Jupiter with respect to well known extragalactic radio sources. Spacecraft range and Doppler data were used to determine the position of the spacecraft with respect to Jupiter. Thirty-one VLBI observations of the spacecraft were made within 30 days of Ulysses closest approach to Jupiter, using the California-Spain and California-Australia baselines of NASA's Deep Space Network. When combined, these data determine the position of Jupiter at the time of encounter with an accuracy of 0.003 min in right ascension and 0.005 sec in declination. In addition, the Earth-Jupiter distance was determined with 20 m accuracy.

Author

Declination; Very Long Base Interferometry; Observation

19990019564 Smithsonian Astrophysical Observatory, Cambridge, MA USA

A Survey of Distant Clusters of Galaxies Selected by X-Rays

McNamara, Brian, Smithsonian Astrophysical Observatory, USA; 1997; 1p; In English; Evolution of Clusters of Galaxies, 13-20 Dec. 1997, Vina del Mar, Chile

Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

I will discuss the results of a new survey of X-ray selected, distant clusters of galaxies that has been undertaken by our group at.CfA (Vikhlinin, McNamara, Forman, Jones). We have analyzed the inner 17.5 arcminute region of roughly 650 ROSAT PSPC images of high latitude fields to compile a complete, flux-limited sample of clusters with a mean flux limit roughly 20 times more sensitive than the Einstein Medium Sensitivity Survey. The goal of our survey, which presently contains 233 extended X-ray sources, is to study cluster evolution over cosmological timescales. We have obtained optical images for nearly all of the faintest sources using the 1.2 m telescope of the Fred L. Whipple Observatory, and when including POSS images of the brighter sources, we have nearly completed the identification of all of the extended sources. Roughly 80% of the sources were identified as clusters of galaxies. We have measured redshifts for 42 clusters using the MMT, and including additional measurements from the literature, roughly 70 clusters in our catalog have spectroscopic redshifts. Using CCD photometry and spectroscopic redshifts, we have determined a magnitude-redshift relation which will allow redshifts of the remaining clusters in our sample to be determined photometrically to within a delta z over z of roughly ten percent. I will discuss the Log(N)-Log(S) relation for our sample and compare it to other determinations. In addition, I will discuss the evolution of core radii of clusters.

Author

Surveys; Galactic Clusters; X Rays; Images; Polar Regions; Radii

19990019566 NASA Marshall Space Flight Center, Huntsville, AL USA

X1354-644 = GS1354-64

Harmon, B. A., NASA Marshall Space Flight Center, USA; Robinson, C. R., NASA Marshall Space Flight Center, USA; International Astronomical Union; 1997; 1p; In English

Report No.(s): Circular-6774; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

This X-ray transient (cf. IAUC 6772; Kitamoto et al. 1990, Ap.J. 361, 590) is being detected in hard x-rays with emission up to 200 keV - the outburst being first visible to BATSE around Oct. 29 at a level of 60 mCrab (20-100 keV where R remained until Nov. 7. More recent data indicate that the source intensity (Nov. 12-18) has increased to 160 mCrab, considerably higher than the reported 2-10 keV flux from RXTE (IAUC 6772). Its location is consistent with Ginga source GS 1354-64, Cen X-2, and MX 1353-64. Evolution from a hard spectrum (power-law index -2.1 to -2.3) to a softer one (index -2.7) occurred between early November and Nov. 18, possibly with a cutoff above 100 keV.

Author

X Rays; Spectra; Gamma Ray Bursts; Data Acquisition; Observation

19990019574 Universidad Nacional Autonoma de Mexico, Inst. de Astronomia, Mexico City, Mexico

Are There Significant Equator and Equinox Errors in the FK5 System?

Branham, Richard L., Jr., Centro Regional de Investigaciones Cientificas y Tecnologicas, Argentina; Sanguin, Juan G., Felix Aguilar Observatory, Argentina; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 3-8; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

11739 observations in right ascension and 11656 in declination, made between 1847 and 1993, of 21 minor planets are used to estimate the equinox and equator errors of the FK5 fundamental system. Each minor planet's orbit was corrected along with corrections for the Earth's orbit and the FK5 equator, and equinox errors with their secular variations. No strong evidence exists for an equator correction or secular variation. Evidence does exist, however, for an equinox correction of the order of 0.18" at the approximate epoch 1970 and for a possible motion of the equinox of about 0.11" 0.14" per century. External evidence confirms at least part of these conclusions.

Author

Astrometry; Correction; Equators; Equinoxes; Errors

19990019575 Universidad Nacional Autonoma de Mexico, Inst. de Astronomia, Mexico City, Mexico

Photometry of Asteroids 558 Carmen, 613 Ginevra, and 1124 Stroobantia

Gil-Hutton, Ricardo, Felix Aguilar Observatory, Argentina; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 9-11; In English

Contract(s)/Grant(s): NSF AST-90-15827; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

CCD photometry of asteroids 558, 613 and 1124 are herein presented, which was obtained during four observing periods on 1993 and 1995. We have determined the following synodic rotational periods: 558 Carmen (9.264 +/- 0.005 hours), 613 Gineva (16.45 +/- 0.01 hours) and 1124 Stroobantia (16.39 +/- 0.01 hours).

Author

Photometry; Asteroids; Observation

19990019576 Universidad Nacional Autonoma de Mexico, Inst. de Astronomia, Mexico City, Mexico

VLA Detection of the Exciting Sources of HH 83, HH 117, HH 124, HH 192, HH 300, HH 366, and HH 375

Rodriguez, Luis F., Universidad Nacional Autonoma de Mexico, Mexico; Reipurth, Bo, Colorado Univ., USA; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 13-19; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present sensitive VLA observations at 3.6 cm of nine fields containing Herbig-Haro objects. In 7 out of the 9 observed fields we detect radio sources inside the error ellipsoid of the IRAS source that is believed to be exciting the outflow: HH 366 in B5, HH 300 in B18w, HH 192 in L1527, HH 83 in L1641, HH 117 in L1598, HH 124 near NGC 2264 and HH 375 in L1157. These radio sources are quite likely thermal jets produced by the stars that excite the region. In the case of IRAS 04368+2557 we made a map of higher angular resolution at 2 cm that shows that the source is elongated in the direction of the molecular outflow in the region, confirming its nature as a thermal jet. For two flows, HH 376 in L1152 and HH 363 in L1221, we did not detect any radio source coinciding with the infrared driving source. When these results are combined with previous sensitive

observations, we conclude that most HH energy sources can be detected at 3.6 cm in surveys reaching rms noise levels of about 20 /micro Jy.
Author
Very Large Array (VLA); Observation; Herbig-Haro Objects; Infrared Astronomy Satellite; Infrared Radiation

19990019579 Universidad Nacional Autonoma de Mexico, Inst. de Astronomia, Mexico City, Mexico
Site Testing at Observatorio Astronomico Nacional in San Pedro Martir
Echevarria, J., Universidad Nacional Autonoma de Mexico, Mexico; Tapia, M., Universidad Nacional Autonoma de Mexico, Mexico; Costera, R., Universidad Nacional Autonoma de Mexico, Mexico; Salas, L., Universidad Nacional Autonoma de Mexico, Mexico; Michel, R., Universidad Nacional Autonoma de Mexico, Mexico; Michel, R., Universidad Nacional Autonoma de Mexico, Mexico; Rojas, M. A., Universidad Nacional Autonoma de Mexico, Mexico; Munoz, R., Universidad Nacional Autonoma de Mexico, Mexico; Valdez, J., Universidad Nacional Autonoma de Mexico, Mexico; Ochoa, J. L., Universidad Nacional Autonoma de Mexico, Mexico; Palomares, J., Universidad Nacional Autonoma de Mexico, Mexico; Harris, O., Universidad Nacional Autonoma de Mexico, Mexico; Cromwell, R. H., Arizona Univ., USA; Woolf, N. J., Arizona Univ., USA; Persson, S. E., Carnegie Institution of Washington, USA; Carr, D. M., Carnegie Institution of Washington, USA; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 47-60; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Detailed measurements of the atmospheric turbulence and climatological conditions have been carried out at the site of the Observatorio Astronomico Nacional at San Pedro Mirtir. The results obtained during a three year period with the Site Testing Telescope from Steward Observatory yielded a median seeing of 0.61 arcsec and a first quartile of 0.50 arcsec. These were confirmed by independent and simultaneous measurements with the monitor of the Observatories of the Carnegie Institution. We detect a seasonal dependence on the seeing, with better results during spring and summer when we find a median of 0.59 arcsec, compared with autumn and winter, which have a median of 0.69 arcsec. Measurements with the Micro-Thermal Array show that the seeing decreases by 0.1 arcsec at a height of 15 meters. The seeing does not seem to depend strongly on meteorological variables like wind direction and velocity, humidity or external temperature.
Author
Atmospheric Turbulence; Meteorological Parameters; Data Acquisition; Wind Direction

19990019893 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Search for a Near-Infrared Halo Around NGC 4565
Uemizu, Kazunori, Tokyo Univ., Japan; Bock, James J., Jet Propulsion Lab., California Inst. of Tech., USA; Kawada, Mitsunobu, Tokyo Univ., Japan; Lange, Andrew E., California Inst. of Tech., USA; Matsumoto, Toshio, Tokyo Univ., Japan; Watabe, Toyoki, Nagoya Univ., Japan; Yost, Sarah A., California Inst. of Tech., USA; Astrophysical Journal; Oct. 10, 1998; Volume 506, pp. L15-L18; In English
Contract(s)/Grant(s): NAG5-4079; MOESSC-06402002; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present a near-infrared (3.5-5 micron) search for the integrated emission from low-mass stars and/or brown dwarfs in the halo of the nearby edge-on spiral galaxy NGC 4565. The observation was made with a liquid-helium-cooled rocket-borne telescope using a 256 x 256 InSb array with a pixel scale of 17”. Images of NGC 4565 were successfully obtained with sensitivity near the natural background limit. Our search reveals no evidence of a faint halo around the galaxy, in contrast with the previous reports of a halo around NGC 5907. The lower limit of the mass-to-light ratio for the halo of NGC 4565 is 260 (2 delta) in solar units at 3.5-5 microns. This implies that hydrogen-burning stars do not contribute significantly to the mass of the dark halo in NGC 4565.
Author
Halos; Brown Dwarf Stars; Near Infrared Radiation; Rocket-Borne Instruments; Liquid Helium

19990021014 Smithsonian Astrophysical Observatory, Cambridge, MA USA
ASCA Observations of LMC SNRS ***Final Report, 1 Sep. 1994 - 31 Aug. 1997***
Hughes, John P., Smithsonian Astrophysical Observatory, USA; January 1999; 24p; In English
Contract(s)/Grant(s): NAG5-638; NAG5-4794; NAG5-2684; NSF INT-93-08299; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present our first results from a study of the supernova remnants (SNRs) in the Large Magellanic Cloud (LMC) using data from ASCA. The three remnants we have analyzed to date, 0509-67.5, 0519-69.0, and N103B, are among the smallest, and presumably also the youngest, in the Cloud. The X-ray spectra of these SNRs show strong K(alpha) emission lines of silicon, sulfur, argon, and calcium with no evidence for corresponding lines of oxygen, neon, or magnesium. The dominant feature in the spectra

is a broad blend of emission lines around 1 keV which we attribute to L-shell emission lines of iron. Model calculations (Nomoto, Thielemann, & Yokoi 1984) show that the major products of nucleosynthesis in Type Ia supernovae (SNs) are the elements from silicon to iron, as observed here. The calculated nucleosynthetic yields from Type Ib and II SNs are shown to be qualitatively inconsistent with the data. We conclude that the SNs which produced these remnants were of Type Ia. This finding also confirms earlier suggestions that the class of Balmer-dominated remnants arise from Type Ia SN explosions. Based an these early results from the LMC SNR sample, we find that roughly one-half of the SNRs produced in the LMC within the last approximately 1500 yr came from Type Ia SNs.
Author
Supernova Remnants; Magellanic Clouds; Magnesium; Supernovae; X Ray Spectra; Nuclear Fusion

19990021041 Nebraska Univ., Dept. of Physics and Physical Sciences, Kearney, NE USA
The Dependence of Signal-to-Noise Ratio (S/N) Between Star Brightness and Background on the Filter Used in Images Taken by the Vulcan Photometric Planet Search Camera
Mena-Werth, Jose, Nebraska Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Vulcan Photometric Planet Search is the ground-based counterpart of Kepler Mission Proposal. The Kepler Proposal calls for the launch of telescope to look intently at a small patch of sky for four year. The mission is designed to look for extra-solar planets that transit sun-like stars. The Kepler Mission should be able to detect Earth-size planets. This goal requires an instrument and software capable of detecting photometric changes of several parts per hundred thousand in the flux of a star. The goal also requires the continuous monitoring of about a hundred thousand stars. The Kepler Mission is a NASA Discovery Class proposal similar in cost to the Lunar Prospector. The Vulcan Search is also a NASA project but based at Lick Observatory. A small wide-field telescope monitors various star fields successively during the year. Dozens of images, each containing tens of thousands of stars, are taken any night that weather permits. The images are then monitored for photometric changes of the order of one part in a thousand. These changes would reveal the transit of an inner-orbit Jupiter-size planet similar to those discovered recently in spectroscopic searches. In order to achieve a one part in one thousand photometric precision even the choice of a filter used in taking an exposure can be critical. The ultimate purpose of an filter is to increase the signal-to-noise ratio (S/N) of one's observation. Ideally, filters reduce the sky glow cause by street lights and, thereby, make the star images more distinct. The higher the S/N, the higher is the chance to observe a transit signal that indicates the presence of a new planet. It is, therefore, important to select the filter that maximizes the S/N.
Derived from text
Signal to Noise Ratios; Brightness; A Stars; Image Filters; Lunar Prospector; Observatories; Star Distribution; Telescopes

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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.

19990019156 National Optical Astronomy Observatories, Tucson, AZ USA
Spectral Synthesis of TiO Lines
Valenti, Jeff A., Uppsala Univ., Sweden; Johns-Krull, Christopher M., Colorado Univ., USA; Piskunov, Nikolai, Colorado Univ., USA; Jan. 1998; 23p; In English
Report No.(s): NOAO-Preprint-776; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We explore the extent to which current titanium oxide (TiO) line data (Jorgensen 1994) and M dwarf model atmospheres (Allard & Hauschildt 1995a, 1997) can be used to reproduce an R = 120,000 optical spectrum of the relatively inactive star Gliese 725B (M3.5 V). We find that tabulated TiO wavelengths have errors large enough to complicate line identification, especially for transitions involving higher vibrational states. We determine empirical wavelength corrections for twelve strong gamma bands near 6680 and 7090 A. For the sequence of orbital quantum numbers, J, within any one of these bands, our observations confirm the predicted line spacing, thereby validating the rotational constants for low vibrational levels. However, the predicted wavelengths have zero point errors that differ for each overlapping band. Next, we compare observed and synthetic spectra near 8463 A, where an epsilon Q(sub 3) 0-0 bandhead is expected, demonstrating that the electronic oscillator strength of 0.014 advocated by Jorgensen (1994) is too large by at least a factor of five. This has a minor effect on the structure of theoretical model atmospheres. Using our empirically corrected TiO wavelengths, we compute a grid of synthetic spectra for Allard & Hauschildt (1995a, 1997) models spanning a range in effective temperature (T(sub eff)), surface gravity (log g), and metallicity ([M/H]). Interpolating

in this grid of synthetic spectra, we simultaneously fit observations of the TiO bandhead region near 7088 A and five Ti I and Fe I lines near 8683 A. For Gliese 725B, we find T(sub eff) = 3170 +/- 71 K, log g = 4.77 +/- 0.14, [M/H]= -0.92 +/- 0.07, and upsilon(sub mac) = 1.1 +/- 0.7 km/s. We show that by using both atomic and molecular lines as constraints, systematic uncertainties in derived stellar parameters can be reduced. These parameters are consistent with published values obtained by other means, but more stringent tests would be useful. In the appendix, we tabulate wavelengths, identifications, relative line strengths, and other properties of the strongest bandheads in the alpha, beta, gamma, gamma', delta, epsilon, and phi electronic systems of TiO.
Author
Titanium Oxides; Spectra; Atmospheric Models; Atomic Spectra; Line Spectra

19990019157 National Optical Astronomy Observatories, Tucson, AZ USA
WFPC2 Observations of Small Magellanic Cloud Intermediate-Age Populous Cluster NGC 416
Mighell, Kenneth J., Kitt Peak National Observatory, USA; Sarajedini, Ata, Kitt Peak National Observatory, USA; French, Rica S., Kitt Peak National Observatory, USA; Jan. 1998; 12p; In English
Contract(s)/Grant(s): NAS5-26555; HF-01077.01-94A; NRA-95-OSS-16; NASA Order S-67046-F
Report No.(s): NOAO-Preprint-777; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present our analysis of archival Hubble Space Telescope Wide Field Planetary Camera 2 observations in F555W (approx. V) and F45OW (approx. B) of the intermediate-age populous star cluster NGC 416 in the Small Magellanic Cloud galaxy. We use published photometry of two other SMC populous star clusters, Lindsay 1 and Lindsay 113, to investigate the age sequence of these three star clusters. We estimate that these clusters have age ratios of age(sub NGC 416)/age(sub Ll) approx. = 0.73 +/- 0.05 and age(sub Lll3)/age(sub Ll) approx. = 0.52 +/- 0.09 using an extrapolation of the d(sub (B-V)) method (which uses the color difference between the red horizontal branch and the red giant branch as an age indicator) of Sarajedini, Lee, & Lee [ApJ, 450, 712 (1995)]. These age ratios provide absolute age estimates of 6.6 +/- 0.5 Gyr and 4.7 +/- 0.8 Gyr for NGC 416 and Lindsay 113, respectively, assuming that Lindsay 1 is 9 Gyr old. Metallicities of [Fe/H] = -1.44 +/- 0.12, -1.35 +/- 0.08, - 1.24 +/- 0.11 dex, and reddenings of E(B - V) = 0.08 +/- 0.03, 0.06 +/- 0.02, 0.00 +/- 0.02 mag for NGC 416, Lindsay 1, and Lindsay 113, respectively, were determined using the simultaneous reddening and metallicity (SRM) method of Sarajedini & Layden [AJ, 113, 264, (1997)]. Accurate (relative) ages for the intermediate-age populous clusters in the Small Magellanic Cloud (e.g. via deep main sequence photometry) would allow the d(sub (B-V)) method to be recalibrated with star clusters that are significantly younger than 7 Gyr. An extended d(B-V) method could prove to be a very useful age diagnostic for future studies of the intermediate-age metal-poor stellar populations in Local Group galaxies where accurate main-sequence turnoff photometry at M(sub v) approx. = +4 mag is currently not possible or practical.
Author
Magellanic Clouds; Research; Stellar Spectra; Stellar Evolution; Star Clusters; Estimates

19990019158 National Optical Astronomy Observatories, Tucson, AZ USA
Evolved Massive Stars in the Local Group, 1, Identification of Red Supergiants in NGC 6822, M31, M33
Massey, Philip, National Optical Astronomy Observatories, USA; Jan. 1998; 63p; In English
Report No.(s): NOAO-Preprint-778; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Knowledge of the red supergiant (RSG) population of nearby galaxies allows us to probe massive star evolution as a function of metallicity; however, contamination by foreground Galactic dwarfs dominates surveys for red stars in Local Group galaxies beyond the Magellanic Clouds. Model atmospheres predict that low-gravity supergiants will have B - V values that are redder by several tenths of a magnitude than foreground dwarfs at a given V - R color, a result that is largely independent of reddening. We conduct a BVR survey of several fields in the Local Group galaxies NGC 6822, M 33, and M 31, as well as neighboring control fields, and identify RSG candidates from CCD photometry. The survey is complete to V = 20.5, corresponding to M(sub V) = -4.5 or an M(sub bol) of -6.3 for the reddest stars. Follow-up spectroscopy at the Ca II triplet of 130 stars is used to demonstrate that our photometric criterion for identifying RSGs is highly successful (96% for stars brighter than V = 19.5; 82% for for V = 19.5-20.5). Classification spectra are also obtained for a number of stars in order to calibrate color with spectral type empirically. We find that there is a marked progression in the average (B - V)(sub 0) and (V - R)(sub 0) colors of RSGs in these three galaxies; with the higher metallicity systems having a later average spectral type, consistent with previous findings by Elias, Frogel, &, Humphreys for the Milky Way and Magellanic Clouds. More significantly, we find that there is a clear progression with metallicity in the relative number of the highest luminosity RSGS, a trend that is apparent both in absolute visual magnitude and in bolometric luminosity. Thus any use of RSGs as distance indicators requires correction for the metallicity of the parent galaxy. Our findings are in accord with the predictions of the "Conti scenario" in which higher metallicities result in higher mass-loss rates, resulting

in a star of a given luminosity spending in increasing fraction of its He-burning lifetime as a WR star rather than as a RSG with increasing metallicity.
Author
A Stars; Color; Contamination; Distance Measuring Equipment; Dwarf Stars; Magellanic Clouds; Massive Stars; Milky Way Galaxy; Supergiant Stars

19990019164 National Optical Astronomy Observatories, Tucson, AZ USA
The Redshift of an Extremely Red Object and the Nature of the Very Red Galaxy Population
Graham, James R., California Univ., USA; Deu. Arjun, National Optical Astronomy Observatories, USA; Jun. 1996; 22p; In English; Sponsored in part by the Packard Foundation
Report No.(s): NOAO-Preprint-716; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Infrared surveys have discovered a significant population of bright (K approx. less than 19) extremely red (R - K approx. greater than 6) objects. Little is known about the properties of these objects on account of their optical faintness (R approx. greater than 24). Here, we report deep infrared imaging and spectroscopy of one of the extremely red objects (EROs) discovered by Hu & Ridgway (1994) in the field of the z = 3.79 quasar PC 1643+4631A. The infrared images were obtained in 0.5 sec. seeing, and show that the object (denoted HR 10) is not a dynamically relaxed elliptical galaxy dominated by an old stellar population as was previously suspected, but instead has an asymmetric morphology suggestive of either a disk or an interacting system. The infrared spectrum of HR 10 shows a single, possibly broad emission feature at 1.60 microns which we identify as H(alpha)+[N II] at z = 1.44. The luminosity and width of this emission line indicates either intense star formation (approx. 20/h(sup -2) solar mass/ yr) or the presence of an active nucleus. Based on the rest frame UV-optical spectral energy distribution, the luminosity of HR 10 is estimated to be 3 - 8 solar luminosity*. The colors of HR 10 are unusually red for a galaxy (at z = 1.44 the age of HR 10 is at most 2 - 8 Gyr depending on cosmology), and indicate that HR 10 is dusty. HR 10 is detected weakly at radio wavelengths; this is consistent with either the starburst or AGN hypothesis. If HR 10 is a typical representative of its class, EROs are numerous and represent a significant component of the luminous objects in the Universe at z approx. = 1.5.
Author
Cosmology; Infrared Spectra; Infrared Radiation; Red Shift; Starburst Galaxies; Elliptical Galaxies; Star Formation; Ultraviolet Spectra

19990019265 New Mexico Univ., Albuquerque, NM USA
Iron Meteorites and the Nature of Asteroidal Cores
Scott, Edward R. D., New Mexico Univ., USA; Nature; Jul. 21, 1983; Volume 304, No. 5923, pp. 216-217; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

One of the more munificent features of the clockwork of the Solar System is the occasional delivery of lumps of extraterrestrial material to the Earth's surface. Many of these are chondrites, silicate meteorites whose composition and petrology betray little alteration since their condensation in the solar nebula, and whose geochemistry can provide unique information on the early evolution of the Solar System. by contrast, iron meteorites, which consist primarily of iron-nickel alloys, seem to have had more eventful lives; they have long been thought to have originated within 'parent bodies' that subsequently disintegrated. Recent laboratory studies of the distribution of elements between solid and liquid iron-nickel support the theory that most iron meteorites are samples from asteroidal cores that fractionally crystallized.
Derived from text
Iron Meteorites; Asteroids; Cores; Chondrites; Nickel Alloys; Geochemistry

19990019269 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA
Radiation-Driven Warping, 2, Nonisothermal Disks
Maloney, Philip R., Colorado Univ., USA; Begelman, Mitchell C., Colorado Univ., USA; Nowak, Michael A., Colorado Univ., USA; Astrophysical Journal; Sep. 01, 1998; Volume 504, pp. 77-92; In English
Contract(s)/Grant(s): NAG5-4061; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent work by Pringle and by Maloney, Begelman, & Pringle has shown that geometrically thin, optically thick, accretion disks are unstable to warping driven by radiation torque from the central source. This work was confined to isothermal (i.e., surface density Sigma varies as R(sup -3/2) disks. In this paper we generalize the study of radiation-driven warping to include general power-law surface density distributions, Sigma varies as R(sup -delta).We consider the range from Delta = 3/2 (the isothermal case) to Delta = -3/2, which corresponds to a radiation-pressure-supported disk; this spans the range of surface density distributions likely to be found in real astrophysical disks. In all cases there are an infinite number of zero-crossing solutions (i.e., solutions that cross the equator), which are the physically relevant modes if the outer boundary of the disk is required to lie in a specified

plane. However, unlike the isothermal disk, which is the degenerate case, the frequency eigenvalues for Delta does not equal 3/2 are all distinct. In all cases the location of the zero moves outward from the steady state (pure precession) value with increasing growth rate; thus, there is a critical minimum size for unstable disks. Modes with zeros at smaller radii are damped. The critical radius and the steady state precession rate depend only weakly on Delta. An additional analytic solution has been found for Delta = 1. The case Delta = 1 divides the solutions into two qualitatively different regimes. For Delta greater than or equal to 1, the fastest growing modes have maximum warp amplitude, close to the disk outer edge, and the ratio of Beta(sub max) to the warp amplitude at the disk inner edge, Beta(sub o), is much greater than 1. For Delta less than 1, Beta(sub max/Beta(sub o) approximately equals 1, and the warp maximum steadily approaches the origin as Delta decreases. This implies that nonlinear effects must be important if the warp extends to the disk inner edge for Delta greater than or equal to 1, but for Delta less than 1 nonlinearity will be important only if the warp amplitude is large at the origin. Because of this qualitative difference in the shapes of the warps, the effects of shadowing of the central source by the warp will also be very different in the two regimes of Delta. This has important implications for radiation-driven warping in X-ray binaries, for which the value of Delta characterizing the disk is likely to be less than unity. In real accretion disks the outer boundary condition is likely to be different from the zero-crossing condition that we have assumed. In accretion disks around massive black holes in active galactic nuclei, the disk will probably become optically thin before the outer disk boundary is reached, whereas in X-ray binaries there will be an outer disk region (outside the circularization radius) in which the inflow velocity is zero but angular momentum is still transported. We show that in both these cases the solutions are similar to the zero-crossing eigenfunctions.
Author
Accretion Disks; X Ray Binaries; Eigenvectors; Active Galactic Nuclei; Density Distribution; Boundary Conditions; Angular Momentum

19990019270 Colorado Univ., Boulder, CO USA
Relating Stellar Cycle Periods to Dynamo Calculations
Tobias, S. M., Colorado Univ., USA; Mon. Not. R. Astron. Soc.; 1998; Volume 296, pp. 653-661; In English
Contract(s)/Grant(s): NAG5-2256; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche
Stellar magnetic activity in slowly rotating stars is often cyclic, with the period of the magnetic cycle depending critically on the rotation rate and the convective turnover time of the star. Here we show that the interpretation of this law from dynamo models is not a simple task. It is demonstrated that the period is (unsurprisingly) sensitive to the precise type of non-linearity employed. Moreover the calculation of the wave-speed of plane-wave solutions does not (as was previously supposed) give an indication of the magnetic period in a more realistic dynamo model, as the changes in length-scale of solutions are not easily captured by this approach. Progress can be made, however, by considering a realistic two-dimensional model, in which the radial length-scale of waves is included. We show that it is possible in this case to derive a more robust relation between cycle period and dynamo number. For all the non-linearities considered in the most realistic model, the magnetic cycle period is a decreasing function of IDI (the amplitude of the dynamo number). However, discriminating between different non-linearities is difficult in this case and care must therefore be taken before advancing explanations for the magnetic periods of stars.
Author
Stellar Magnetic Fields; Stellar Rotation; Magnetic Stars; Plane Waves; Nonlinearity; Stellar Activity

19990019279 National Optical Astronomy Observatories, National Solar Observatory, Tucson, AZ USA
X-ray Activity in the Open Cluster IC 4665
Giampapa, Mark S., National Optical Astronomy Observatories, USA; Prosser, Charles F., Smithsonian Astrophysical Observatory, USA; Fleming, Thomas A., Arizona Univ., USA; Dec. 1997; 51p; In English; Sponsored in part by the W. M. Keck Foundation
Contract(s)/Grant(s): NAG5-3238; NAGw-3698; NAG5-2203
Report No.(s): NOAO-Preprint-775; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
We present the results of a joint ROSAT High Resolution Imager (HRI) and optical investigation of the open cluster IC 4665. The ROSAT data contains detections for 28 stellar sources in the field, including 22 cluster members and candidate members spanning the color range -0.18 less than or equal to (B - V)(sub 0) less than or equal to +1.63 (approx. B3 - M3). Upper limits are given for the remaining members (or candidate members) in the HRI field. Keck HIRES spectra have been obtained that yield radial and rotational velocity measures, respectively, for faint, low mass candidate members located within the field of the ROSAT HRI observation. In addition, photometry of possible optical counterparts to previously uncatalogued X-ray sources in the HRI field is presented. The trends in X-ray properties with (B - V) color in IC 4665 are found to be quite similar to that for other, more nearby young clusters such as the Pleiades and alpha Persei. In particular, a maximum in normalized X-ray luminosity of log (L(sub x)/L(sub bol)) approx. = -3 is observed, beginning in the color range of (B - V)(sub 0) = 0.7 - 0.8. This is similax to the corresponding color range among Pleiades members, in agreement with the earlier estimate by Prosser & Giampapa (1994) that the age of

IC 4665 is similar to the age of the Pleiades. The correlation of rotation and X-ray emission levels is consistent with that in other young clusters. Among the high mass stars in IC 4665, five B stars axe detected as X-ray sources. of these, one is a spectroscopic binary while the remaining objects are apparently single stars. The level of intrinsic X-ray emission observed in the rapidly rotating (upsilon sin i greater than 200 km/s), single B staxs is consistent with an origin due to shock heating of the ambient medium by radiatively driven, rotationally enhanced winds. On the basis of these observations and the results for other clusters, we argue that observed levels of X-ray emission in high mass stars of log (L(sub x)/L(sub bol)) greater than -6.0 are likely due to intrinsic emission associated with the B star itself rather than emission from a late-type secondary. Finally, our results suggest that the initial angular momentum distributions and the subsequent evolution of rotation, L(sub x), and (L(sub x)/L(sub bol)) occur in practically identical fashions in clusters with ages approx. less than 100 Myr.
Author
X Rays; Open Clusters; Data Acquisition; Research; Stellar Mass; X Ray Sources; B Stars

19990019288 NASA Ames Research Center, Moffett Field, CA USA
Numerical Simulations of Fission
Durisen, Richard H., NASA Ames Research Center, USA; Gingold, Robert A., National Academy of Sciences - National Research Council, USA; Origin of the Moon; 1987, pp. 487-498; In English
Contract(s)/Grant(s): NCA2-1R335-401; NSF AST-81-20367; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
In this paper, we use the term fission to refer to the breakup of an equilibrium celestial body driven by rapid rotation. Historically, it was conjectured that fission would lead to splitting of a body directly into two or more pieces. Numerical hydrodynamic simulation techniques have now become sufficiently powerful to study the outcome of dynamic fission instabilities. We summarize recent work and present new simulations spanning a range of rotation rates and fluid compressibility. In the best resolved cases dynamic fission instability always leads to ejection of a ring or disk of debris rather thin one or a few discrete bodies. In this case, just as in most other lunar origin theories, a fission-product Moon must accrete out of a geocentric swarm of material. Intrinsic nonaxisymmetry of the remnant Earth after fission would prevent rapid recollapse of the swarm. The revised picture aleviates some of the problems associated with earlier versions of the fission theory. The two most serious remaining objections are that it is difficult to make the proto-Earth rotate fast enough to undergo fission and that the proto-Earth must be largely molten at the time it fissions. to overcome the first objection, it may be necessary to combine fission with the planetesimal impact theory. Some advantages of such a hybrid theory are discussed. The second objection cannot be fully assessed until more is known about the fission history and accretion of the proto-Earth.
Author
Fission; Mathematical Models; Stability; Celestial Bodies

19990019309 Aerospace Corp., Technology Operations, El Segundo, CA USA
Fe XVIII Emission Lines in Solar X-Ray Spectra
Warren, G. A.; Keenan, F. P.; Greer, C. J.; Phillips, K. J.; Bruner, M. E.; Jan. 15, 1998; 16p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A357546; TR-96(8570)-4; SMC-TR-98-36; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We have calculated intensity ratios for emission lines of Fe XVIII in the 19-94A wavelength range at electron temperatures characteristic of the solar corona, Te = 2-10 x 10 to the 6th power K. Our model ion includes data for transitions among the 2s22p5, 2s2p6, 2s22p43l, and 2s2p53l (l = s, p, and d) states. Test calculations that omit the 2s2p53l levels show that cascades from these are important. We compare our results with observed ratios determined from four solar X-ray instruments, a rocket-borne spectrograph, and spectrometers on the P78-1, OV1-17 and Solar Maximum Mission (SMM) satellites. In addition, we have generated synthetic spectra which we compare directly with flare observations from SMM. Agreement between theory and observation is generally quite good, with differences that are mostly less than 30%, providing limited support for the accuracy of the atomic physics data used in our calculations. However, large discrepancies are found for ratios involving the 2s22p5 2P3/2-2s2p6 2S line at 93.84A, which currently remain unexplained. Our analysis indicates that the Fe XVIII feature at 15.83A is the 2s22p5 2P3/2-2s22p4(3P)3s4 P3/2 transition, rather than 2s22p5 2P3/2-2s22p4(3P)3s 2P3/2, as suggested by some authors.
DTIC
Solar Corona; Solar Maximum Mission; Atomic Physics; Electron Energy; Solar X-Rays

19990019468 Tokai Univ., School of Science, Tokyo, Japan

Quantum Theory of 2D Dilaton Black Hole

Egawa, Hiroshi S., Tokai Univ., Japan; Ooike, Kouji, Tokai Univ., Japan; Wada, Morihiro, Tokai Univ., Japan; Proceedings of the School of Science of Tokai University; Mar. 1994; ISSN 0563-6795; Volume 29, pp. 59-79; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Callan, Giddings, Harvey and Strominger(CGHS) have investigated an interesting two-dimensional (2D) dilatonic gravity which shows the black hole evaporation in the semi-classical approximation. CGHS model includes the 2D black hole solution in critical string theory researched by Witten. The black holes, moreover, evaporate completely, in terms of Hawking radiation and its back reaction of the metric, without a singularity. It has been, however, pointed out that in the case of 2D dilatonic black hole the semi-classical equations give a new singularity hidden inside a black hole. Consequently, following the quantum effects, the full quantum version of 2D dilatonic gravity model is presented by means of the procedure in 2D quantum gravity by Distler and Kawai.

Author

Quantum Theory; Two Dimensional Models; Black Holes (Astronomy)

19990019577 Universidad Nacional Autonoma de Mexico, Inst. de Astronomia, Mexico City, Mexico

The Production and Depletion Rates in Models for the Chemical Evolution of the Galaxy

Arany-Prado, Lilia I., Universidade Federal do Rio de Janeiro, Brazil; Maciel, Walter J., Sao Paulo Univ., Brazil; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 21-28; In English; Sponsored in part by Fundacao Universitaria Jose Bonifacio; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The stellar production and depletion rates associated with a given metal are derived, to be used in the general equation for the mass conservation in models of the chemical evolution of the Galaxy. It is shown that the metal conservation equation of Tinsley (1980) can be recovered with the adoption of some simplifying hypotheses, such as neglecting the metals stored in the remnants. With the derived equation, we show that the total mass of a given metal can be affected by the hypotheses usually made. For the bulk of metals, we find that their total mass can be increased up to an order of magnitude relative to the expected mass of metals as given by Tinsley (1980).

Author

Galaxies; Chemical Evolution; Depletion; CCD Star Tracker

19990019580 Universidad Nacional Autonoma de Mexico, Inst. de Astronomia, Mexico City, Mexico

Non-Minimally Coupled Theories: Anisotropic Cosmologies Through Hyperextended Gravity

Torres, Diego F., La Plata Univ., Argentina; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 61-65; In English; Sponsored in part by British Council; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Anisotropic cosmologies in general scalar-tensor gravitation -including non-minimally couplings are considered. Previous algorithm methods are generalized In order to admit the study of any non-minimally coupled theory.

Author

Anisotropy; Cosmology; Gravitation Theory; Algorithms

19990019640 Universidad Nacional Autonoma de Mexico, Inst. de Astrnomia, Mexico City, Mexico

The Galactic Orbits of Nearby UV Ceti Stars

Allen, Christine, Universidad Nacional Autonoma de Mexico, Mexico; Herrera, Miguel A., Universidad Nacional Autonoma de Mexico, Mexico; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 37-46; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The galactic orbits of 93 UV Ceti stars of the solar neighborhood have been numerically integrated. The UV Ceti stars studied are those of the working list for which Poveda et al. (1996a) determined kinematic properties and ages. All stars are contained within 25 pc of the Sun (pi greater than or equal to 0.04 sec), and values for their distances, proper motions and radial velocities are available for them (Gliese & Jahreiss 1991). The galactic potential model of Allen & Santillin (1991) was used, and the orbits were integrated for times similar to the age of the old disk. The galactic orbital parameters are obtained. The orbits are all regular, and the values found for the orbital parameters are similar to those characteristic of the classic voting thin disk. The vertical scale height found for the whole sample is 115 pc. However, the orbital parameters found for the 7 objects with extreme kinematic characteristics recognized in Poveda et al. are markedly different from those of the rest of the flare stars; in particular, their orbital eccentricities are larger than 0.3. The vertical scale height of the sample excluding the anomalous objects is just 103 pc. Conse-

quently, we propose that the anomalous objects belong to the thick disk, which may be characterized by either e greater than or equal to 0.3 or absolute value of z(sub max) greater than 400 pc.
Author
Galaxies; Orbits; Mathematical Models; Radial Velocity; Flare Stars; Astronomical Models

19990019758 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Various Methods of Perturbing Three Asteroids from an Earth-Impact Trajectory
Kulesa, Richard J.; Oct. 26, 1998; 61p; In English
Report No.(s): AD-A356196; AFIT-98-013; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Asteroids with orbits intersecting earth pose varying levels of threat to mankind and our planet. A small object, 100 m diameter, can wipe out cities the size of New York or San Francisco. Larger objects, >1 km diameter, impacting the Earth can have global, catastrophic consequences. Possible ways of preventing dangerous objects from colliding with Earth are presented in this investigation. Methods of asteroid mitigation fall into two general classes: deflection and fragmentation. Significant work has been done in both areas, but the majority of the numerical results have been for general types (i.e. sizes) of asteroids. This investigation will give numerical results for three real asteroids that get within 0.04 AU of Earth or closer. Results are produced for a variety of techniques, both deflection and fragmentation, available for hazard mitigation.
DTIC
Asteroid Collisions; Hypervelocity Impact; Asteroids; Impact Damage; Earth Surface

19990020837 NASA Johnson Space Center, Houston, TX USA
Biomarkers in Carbonate Thermal Springs: Implications for Mars
Allen, C. C., Lockheed Martin Corp., USA; Kivett, S. J., Houston Univ., USA; McKay, D. S., NASA Johnson Space Center, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 2-3; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Evidence of possible relict biogenic activity has been reported in carbonate inclusions within martian meteorite ALH 84001. The initial evidence included ovoid and elongated forms 50 - 500 nanometers in length, morphologically similar to but significantly smaller than many terrestrial microbes. More recently, thin structures resembling the remains of organic biofilms have been reported in the same meteorite. Carbonates have also been discussed in the context of Mars sample return missions. Thermal spring deposits have often been cited as prime locations for exobiological exploration. By analogy to Earth, specialized microbes may have existed in the heated, mineralized waters, and precipitates of carbonate and/or silica from these waters may have trapped and preserved evidence of life. Since the geological interactions that produce thermal springs can be recognized in orbital imagery, directed searches for microfossils in such deposits are deemed possible. We are engaged in a study of the signatures produced by contemporary biogenic activity (biomarkers) in carbonate thermal springs. We are examining the microbes that live in such environments and the preservation of microbial forms, biofilms, and petrographic fabrics indicative of life in thermal spring mineral deposits. This work is part of a much more extensive study to refine the appropriate tools, techniques, and approaches to seek evidence of life in a range of planetary samples. A deeper understanding of biological signatures will prepare us for the detailed search for life on Mars and eventually on other planets. Overall. the study of biomarkers in rocks and soils will provide insight into the evolution of life because such signatures are a record of how life interacts with its environment, how it adapts to changing conditions, and how life can influence geology and climate.
Author
Carbonates; Exobiology; Extraterrestrial Life; Mars Sample Return Missions; Meteoritic Composition; Microorganisms; SNC Meteorites; Springs (Water)

19990020838 Virginia Polytechnic Inst. and State Univ., Fluids Research Lab., Blacksburg, VA USA
Fluid Inclusions in Allan Hills 84001 and Other Martian Meteorites: Evidence for Volatiles on Mars
Bodnar, R. J., Virginia Polytechnic Inst. and State Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 3-5; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The important role that volatiles play in planetary evolution is well known. On Earth, volatiles have and continue to play key roles in the development and properties of the crust, hydrosphere, and atmosphere. More recently, the recognition that the mantle contains small but ubiquitous quantities of volatile components has led to an improved understanding of mantle rheology and chemistry and the recycling of volatiles in the Earth system. And, of course, volatiles, especially water, are considered to be a prerequisite for the origin and evolution of life as we know it. The recent announcement that evidence for life had been discovered in the ALH 84001 martian meteorite combined with the highly successful Mars Pathfinder Mission has led to renewed interest

in the geochemical evolution of Mars. Much of the scientific effort in this area has been devoted to characterizing the volatiles present in the SNC meteorites and, by inference, the volatiles present on Mars when the rocks formed. Here, the occurrence of ”free” volatiles (i.e., volatiles occurring in the fluid state, and not as minor components of minerals and/or glasses) in the ALH 84001 and Nakhla meteorites is reported, along with possible implications.
Author
Mars Atmosphere; Meteorites; SNC Meteorites; Inclusions; Mars Surface; Planetary Geology; Meteoritic Composition

19990020839 NASA Johnson Space Center, Houston, TX USA
Rubidium-Strontium Formation Age of Allan Hills 84001 Carbonates
Borg, L. E., NASA Johnson Space Center, USA; Nyquist, L. E., NASA Johnson Space Center, USA; Shih, C.-Y., Lockheed Martin Corp., USA; Weismann, H., Lockheed Martin Corp., USA; Reese, Y., Lockheed Martin Corp., USA; Connelly, J. N., Texas Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 5-6; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Our preferred age for the formation of carbonates in the martian meteorite ALH 84001 is 3.90 plus or minus 0.04 Ga for Lambda (Rubidium 87) equals 0.01402 Ga (exp -1), or 3.85 plus or minus 0.04 Ga for Lambda (Rubidium 87) = 0.0142 Ga(exponent -1). This age is determined by a three-point Rb-SR isochron defined by leachates of high-graded carbonate-rich material. Major cation and especially phosphorous analyses of the leachates permit contributions from igneous whitlockite to be recognized for low-acidity leachates, and the corresponding data are omitted from the isochron. Data for the two highest acidity leachates plot close to the preferred isochron, but are omitted because we believe they contain contributions leached from the pyroxene substrate on which most of the carbonates are found. Nevertheless, the isochron age for all five highest-acidity leachates is 3.94 plus or minus 0.04 Ga, and is within error of the age obtained for the more restricted data set. All leachates used to define the isochron have major cation compositions that are singular to those obtained by microprobe analyses of the carbonate rosettes and are consistent with progressive digestion of the carbonates according to their composition. The age thus obtained for the carbonates is about 600 m.y. younger than the crystalization age of ALH 84001 determined by Sm-Nd analyses but is within error limits of the age of impact metamorphism inferred from the Rb-SR and Ar-Ar systematics of silicates. which yield ages of 3.85 plus or minus 0.05 Ga and 4.05- 3.80 Ga to 4.3-3.8 Ga, respectively. Similarities between the carbonate crystallization age and the age of impact metamorphism as determined by Ar-Ar and Rb-SR suggest that the carbonate formation is impact-related. Nevertheless, both high and low- temperature scenarios for the origin of the carbonates are possible.
Author
SNC Meteorites; Carbon; Chronology; Impact; Extraterrestrial Life

19990020842 Joint Inst. for Nuclear Research, Dubna, USSR
On Independent Proof of a Martian Origin for the Shergotty Meteorite
Chuburkov, Y. T., Joint Inst. for Nuclear Research, USSR; Perelygin, V. P., Joint Inst. for Nuclear Research, USSR; Alekseev, V. A., Troitsk Inst. for Innovation and Thermonuclear Research, Russia; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 9; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The Mendeleev’s Periodic Law was used to obtain proof of the existense of the hypothetical process of element magnetic separation in protoplanetary nebula. The share of free neutral atoms, N(sub O2), for all elements in proto-planetary nebula has been determined with an account of their abundance and physical and chemical properties. The linear dependence for the ratio of nonvolatile and volatile element contents in igneous rocks of the Earth (R = 1 Astronomical Unit) up to the asteroid belt (R = 2.80 Astronomical Units) on N(sub O) was obtained. to this end the concentration ratios of elements - analogs with different N (sub O) in the matters of Venus, Earth, Mars, and chondrites - were compared. The data obtained are sufficient for the demonstration of the existence of the process of element magnetic separation in protoplanetary nebula. The concentration ratio Z(sub 1)/Z(sub 2) for some pairs of chemically similar elements is presented in Table I for the Earth (IR), Mars (Ms), Shergotty meteorite (Sh), and chondrites (Ch).
Author
Mars (Planet); Meteorites; Meteoritic Composition; Shergottites; SNC Meteorites

19990020853 Case Western Reserve Univ., Cleveland, OH USA
Recovering More Antarctic Martian Meteorites: Answers to Common Questions
Harvey, R. P., Case Western Reserve Univ., USA; Cassidy, W. A., Pittsburgh Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 22-23; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Of the 13 martian meteorites reported, almost half were collected in Antarctica. With the increased interest in martian meteorite studies accompanying the report of possible biogenic activity in ALH 84001, many have wondered whether recoveries of Antarctic martian meteorites could be enhanced or accelerated. Given that the recovery of Antarctic meteorites is a planned activity, (unlike the recovery of non-Antarctic martian meteorites via random finds and falls), such questions are worth considering. Listed below are several topical questions, followed by answers based on experience gathered during the 21 completed field seasons of ANSMET (the Antarctic Search for Meteorites program).
Author
Antarctic Regions; Meteorites; SNC Meteorites; Searching

19990020854 New Mexico Univ., Dept. of Earth and Planetary Sciences, Albuquerque, NM USA
Estimates of Oxygen Fugacity in the Basaltic Shergottites From Electron Microprobe Oxygen Analysis
Herd, C. D. K., New Mexico Univ., USA; Papike, J. J., New Mexico Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 23-24; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The basaltic shergottites consist of four meteorites thought to have a martian origin: Shergotty, Zagami, EETA 79001, and QUE 94201. All are basaltic in composition, but only QUE 94201 contains no cumulus pyroxene and may therefore represent a martian liquid. Previous estimates of f(sub O2) at the time of crystallization of the shergottites range from the quartz-fayalite-magnetite (QFM) buffer to 4 log units below QFM, based on coexisting Fe-Ti oxides, for all but QUE94201. Oxygen fugacity conditions for QUE94201 are near the iron-wustite (IW) buffer about 4 log units below QFM. The current research aims to refine the estimates of f(sub O2), for the basaltic shergottites, through electron microprobe techniques. The technique of quantitative analysis of f(sub O2) using the electron micro-probe has been developed to the point where O can be analyzed with certainty comparable to the analysis of most cations. Practical application of the technique to naturally occurring spinels has been demonstrated demonstrated. A set of O standards now exists that can be readily obtained. The technique also allows an assessment of stoichiometry, since the cation total, on the basis of four O atoms, does not rely on the assumption of stoichiometry. Instead, the amount of Fe3(+), is determined by charge balance.
Author
Magnetite; Meteorites; Meteoritic Composition; Microanalysis; Oxides; Oxygen; Shergottites; Stoichiometry; Cations; SNC Meteorites

19990020861 NASA Johnson Space Center, Houston, TX USA
Curation of US Martian Meteorites Collected in Antarctica
Lindstrom, M., NASA Johnson Space Center, USA; Satterwhite, C., Lockheed Martin Corp., USA; Allton, J., Lockheed Martin Corp., USA; Stansbury, E., NASA Johnson Space Center, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 29-30; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

To date the ANSMET field team has collected five martian meteorites (see below) in Antarctica and returned them for curation at the Johnson Space Center (JSC) Meteorite Processing Laboratory (MPL). ne meteorites were collected with the clean procedures used by ANSMET in collecting all meteorites: They were handled with JSC-cleaned tools, packaged in clean bags, and shipped frozen to JSC. The five martian meteorites vary significantly in size (12-7942 g) and rock type (basalts, lherzolites, and orthopyroxenite). Detailed descriptions are provided in the Mars Meteorite compendium, which describes classification, curation and research results. A table gives the names, classifications and original and curatorial masses of the martian meteorites. The MPL and measures for contamination control are described.
Author
Antarctic Regions; Classifications; Collection; Meteorites; Clean Rooms; Decontamination

19990020865 NASA Johnson Space Center, Houston, TX USA
What Were the Major Factors That Controlled Mineralogical Similarities and Differences of Basaltic, Lherzolitic and Clinopyroxentic Martian Meteorites Within Each Group
Mikouchi, T., Tokyo Univ., Japan; Miyamoto, M., Tokyo Univ., Japan; McKay, G. A., NASA Johnson Space Center, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 34-36; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Twelve martian meteorites that have been re- covered so far are classified into five groups (basalt, lherzolite, clinopyroxenite, dunite, and orthopyroxenite) mainly from petrology and chemistry. Among them, the dunite and orthopyroxenite groups consist of only one meteorite each (dunite: Chassigny, orthopyroxenite: ALH 84001). The basalt group is the largest group and consists

of four meteorites (Shergotty, Zagani, EETA 79001, and QUE 94201). The lherzolitic and clinopyroxenitic groups include three meteorites each (Lherzolite: ALH 77005, LEW 88516, and Y793605, clinopyroxenite: Nakhla, Governador Valadares, and Lafayette). These meteorites within each group are generally similar to the others, but none of them is paired with the others. In this abstract, we discuss the major factors that controlled mineralogical similarities and differences of basaltic, lherzolitic, and clinopyroxenitic meteorites within each group. This may help in understanding their petrogenesis and original locations on Mars in general.
Author
Basalt; Dunite; Meteoritic Composition; Mineralogy; Petrogenesis; Shergottites; SNC Meteorites; Crystallization

19990020870 Manchester Univ., Dept. of Earth Sciences, UK
Oxygen-Isotopic Composition of Nakhla Siderite: Implications for Martian Volatiles
Saxton, J. M., Manchester Univ., UK; Lyon, I. C., Manchester Univ., UK; Turner, G., Manchester Univ., UK; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 39-40; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

We have previously [1] reported the O-isotopic measurements of two grains (CI and C3) of Mn-rich siderite in Nakhla, Four O-isotopic measures were identical within error, yielding mean delta(18)0 = 34 plus or minus 1 per mil SMOW. This is the heaviest carbonate yet reported from a martian meteorite. We now explore the implications of these data for martian volatiles. More recently, we have measured more carbonate grains (C8, C9, ClO) that differ chemically from Cl and C3, being richer in Mg and lower in Mn. These new grains still have delta 18(0) near 34 per mil (the accuracy of each measurement is 1-2 per mil). The carbonate grains are orange-brown in transmitted light, suggesting some staining by ferric oxides; C8 was particularly badly stained, and its lower delta 18(0) probably reflects contamination by oxides and/or silicates.
Author
Atmospheric Composition; Carbonates; Isotopes; Oxygen; Siderites; SNC Meteorites; Meteoritic Composition; Water; Carbon Dioxide; Planetary Atmospheres; Mars Atmosphere

19990020872 Hawaii Univ., Inst. of Geophysics and Plantology, Honolulu, HI USA
Biogenic or Abiogenic Origin of Carbonate-Magnetite-Sulfide Assemblages in Martian Meteorite Allan Hills 84001
Scott, E. R. D., Hawaii Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 42-44; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

It has been suggested that the carbonates and submicrometer grains of magnetite, pyrrhotite, and an Fe-S phase identified as ”probably griegite” were all biogenic in origin. Their arguments were based on similarities in the compositions, structures, shapes, and sizes of these minerals with terrestrial bio-minerals and the apparent absence of plausible abiogenic origins. Here we compare the carbonate assemblages to possible martian, terrestrial, and meteoritic analogs and discuss new and published arguments for and against abiogenic and biogenic origins for these minerals.
Author
Abiogenesis; Carbonates; Magnetite; Mars (Planet); Minerals; SNC Meteorites; Exobiology

19990020873 Hawaii Univ., Inst. of Geophysics and Planetology, Honolulu, HI USA
Origin of Carbonate in Martian Meteorite Allan Hills 84001
Scott, E. R. D., Hawaii Univ., USA; Krot, A. N., Hawaii Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 44-45; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

A significant argument advanced by McKay et al., in favor of a biogenic origin of the carbonates in ALH 84001 was that abiogenic origins - both low and high temperature - appeared to be less plausible. However, subsequent shock studies have suggested that impact heating may have modified carbonates. We inferred that plagioclase glass and rare silica grains formed from impact melts, and Raman spectroscopy confirmed that plagiociase had been melted at greater than 1200C, suggesting shock pressures exceeded 35-45 GPa. Morphological similarities between grains of plagioclase glass and irregularly shaped carbonates in fractures and the occurrence of intermixed grains in fractures suggested that carbonates may also have been shock heated so that a CO2-rich fluid was injected into cooler-fractured pyroxene during shock decompression causing crystallization in seconds.
Author
Carbon Dioxide; Carbonates; Crystallization; High Temperature; Pyroxenes; Shock Heating; Silicon Dioxide; SNC Meteorites; Abiogenesis

19990020874 New Mexico Univ., Inst. of Meteorites, Albuquerque, NM USA

A Comparison Between Sulfide Assemblages in Martian Meteorites Allan Hills 84001 and Governador Valadares

Shearer, C. K., New Mexico Univ., USA; Adcock, C., New Mexico Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 45-47; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Understanding the development, timing, and setting of sulfide and sulfate deposition is critical to interpreting S-isotopic systematics in martian meteorites and future mission samples. For example, to properly interpret S isotopes as a marker for biogenic activity in low-temperature hydrothermal mineral assemblages, it is important to understand the relative sequence of sulfide and/or sulfate precipitation, the temperature of precipitation the openness of the system 121, and the postdepositional thermal history of the sulfide-sulfate assemblages. to interpret S isotopes in magmatic assemblages, it is critical to decipher the effect of subsolidus processes.

Author

Isotopes; Minerals; SNC Meteorites; Sulfides; Sulfur Isotopes; Crystallization; Pyrrhotite; Pyrites

19990020878 NASA Johnson Space Center, Houston, TX USA

Mineral Biomarkers in Martian Meteorite Allan Hills 84001?

Thomas-Keprta, K. L., Lockheed Martin Corp., USA; Bazylinski, D. A., Iowa State Univ. of Science and Technology, USA; Wentworth, S. J., Lockheed Martin Corp., USA; McKay, D. S., NASA Johnson Space Center, USA; Golden, D. C., Lockheed Martin Corp., USA; Gibson, E. K., Jr., NASA Johnson Space Center, USA; Romanek, C. S., Savannah River Ecology Lab., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 51-53; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The occurrence of fine-grained magnetite in the Fe-rich rims surrounding carbonate globules in the martian meteorite ALH84001, originally described in , have been proposed as fossil remains of primitive martian organisms. Here we report observations on size and shape distributions of magnetites from ALH84001 and compare them to biogenic and inorganic magnetite crystals of terrestrial origin. While some magnetite morphology is not unequivocally diagnostic for its biogenicity, such as cubodial forms of magnetite, which are common in inorganically formed magnetites, other morphologies of magnetite (parallel-epiped or elongated prismatic and arrowhead forms) are more likely signatures of biogenic activity. Some ALH 84001 magnetite particles described below have unique morphology and length-to-width ratios that are indistinguishable from a variety of terrestrial biogenic magnetite and distinct from all known inorganic forms of magnetite.

Author

Carbonates; Magnetite; Mars (Planet); Morphology; SNC Meteorites; Extraterrestrial Life; Exobiology

19990020884 NASA Johnson Space Center, Houston, TX USA

Alteration Products and Secondary Minerals in Martian Meteorite Allan Hills 84001

Wentworth, S. J., Lockheed Martin Corp., USA; Thomas-Keprta, K. L., Lockheed Martin Corp., USA; McKay, D. S., NASA Johnson Space Center, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 59-60; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The martian meteorites contain alteration products and secondary minerals that are a critical part of understanding their near-surface histories on both Mars and Earth. In some martian meteorites, suspected martian preterrestrial alteration products can be distinguished from terrestrial weathering effects Using scanning electron microscopy (SEM), field emission SEM (FE-SEM), transmission electron microscopy (TEM), and energy-dispersive X-ray analysis (EDS), we are studying natural fracture surfaces of ALH 84001 chips, including samples from both the interior and the exterior of the meteorite. Exterior samples include fusion crust surfaces, which are important in determining the extent of terrestrial weathering of meteorites. The focus of this study is weathering features and secondary minerals other than the distinctive carbonate globules that continue to be studied by many researchers.

Author

Mars (Planet); SNC Meteorites; Weathering; Minerals; Carbonates

19990020886 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA

Abiotic Synthesis of Hydrocarbons on Mars: Theoretical Modeling of Metastable Equilibria

Zolotov, M. Y., Washington Univ., USA; Shock, E. L., Washington Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 62-64; In English; Also announced as 19990020835

Contract(s)/Grant(s): NSF CHE-97-14060; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The martian meteorite ALH84001 contains polycyclic aromatic hydrocarbons (PAHs) and other hydrocarbons of endogenous origin. It has been proposed that the presence of PAHs in carbonate globules of ALH84001 indicates biological activity on ancient Mars. On the other hand, the presence of hydrocarbons in other meteorites, interstellar clouds, and Earth's pristine and altered igneous rocks (e.g., serpentinites) is not attributed to biological sources. In many cases these hydrocarbons are formed abiotically due to reduction of C oxides by H. We used thermodynamic calculations of metastable equilibria to evaluate the possibility of abiotic synthesis of PAHs and n-alkanes in possible hydrothermal fluids and thermal gases on Mars.

Author

Carbonates; Hydrocarbons; Metastable State; Polycyclic Aromatic Hydrocarbons; SNC Meteorites; Planetary Temperature

19990021044 Arizona State Univ., Dept. of Chemistry and Biochemistry, Tempe, AZ USA

Enantiomeric Excesses of Acid Labile Amino Acid Precursors of the Murchison Meteorite

Pizzarello, Sandra, Arizona State Univ., USA; Oct. 1998; 4p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Amino acids present in carbonaceous chondrite are extracted in water in part as free compounds and in approximately equal part as acid labile precursors. On the assumption that they would be free of contamination, the precursors of two Murchison amino acids that have terrestrial occurrence, alanine and glutamic acid, have been targeted for analysis of their enantiomeric ratios. Pyroglutamic acid, the precursor of glutamic acid, was found with an L-enantiomeric excess comparable to that of the free acid, while alanine's precursor, N-acetyl alanine, appears approximately racemic. Also alpha-imino propioacetic acid, a proposed end product of alanine synthesis in the meteorite, was analyzed and found racemic.

Author

Amino Acids; Murchison Meteorite; Carbonaceous Chondrites

19990021050 San Diego Univ., Dept. of Physics, San Diego, CA USA

Rossby Waves in the Protoplanetary Nebula

Sheehan, Daniel P., San Diego Univ., USA; Oct. 1998; 4p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Fluid waves and instabilities are considered critical to the evolution of protoplanetary nebulae, particularly for their roles in mass, angular momentum, and energy transport. A number have been identified, however, notably absent, is an influential wave commonly found in planetary atmospheres and oceans: the planetary Rossby wave (PRW). Since, in the Earth's atmosphere, the PRW is of primary importance in shaping large-scale meteorological phenomena, it is reasonable to consider whether it might have similar importance in the protoplanetary nebula. The thrust of the research project this summer (1998) was to determine whether a nebular analog to the PRW is viable, a so-called nebular Rossby wave (NRW), and if so, to explore possible ramifications of this wave to the evolution of the nebula. This work was carried out primarily by S. Davis, J. Cuzzi and me, with significant discussions with P. Cassen. We believe we have established a good case for the NRW and as a result believe we have opened up a new and possibly interesting line of research in regard to the nebular development, in particular with regard to zonal jet formation, a potent accretion mechanism, and possible ties to vortex formation. The standard model of the protoplanetary nebula consists of a large disk of gas with about 1% entrained dust gravitationally bound to a large central mass, m(sub c) i.e., the protostar. The planet-forming region of the disk extends to roughly 100 A.U. in radius. Disk thickness, H, is believed to be on the order of 10-100 times less than disk radius. Disk lifetime is on the order of a million years.

Derived from text

Nebulae; Energy Transfer; Kinetic Energy; Meteorological Parameters; Planetary Waves; Protostars

19990021052 San Jose State Univ., Dept. of Chemistry, CA USA

The Identification of Complex Organic Molecules in the Interstellar Medium: Using Lasers and Matrix Isolation Spectroscopy to Simulate the Interstellar Environment

Stone, Bradley M., San Jose State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Astrochemistry Group at NASA Ames Research Center is interested in the identification of large organic molecules in the interstellar medium Many smaller organic species (e.g. hydrocarbons, alcohols, etc.) have been previously identified by their radiofrequency signature due to molecular rotations. However, this becomes increasingly difficult to observe as the size of the molecule increases. Our group in interested in the identification of the carriers of the Diffuse Interstellar Bands (absorption features observed throughout the visible and near-infrared in the spectra of stars, due to species in the interstellar medium). Polycyclic Aromatic Hydrocarbons (PAHs) and related molecules are thought to be good candidates for these carriers. Laboratory experiments am performed at Ames to simulate the interstellar environment, and to compare spectra obtained from molecules in the laboratory to those derived astronomically. We are also interested in PAHs with respect to their possible connection to the UIR (Unidentified infrared) and ERE (Extended Red Emission) bands - emission features found to emanate from particular regions of our galaxy (e.g. Orion nebula, Red Rectangle, etc.). An old, ”tried and proven spectroscopic technique, matrix isolation spectroscopy creates molecular conditions ideal for performing laboratory astrophysics.
Derived from text
Organic Materials; Molecules; Interstellar Matter; Stellar Spectra; Polycyclic Aromatic Hydrocarbons; Molecular Rotation

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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.

19990019276 Massachusetts Inst. of Tech., Dept. of Earth, Atmospheric, and Planetary Sciences, Cambridge, MA USA
Triton’s Distorted Atmosphere
Elliot, J. L., Massachusetts Inst. of Tech., USA; Stansberry, J. A., Lowell Observatory, USA; Olkin, C. B., Lowell Observatory, USA; Agner, M. A., Massachusetts Inst. of Tech., USA; Davies, M. E., RAND Corp., USA; Science; Oct. 17, 1998; Volume 278, pp. 436-439; In English
Contract(s)/Grant(s): NAG5-3940; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche
A stellar-occultation light curve for Triton shows asymmetry that can be understood if Triton’s middle atmosphere is distorted from spherical symmetry. Although a globally oblate model can explain the data, the inferred atmospheric flattening is so large that it could be caused only by an unrealistic internal mass distribution or highly supersonic zonal winds. Cyclostrophic winds confined to a jet near Triton’s northern or southern limbs (or both) could also be responsible for the details of the light curve, but such winds are required to be slightly supersonic. Hazes and clouds in the atmosphere are unlikely to have caused the asymmetry in the light curve.
Author
Triton; Stellar Occultation; Light Curve; Middle Atmosphere; Distortion; Flattening; Asymmetry

19990019384 Clark-Atlanta Univ., Dept. of Physics, GA USA
Collision Strengths for Electron Collisional Excitation of S II
Tayal, S. S., Clark-Atlanta Univ., USA; Astrophysical Journal Supplement Series; Aug. 1997; Volume 111, pp. 459-466; In English
Contract(s)/Grant(s): NAGw-4447; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Electron collisional excitation strengths for inelastic transitions in S II are calculated using the R-matrix method in a 19-state (3s(sup 2)3p(sup 3)(sup 4)S(sup o), (sup 2)D(sup o), (sup 2)p(sup o), 3s3p(sup 4)(sup 4)P, (sup 2)D, (sup 2)S, 3S(sup 2)3p(sup 2)3d(sup 2)P, (sup 4)F, (sup 4)D, (sup 2)F, (sup 4)P, 3s(sup 2)3p(sup 2)4s(sup 4)P, (sup 2)P, 3s(sup 2)3p(sup 2)4p(sup 2)S(s o), (sup 4)D(sup o), (sup 4)P(sup o), (sup 2)D(sup o), (sup 4)S(sup o), (sup 2)P(sup o)) close-coupling approximation. These target states are represented by extensive configuration-interaction wave functions that give excitation energies and oscillator strengths that are usually in good agreement with the experimental values and the available accurate calculations. The present results for collision strengths are in very good agreement with the recent merged beams energy loss measurement of Liao et al. and agree reasonably well with the 18-state R-matrix calculation of Ramsbottom, Bell, & Stafford, but show significant differences from the 12-state R-matrix calculation of Cai & Pradhan.
Author
Matrix Methods; Wave Functions; Energy Dissipation; Electron States; Atomic Energy Levels; Atomic Excitations

19990019474 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Chemical Schemes for Surface Modification of Icy Satellites: A Road Map

Delitsky, Mona L., Jet Propulsion Lab., California Inst. of Tech., USA; Lane, Arthur L., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Jul. 25, 1997; ISSN 0148-0227; Volume 102, No. E7, pp. 16,385-16,390; In English

Report No.(s): Paper 97JE01250; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The icy Galilean satellites of Jupiter are subject to magnetospheric plasma ion bombardment, which induces chemical changes within the ice. The possible detection of CO2 on the surface of Ganymede by the Galileo spacecraft makes for a more complicated chemistry and increases the number of chemical compounds that may then be present. We outline chemical schemes for the irradiation of pure and mixed ices H2O/CO2 and suggest species which observers may detect on Europa, Ganymede, and Callisto, such as C3O2, H2CO3, H2O2, CO3, HO2, CO, H2CO, CH2CO, as well as K2O, KOH, and SO3, from plasma implantation. Column abundances of compounds in the ice are calculated using a specified energy input and G values (yield per 100 eV). Author

Research; Detection; Carbon Dioxide; Icy Satellites; Ion Irradiation

19990019508 San Jose State Univ., Dept. of Meteorology, CA USA

Work on Planetary Atmospheres and Planetary Atmosphere Probes ***Final Report, 1 Apr. 1987 - 30 Jun. 1998***

Seiff, Alvin, San Jose State Univ., USA; Lester, Peter, San Jose State Univ., USA; Jan. 08, 1999; 10p; In English

Contract(s)/Grant(s): NCC2-471; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A major objective of the grant was to complete the fabrication, test, and evaluation of the atmosphere structure experiment on the Galileo Probe, and to receive, analyze, and interpret data received from the spacecraft. The grantee was competitively selected to be Principal Investigator of Jupiter's atmosphere structure on the Galileo Probe. His primary motivation was to learn as much as possible about Jupiter's atmosphere by means of a successful atmosphere structure experiment, and to support the needs and schedule of the Galileo Project. After a number of launch delays, the Flight instrument was shipped to Kennedy Space Center 2 years after the start of this collaboration, on April 14, 1989, at which time it was determined from System level tests of the ASI on the Probe that the instrument was in good working order and ready for flight. The spacecraft was launched on October 18, 1989. Data analysis of test and calibration data taken over a period of years of instrument testing was continued in preparation for the encounter. The initial instrument checkout in space was performed on October 26, 1989. The data set received by telemetry was thoroughly analyzed, and a report of the findings was transmitted to the Probe Operations Office on Feb. 28, 1990. Key findings reported were that the accelerometer biases had shifted by less than 1 mg through launch and since calibration at Bell Aerospace in 1983; accelerometer scale factors, evaluated by means of calibration currents, fell on lines of variation with temperature established in laboratory calibrations; pressure sensor offsets, correlated as a function of temperature, fell generally within the limits of several years of ground test data; atmospheric and engineering temperature sensor data were internally consistent within a few tenths of a degree; and the instrument electronics performed all expected functions without any observable fault. Altogether, this checkout was highly encouraging of the prospects of instrument performance, although performed greater than 5 years prior to Jupiter encounter. Capability of decoding the science data from the Experiment Data Record to be provided at encounter was developed and exercised using the tape recording of the first Cruise Checkout data. A team effort was organized to program the selection and combination of data words defining pressure, temperature, acceleration, turbulence, and engineering quantities; to apply decalibration algorithms to convert readings from digital numbers to physical quantities; and to organize the data into a suitable printout. A paper on the Galileo Atmosphere Structure Instrument was written and submitted for publication in a special issue of Space Science Reviews. At the Journal editor's request, the grantee reviewed other Probe instrument papers submitted for this special issue. Calibration data were carefully taken for all experiment sensors and accumulated over a period of 10 years. The data were analyzed, fitted with algorithms, and summarized in a calibration report for use in analyzing and interpreting data returned from Jupiter's atmosphere. The sensors included were the primary science pressure, temperature, and acceleration sensors, and the supporting engineering temperature sensors. This report was distributed to experiment coinvestigators and the Probe Project Office.

Derived from text

Planetary Atmospheres; Galileo Probe; Temperature Sensors; Pressure Sensors; Jupiter Atmosphere; Fabrication

19990019892 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

An Improved Magnetic Field Model for Jupiter's Inner Magnetosphere Using a Microsignature of Amalthea

Randall, Bruce A., Iowa Univ., USA; Journal of Geophysical Research; Aug. 01, 1998; ISSN 0148-0227; Volume 103, No. A8, pp. 17,535-17,542; In English

Contract(s)/Grant(s): NAS2-571; JPL-958780

Report No.(s): Paper-98JA01437; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Observation of a particle absorption microsignature of the Jovian satellite Amalthea during the Pioneer II close flyby of Jupiter on December 3, 1974, has been described by McKibben et al. The microsignature was also observed by the University of Iowa/ Pioneer II instrument in the distribution of protons in the kinetic energy range 0.61 less than T(sub p) less than 3.41 MeV but has not been previously reported. The finer time resolution and superior data quality of the latter observations provide a fresh basis for assessing the accuracy with which various published magnetic field models of Jupiter's magnetic field models describe Jupiter's magnetic field for radial distances of the order of or less than several planetary radii. The expected time of occurrence of the minimum of Amalthea's microsignature was calculated for each model and compared to the time of the observed minimum. The discrepancy between these two times was significant for each of the published models, but it could be reduced to zero by interpolating between two of the closely related models. The spherical harmonic coefficients of this combination model are tabulated. Also included is a novel method for calculating the intensity-time profile of the microsignature. In a later paper, the improved model is utilized to analyze the energetic particle measurements in Jupiter's innermost magnetosphere by the Galileo entry probe in December 1995.

Author

Jupiter (Planet); Magnetospheres; Amalthea; Energetic Particles; Planetary Magnetic Fields; Jupiter Satellites

19990020835 Lunar and Planetary Inst., Houston, TX USA

Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?

1998; 172p; In English; Martian Meteorites, 2-4 Nov. 1998, Houston, TX, USA; Sponsored by NASA, USA; Also announced as 19990020836 through 19990020886

Contract(s)/Grant(s): NASw-4574

Report No.(s): LPI-Contrib-956; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche; Abstracts Only; Abstracts Only

The presentations in this workshop discuss the composition of Martian meteorites. Many of the talks were on a specific meteorite, i.e., Allan Hills 84001 (ALH84001). The discovery earlier of carbonates in ALH84001 lead some researchers to suggest that there was evidence of martian life. Other possible explanations for this phenomena are given. Other papers discuss methods to sterilize martian samples, the existence of water on Mars, the facilities of the Meteorite Processing Laboratory at Johnson Space Center, comparative analyses of geologic processes and the gathering of meteorites.

CASI

Mars Surface; Meteoritic Composition; SNC Meteorites; Extraterrestrial Life; Exobiology; Life Detectors; Conferences

19990020836 Lockheed Martin Corp., Houston, TX USA

Gamma-Ray Sterilization of Mars Analog Rocks and Minerals

Allen, C. C., Lockheed Martin Corp., USA; Workshop on the Issue, Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 1-2; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Samples of rock and soil, collected by robotic spacecraft on Mars, will be returned to terrestrial laboratories early in the next century. Plans call for the samples to be placed immediately in biological containment and tested for signs of present or past life and biological hazard. It is recommended that "controlled distribution of unsterilized materials from Mars should occur only if rigorous analyses determine that the materials do not constitute a biological hazard. If any portion of the sample is removed from containment prior to completion of these analyses it should first be sterilized." While sterilization of Mars samples may not be required, an acceptable method must be available before the samples are returned to Earth. Various techniques are routinely used to sterilize biological samples. These include dry heating to temperatures of 150C or higher, heating in the presence of steam, exposure to poisonous gases such as formaldehyde and propiolactone, exposure to H2O2 vapor or plasma, exposure to ultraviolet light, and exposure to gamma radiation. The appropriate technique depends on the physical characteristics of the sample and the desired results. Gamma radiation is routinely used to inactivate viruses and destroy bacteria in medical research. The most commercial sterilizers use Cobalt 60, which emits gamma photons with energies of 1. 173 and 1. 332 MeV. Absorbed doses of approximately 10(exp 6) rad (10(exp 4) gamma ray is equal to 10(exp 4) ergs/gm) are sufficient to destroy most bacteria. The current study is designed to investigate the effects of lethal doses of Cobalt 60 gamma radiation on geologic materials analogous to the first samples to be returned from Mars. The goals are (1) to determine the gamma ray dose required to kill microorganisms within geo-

logic samples, and (2) to determine the effects of lethal doses of gamma radiation on the physical and chemical properties of the samples.
Author
Gamma Rays; Mars Surface Samples; Planetary Geology; Radiation Dosage; Sterilization; Bacteria; Viruses; Radiobiology; Cobalt 60; Mars Sample Return Missions

19990020840 New Mexico Univ., Inst. of Meteorites, Albuquerque, NM USA
Rare Potassium-Bearing Mica in Allan Hills 84001: Additional Constraints on Carbonate Formation
Brearley, A. J., New Mexico Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 6-8; In English; Also announced as 19990020835
Contract(s)/Grant(s): NAG5-4935; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

There have been presented several intriguing observations suggesting evidence of fossil life in martian orthopyroxenite ALH 84001. These exciting and controversial observations have stimulated extensive debate over the origin and history of ALH 84001, but many issues still remain unresolved. Among the most important is the question of the temperature at which the carbonates, which host the putative microfossils, formed. Oxygen- isotopic data, while showing that the carbonates are generally out of isotopic equilibria with the host rock, cannot constrain their temperature of formation. Both low- and high-temperature scenarios are plausible depending on whether carbonate growth occurred in an open or closed system. Petrographic arguments have generally been used to support a high-temperature origin but these appear to be suspect because they assume equilibrium between carbonate compositions that are not in contact. Some observations appear to be consistent with shock mobilization and growth from immiscible silicate-carbonate melts at high temperatures. Proponents of a low-temperature origin for the carbonates are hampered by the fact that there is currently no evidence of hydrous phases that would indicate low temperatures and the presence of a hydrous fluid during the formation of the carbonates. However, the absence of hydrous phases does not rule out carbonate formation at low temperatures, because the carbonate forming fluids may have been extremely CO2 rich, such that hydrous phases would not have been stabilized. In this study, I have carried out additional Transmission electron microscopy (TEM) studies of ALH-84001 and have found evidence of very rare phyllosilicates, which appear to be convincingly of pre-terrestrial origin. At present these observations are limited to one occurrence: further studies are in progress to determine if the phyllosilicates are more widespread.
Author
Mars (Planet); Microorganisms; Petrography; SNC Meteorites; Chronology; Extraterrestrial Life; Silicates; Mica; Carbonates

19990020841 Geological Survey, Menlo Park, CA USA
Water on Mars: How Much Was (Is) There, Where Did It Go and When?
Carr, M. H., Geological Survey, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 8-9; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Optimism about the prospects for development of indigenous life on Mars has been fueled in large part by perceptions of the geologic evolution of Mars based mainly on remote-sensing data. The consensus view is that Mars is, or was, a water-rich planet and that it likely experienced warmer climates in the past. Yet this view has not been proved, and it is difficult to reconcile with most modeling studies of climate change and some characteristics of martian meteorites. Moreover, many variants have been proposed for the climate history of the planet and for the amounts and locations of water present at different times.
Author
Extraterrestrial Life; Mars Surface; Planetary Geology; SNC Meteorites; Water; Mars Atmosphere

19990020843 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
The Search for Early Life on Mars: A European Space Agency Exobiology Science Team Study
Clancy, P., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Brack, A., Centre National de la Recherche Scientifique, France; Hofmann, B., Naturhistorisches Museum, Switzerland; Horneck, G., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Kurat, G., Naturhistorisches Museum, Austria; Maxwell, J., Bristol Univ., UK; Ori, G. G., Universita degli studi G. D'Annunzio, Italy; Pillinger, C., Open Univ., UK; Raulin, F., Paris Univ., France; Thomas, N., Max-Planck-Inst. fuer Aeronomie, Germany; Westall, F., Bologna Univ., Italy; Fitton, B., European Science Consultants, Netherlands; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 9-10; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

A recent initiative of the Manned Spaceflight and Microgravity Directorate of the European Space Agency was concerned with the identification of specific objectives in the search for life on Mars. The Exobiology Science Team consisted of experts

in the fields of radiation biology, planetary geology, geochemistry, mineralogy, meteorology, and exobiology. The Science Team study emphasized present European capabilities in the areas of drilling, sample acquisition, and preparation, and in situ analysis. Author

Exobiology; Extraterrestrial Life; Planetary Geology; Mars Surface; Mars Sample Return Missions; Landing Sites; Mars Exploration

19990020844 NASA Ames Research Center, Moffett Field, CA USA

Studies of Life on Earth are Important for Mars Exploration

DesMarais, D. J., NASA Ames Research Center, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 10-11; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The search for evidence of the early martian environment and a martian biosphere is benefitted by diverse studies of life on Earth. Most fundamentally, origin-of-life research highlights the challenge in formulating a rigorous definition of life. Because such definitions typically list several of life's most basic properties, they also help to define those observable features that distinguish life and thus might be sought through telescopes, spacecraft, and analyses of extraterrestrial samples. Studies of prebiotic chemistry also help by defining the range of environments and processes that sustain prebiotic organic synthesis. These studies might indicate if and where prebiotic processes occur today on Earth and elsewhere. Such studies should also help to identify which localities are good candidates for the origin of life. A better understanding of the most fundamental principles by which molecules are assembled into living systems will help us to appreciate possible alternatives to the path followed by life on Earth. These perspectives will sharpen our ability to recognize exotic life and/or those environments that can sustain it.
Author

Biological Evolution; Mars Environment; Earth Environment; Mars Atmosphere; Chemical Evolution; Extraterrestrial Life

19990020845 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Optimizing the Search for a Fossil Record of Ancient Martian Life

Farmer, J. D., Arizona State Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 11-12; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

An important focus of the decade-long Mars Surveyor Program is the search for evidence of past or present life and or prebiotic chemistry. Based on studies of terrestrial analogs, the highest-priority sites for a martian fossil record include such lithologies as fine-grained, clay-rich detrital sediments, water-lain pyroclastics and evaporite deposits of terminal paleolake basins, the deposits of mineralizing springs (including hydrothermal), and mineralized zones (hard-pans) within ancient soils. The systematic exploration for a martian fossil record critically depends on locating accessible surface outcrops of these and other aqueously deposited sediments. The following discussion identifies the steps needed to optimize a plan for implementing the present strategy for Mars exopaleontology.
Author

Fossils; Lithology; Mineralogy; Roving Vehicles; Mars Surface; Mars Sample Return Missions

19990020847 State Univ. of New York, Dept. of Physics, Plattsburgh, NY USA

Organic Carbon in Carbonate and Rim From Allan Hills 84001

Flynn, G. J., State Univ. of New York, USA; Keller, L. P., MVA, Inc., USA; Jacobsen, C., State Univ. of New York, USA; Wirick, S., State Univ. of New York, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 13-14; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

We previously reported scanning transmission X-ray microscope (STXM) C mapping, X-ray absorption near-edge structure (XANES) spectroscopy, and Fourier transform infrared (FTIR) spectroscopy on a carbonate globule and opaque "rim material" from the ALH 84001 meteorite. The globule was consistent with the material described elsewhere. However, the opaque "rim material" was dominated by feldspathic glass, appearing opaque mainly because of the presence of chromites, and containing only minor amounts of the carbonate, magnetite, and sulfide that are major components in the rims. Percent-level organic Carbon was associated with both the carbonate globule and the opaque material. The C-XANES spectrum of the organic compound in the globule was different from that in the opaque material. FTIR spectroscopy indicated the presence of aliphatic hydrocarbons, having different ratios of C-H, to C-H3 groups, in the two samples.
Author

Aliphatic Hydrocarbons; Organic Compounds; SNC Meteorites; Carbonates

19990020848 Florida State Univ., Dept. of Biological Science, Tallahassee, FL USA

Chains of Magnetite Crystals in Allan Hills 84001: Evidence of Biological Origin

Friedmann, E. I., Florida State Univ., USA; Wierzchos, J., Lleida Univ., Spain; Ascaso, C., Consejo Superior de Investigaciones Cientificas, Spain; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 14-16; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The presence of magnetite crystals in carbonate globules in ALH-84001 was one fact leading to the suggestion that this meteorite may contain relics of martian life. These magnetite crystals are morphologically similar in shape and size to magnetosomes formed by magnetotactic bacteria, but less so to typical inorganically formed magnetite crystals. The size range is significant, as within this range the magnetic moment of the crystals is maximal. Terrestrial magnetobacteria produce magnetosomes, magnetite (Fe3O4), or greigite (Fe3S4) crystals assembled into chains, and the organisms use these chains for aligning themselves along the prevailing magnetic field. No inorganic process is known to produce similar structures.

Author

Bacteria; Carbonates; Globules; SNC Meteorites; Exobiology; Crystals; Anaerobes

19990020850 NASA Johnson Space Center, Houston, TX USA

How do the Properties of Allan Hills 84001 Compare With Accepted Criteria for Evidence of Ancient Life?

Gibson, E. K., Jr., NASA Johnson Space Center, USA; McKay, D. S., NASA Johnson Space Center, USA; Thomas-Keprta, K., Lockheed Martin Corp., USA; Westall, F., NASA Johnson Space Center, USA; Romanek, C. A., Savannah River Ecology Lab., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 17-18; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Criteria for Past Life: to be confident that any sample contains evidence of past life or biogenic activity, one must determine beyond a shadow of a doubt that certain well-established features or biomarker signatures are present in the sample. In the case of martian samples, the criteria for past life have not been established because if life existed on the planet, we have no way of knowing its detailed characteristics. Lacking independent evidence about the nature of possible past life on Mars, the scientific community must use, for the time being, the criteria established for ancient samples from the Earth: (1) Do we know the geologic context of the sample? Is it compatible with past life? (2) Do we know the age of the sample and its stratigraphic location? Are they understood enough to relate possible life to geologic history? (3) Does the sample contain evidence of cellular morphology? (4) What structural remains of colonies or communities exist within the samples? (5) Is there any evidence of biominerals showing chemical or mineral disequilibria? (6) Is there any evidence of stable isotope patterns unique to biology? (7) Are there any organic biomarkers present? (8) Are the features indigenous to the sample? For acceptance of past life in a geologic sample, essentially all of these criteria must he met.

Author

Extraterrestrial Life; Mars (Planet); Paleontology; Signatures; Exobiology; SNC Meteorites; Protobiology

19990020851 Manchester Univ., Dept. of Earth Sciences, UK

Xenon and Argon Isotopes in Irradiated, Etched Nakhla: Characterizing the Host of Martian Atmospheric Xenon

Gilmour, J. D., Manchester Univ., UK; Whitby, J. A., Manchester Univ., UK; Burgess, R., Manchester Univ., UK; Turner, G., Manchester Univ., UK; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 18-20; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

A noble gas component with the elevated Xe-129 Xe-132 ratio characteristic of the martian atmosphere is found in Nakhla (and the other nakhlites). It is elementally fractionated with Kr-84/Xe-132 values depleted by factor of -5 relative to the martian atmospheric value (as measured in EET 79001 lithology C). We believe this fractionation reflects the processes by which it was derived from the martian atmosphere and incorporated in the meteorite. If, as has been suggested, aqueous alteration is responsible ”iddingsite”. Our aim is to locate the host phase(s) of the martian atmospheric Xe component and so determine what led to its incorporation and whether the same process can account for the elemental fractionation. We have previously reported analyses of mineral separates form Nakhla that showed the component with elevated Xe-129/Xe-132 is associated with olivine and pyroxene but concentrated in mesostasis. Combining our data with literature abundances of the major minerals suggests that approximately 10 percent of the martian atmosphere derived component is found in olivine with approximately half the remainder being associated with pyroxene and half with mesostasis. We have now supplemented these data with analyses of Nakhla samples crushed and etched in water and acid.

Author

Meteorites; Nakhlites; Olivine; Pyroxenes; Xenon Isotopes; Xenon 129; Argon Isotopes; Krypton Isotopes; Mars Atmosphere

19990020852 Case Western Reserve Univ., Dept. of Geological Sciences, Cleveland, OH USA

Formation of Carbonates in Allan Hills 84001 by Impact Metasomatism: Cooking With Gas

Harvey, R. P., Case Western Reserve Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 20-22; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The possibility that the carbonates in ALH 84001 were formed by the process of impact metasomatism was first put forth earlier. This short paper appeared roughly one month prior to that of McKay et al., in which specific features of ALH 84001 were suggested to be the result of biological activity on ancient Mars. In the media frenzy following that announcement, and subsequent scientific research, the work of Harvey and McSween was often cited as a counterpoint to the McKay groups hypothesis; often this was done as if it were the flag of a ”resistance movement,” rather than as a piece of the complex ALH 84001 puzzle. The purpose of this abstract is to explain the impact metasomatism hypothesis in greater detail and to offer an assessment of its validity in view of subsequent research.

Author

Carbonates; Metamorphism (Geology); SNC Meteorites; Carbon Dioxide; Olivine; Heating

19990020855 Lunar and Planetary Inst., Houston, TX USA

Implication of Hydrous Weathering Product on Mars for Future Exploration

Kirkland, L. E., Lunar and Planetary Inst., USA; Herr, K. C., Aerospace Corp., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 24-25; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Analysis of the newly recovered and recalibrated 1969 Mariner 7 Infrared Spectrometer (IRS) spectra (1.8- 14.4 micrometer) provide evidence for the presence of a hydrous weathering product on the martian surface, interpreted to be goethite. A hydrous weathering product such as goethite may mark areas with a higher abundance of water vapor or areas where water was more abundant in the past. Such areas may contain interesting geologic structures, and an increased abundance of water vapor would have implications in the search for areas most conducive to life. These areas may thus warrant more in-depth examination, and may also make prime targets for future landers. One point the goethite interpretation illustrates that has relevance for future spectral instruments is the importance of obtaining a full spectrum to search for unexpected constituents. A multi-band radiometer, such as the Viking (Infrared Thermal Mapper) IRTM or the proposed Mars Surveyor 2001 THEMIS, has the advantage of lower data rate requirements, and it does provide information on the surface. However, it cannot be used to uniquely identify unexpected constituents, such as goethite.

Author

Infrared Spectrometers; Mars Exploration; Mars Surface; Radiometers; Structural Properties (Geology); Water; Water Vapor; Weathering

19990020858 Institute of Space Research, Moscow, USSR

The Structure of Findings in Allan Hills 84001 May Hint at Their Inorganic Origin

Ksanfomality, L. V., Institute of Space Research, USSR; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 26-27; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The ALH 84001 lessons showed that science at the end of the 20th century is ready for discovery of the simplest organisms on celestial bodies, where minimum conditions for life exist. These conditions, as well as the ways of the origin of primitive microorganisms, are already understood and described in the scientific literature. McKay and others reported that the SNC meteorite ALH 84001 possibly contains traces and fossils of ancient primitive life from Mars. Nevertheless, the authors of this very first study believed that a highly comprehensive verification and more careful further investigation were needed. In this paper, a few remarks on the origin of the structures in the ALH 84001 meteorite are proposed. They may be of interest as a possible proof of their abiogenic nature.

Author

Microorganisms; SNC Meteorites; Extraterrestrial Life; Exobiology; Photomicrographs; Inorganic Chemistry

19990020859 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Constraints on Martian Volatile History From Studies of Martian Meteorites: Lessons Learned and Open Questions

Leshin, L. A., Arizona State Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 27-28; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Studies of the shergottites, nakhlites, Chassigny, and ALH 84001 have provided valuable information on the origin, evolution, and interaction of martian volatile reservoirs. Understanding these reservoirs provides the broadest possible context within which to consider the possibility of life on Mars, and thus such studies are an important component of the quest for addressing issues related to a martian biosphere. The purpose of this work is to outline some of the important insights into martian volatiles provided by studies of martian meteorites, and to highlight inconsistencies and gaps in our knowledge that could be addressed by further research on the meteorites themselves, or by future missions, including sample returns. This is by no means meant to be an exhaustive review of all that has been learned from studies of volatiles in martian meteorites. Rather, it is intended to highlight major conclusions and to stimulate discussion about ”what we really know.”
Author
Mars (Planet); Mars Atmosphere; SNC Meteorites; Water; Water Vapor; Mineralogy; Meteoritic Composition; Mars Environment

19990020860 Biospherics, Inc., Beltsville, MD USA
The Future Search for Life on Mars: An Unambiguous Martian Life Detection Experiment
Levin, G. V., Biospherics, Inc., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 28-29; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

A simple, robotic method to provide an unambiguous determination of extant life in the martian surface or subsurface material is presented. It cannot render a false positive, nor can it mistake a chemical response for a biological one.
Author
Extraterrestrial Life; Mars (Planet); Mars Surface; Robotics; Exobiology; Amino Acids; Isomers; Carbohydrates; Life Detectors

19990020863 NASA Johnson Space Center, Houston, TX USA
Evidence for Ancient Life in Mars Meteorites: Lessons Learned
McKay, D. S., NASA Johnson Space Center, USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 31-33; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The lines of evidence we first proposed as supporting a hypothesis of early life on Mars are discussed by Treiman, who presents pros and cons of our hypothesis in the light of subsequent research by many groups. Our assessment of the current status of the many controversies over our hypothesis is given in reports by Gibson et al. Rather than repeat or elaborate on that information, I prefer to take an overview and present what I think are some of the ”lessons learned” by our team in particular, and by the science community in general.
Author
Extraterrestrial Life; Mars (Planet); Meteorites; SNC Meteorites; Exobiology

19990020864 Tennessee Univ., Dept. of Geological Sciences, Knoxville, TN USA
Key Research: Martian Meteorites and Their Relationships to Planetary Geology and Perhaps Biology
McSween, H. Y., Jr., Tennessee Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 33-34; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Allan Hills 84001 and other SNC meteorites are bewilderingly complex rocks that have generated as many questions as answers. Some remaining questions with profound implications for the geological and perhaps biological evolution of Mars are presented.
Author
Biological Evolution; Planetary Geology; SNC Meteorites; Mars (Planet); Mars Environment; Extraterrestrial Life; Exobiology; Carbonates

19990020866 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Genesis of the Mars Pathfinder ”Sulfur-Free” Rock From SNC Parental Liquids
Minitti, M. E., Brown Univ., USA; Rutherford, M. J., Brown Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 36-37; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

In July 1997, the Mars Pathfinder mission touched down in the Ares Valles region of Mars to begin its scientific study of the Red Planet. The Sojourner rover used its onboard cameras and Alpha-proton X-ray spectrometer (APXS) to study the soils and

rocks of the landing site. Currently, preliminary analyses of five rock samples and six soil samples have been completed. They are based only on the spectra obtained from the X-ray portion of the APXS. When plotted on oxide vs. Sulfur diagrams, the Pathfinder soil and rock data fall on a line extending between the soil data, which fall at high Sulfur contents, and the rock data, which fall at lower S contents. Because the solubility of Sulfur in basaltic melts is less than or equal to 0.2 percent of weight, the range of Sulfur contents in the rocks implies that each rock analysis has a differing amount of soil component. The rock compositions, therefore, fall along a mixing line between the soils and a hypothetical ”Sulfur-free” rock obtained by extrapolating the regression line through the soil and rock data back to 0 percent of weight Sulfur. The composition of the S-free rock is contained in an accompanying table. Accepting the argument that the Pathfinder rocks are igneous, as done by some, the Sulfur-free rock may be classified by its SiO2 and alkali content an andesite. The Sulfur-free rock has the characteristic low Al2O3 and high FeO content expected from martian igneous rocks
Author
Mars Surface; Oxides; Planetary Geology; Sulfur; Basalt; Crystallization; SNC Meteorites

19990020869 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Perspectives on the Future Search for Life on Mars and Beyond
Nealson, K. H., Jet Propulsion Lab., California Inst. of Tech., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 39; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

One can view the search for life on Mars in two ways: first, as the initial step in the search for life elsewhere, and second, as the one place where in situ methods for life detection can be tested and proved via sample return. After Mars, most of the life detection will he done via in situ studies with data return. Mars offers us the opportunity to fine tune our methods - perhaps for a long time to come. Our group is involved in the development of methods for life detection that are independent of specific signals used for detection of life on Earth. These approaches include general indicators of metabolic activity and organismal structure and composition. Using such approaches, we hope to detect the signals of life (biosignatures) that are independent of preconceived notions and yet are convincing and unambiguous. The approaches we are focusing on include stable isotopic analyses of metals, mineral formation and disolution, and elemental analysis. These methods allow us to examine samples at a variety of scales, looking for nonequilibrium distribution of elements that serve as biosignatures. For futures studies of Mars and beyond, they, or some variation of them, should allow inference or proof of life in non-Earth locations.
Author
Extraterrestrial Life; Life Sciences; Mars (Planet); Exobiology; Life Detectors

19990020875 New Mexico Univ., Inst. of Meteoritics, Albuquerque, NM USA
Evidence for a Late-Stage Thermal Overprint in Allan Hills 84001 and Implications for Biomarkers
Shearer, C. K., New Mexico Univ., USA; Brearley, A., New Mexico Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 47-49; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Deciphering the thermal history of ALH 84001 is essential in evaluating the evidence for possible fossil life in that martian meteorite. The focus of this debate has primarily involved the temperature of carbonate formation and has virtually ignored the postdepositional history of the carbonates. Here, we provide evidence for a transient, high-temperature thermal pulse following carbonate deposition and describe possible effects on the carbonates that previously have been attributed to low-temperature processes and biogenic activity.
Author
Carbonates; SNC Meteorites; Olivine; Glass; High Temperature

19990020876 Cornell Univ., Ithaca, NY USA
Overview: The Search for Life on Mars
Squyres, S. W., Cornell Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 49-50; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The search for evidence of life has become the driving force behind NASA’s Mars exploration program. At present, however, the evidence that Mars once harbored life is controversial, and our understanding of how to search for better evidence is rudimentary. A search might be based on the following assumptions: At a minimum, life requires biogenic elements, liquid water, and a biologically useful source of energy. Other requirements are possible as well, but just these simple ones can help to narrow the search significantly. The goals of the search should include both ancient and extant life. Because liquid water is now absent near

Mars' surface, it may be a reasonable strategy to search for evidence of ancient life first and evidence of extant life subsequently. Ancient life forms, if they existed at all, are most likely to have been simple, microbial forms. The same is probably true for extant life. The best approach to searching for evidence of ancient life is probably to look for organic materials. Organics of biological origin may be less open to ambiguous interpretations than putative microfossils, and they have the added virtue of potentially containing important information about prebiotic processes if life never arose.
Author
Extraterrestrial Life; Mars Surface; Microorganisms; Water; Exobiology; Mars (Planet)

19990020877 Westfaelische Wilhelms Univ., Inst. fuer Planetologie, Muenster, Germany
The Lateral Distribution of Polycyclic Aromatic Hydrocarbons in Allan Hills 84001: Implications for Their Origin
Stephan, T., Westfaelische Wilhelms Univ., Germany; Rost, D., Westfaelische Wilhelms Univ., Germany; Heiss, C. H., Westfaelische Wilhelms Univ., Germany; Jessberger, E. K., Westfaelische Wilhelms Univ., Germany; Greshake, A., Museum fuer Naturkunde, Germany; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 50-51; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Polycyclic aromatic hydrocarbons (PAHs) in ALH 84001 were considered to be evidence for relic biogenic activity on Mars. Crucial for their proposed connection to early life forms is a suggested spatial association with carbonates that contain internal structures resembling terrestrial microfossils. Although each observation can be explained individually a lateral correlation would suggest a genetic link between PAHs and the microstructures. Crucial for the investigation of spatial associations is the lateral resolution of the applied analytical methods. In the mentioned studies, microprobe two-step laser mass spectrometry (microL2MS) was used for the analysis of PAHS. With this technique, an unambiguous determination of a spatial association is limited by its lateral resolution, about 50 micrometers, a size that is comparable with the typical dimension of the carbonate globules. Scanning transmission X-ray microscope (STXM) C mapping and X-ray absorption near-edge structure (XANES) spectroscopic measurements on carbonates from ALH 84001 indicated the presence of organic C (pi-bounded C) within or associated with carbonate globules on the scale of approximately 100 nanometers. A definite identification of the nature of this organic C, which seems to be locally present at percent levels, is not possible with these techniques. Only a small fraction, less than 1 percent of wt, of the organic material in this meteorite may actually be represented by PAHS, and there is isotopic evidence favoring a terrestrial origin for the majority of organic matter in ALH84001
Author
Carbonates; Microorganisms; Organic Materials; Polycyclic Aromatic Hydrocarbons; Exobiology; Extraterrestrial Life; SNC Meteorites

19990020881 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
High Strain-Rate Deformation and Friction Melting as a Possible Origin for "Shock" Features in Allan Hills 84001
vanderBogert, C. H., Brown Univ., USA; Schultz, P. H., Brown Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 56-58; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

Many of the debates surrounding martian meteorite ALH84001 address the questions of the temperature and age of carbonate deposition and its ultimate effect on the generation and preservation of evidence for life. to fully answer these questions, we must determine the processes that formed the textures in the meteorite and what implications these have for the environment of carbonate deposition. Discussions of the history and origins of the textures in ALH84001 have been synthesized by among others. All such histories propose the occurrence of shock melting and metamorphism for ALH84001 despite nonunique evidence for shock. Here we present an alternative mechanism for the formation of crush zones in ALH84001, which may also explain the occurrence of feldspar, silica, and carbonate melts.
Author
Carbonates; Feldspars; Friction; Melting; Meteoritic Microstructures; SNC Meteorites; Metamorphism (Geology)

19990020882 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
The Common Ion Effect in Deposition of Martian (e.g., Allan Hills 84001) carbonates
Warren, P. H., California Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 58; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The most plausible model for origin of the carbonates in the ALH84001 meteorite involves deposition from a playa lake or zone of groundwater that underwent evaporative concentration at or near the surface of Mars. A key constraint for such a model

is the virtual absence of sulfate in ALH84001. In a simple closed-system evaporation sequence, abundant sulfate would be expected to form from any plausible martian lake or shallow groundwater. However, several factors would potentially alter the course of the evaporation-deposition sequence enough to engender extremes of sulfate/carbonate fractionation, including the extremely low sulfate/carbonate ratio of ALH84001. Assuming the evaporating water body was transient in nature (i.e., the product of a flood), the water level could easily have been receding during the evaporation-deposition process, and we need only assume that carbonate deposition, but not sulfate deposition, occurred before the water level receded below the level where ALH84001 was perched. Occlusion of pores by incipient sulfate precipitation, in the outer fringes of the rock that ultimately became ALH84001 and/or in overlying solid materials, might also have reduced the yield of sulfate deposition in ALH84001. Another factor that probably played a key role is the common ion effect.
Author
Carbonates; Evaporation; Lakes; Mars (Planet); Mars Surface; Sulfates; Water; Ions; SNC Meteorites

19990020883 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Planetary Core Formation: Evidence From Highly Siderophile Elements in Martian Meteorites
Warren, P. H., California Univ., USA; Kallemeyn, G. W., California Univ., USA; Kyte, F. T., California Univ., USA; Workshop on the Issue Martian Meteorites: Where do we Stand and Where are we Going?; 1998, pp. 58-59; In English; Also announced as 19990020835; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

We present new bulk compositional data for six martian meteorites, including the highly siderophile elements Ni, Re, Os, Ir, and Au. These and literature data are compared with the siderophile systematics of igneous rocks from Earth, the Moon, and the HED asteroid. The composition of ALH 84001 is anomalously siderophile-poor. Whether this reflects a more reducing environment on primordial Mars when this ancient rock first crystallized or secondary alteration is unclear.
Author
Igneous Rocks; Mars (Planet); SNC Meteorites; Nickel; Meteoritic Composition; Mars Surface

19990021033 Santa Clara Univ., Dept. of Physics, CA USA
Photometric Study of Uranian Satellites
Kesten, Philip R., Santa Clara Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The best summary of my work at NASA is expressed in the following abstract, submitted the Division for Planetary Science of the American Astronomical Society and to be presented at the annual meeting in Madison in October. We report photometric measurements of Uranian satellites Miranda, Ariel, Umbriel and Titania (10.4 Aug. 1995), and Neptune's satellite Triton (21.2 Sept. 1995) with the infrared camera (IRCAM) and standard J (1.13 - 1.42 microns), H (1.53 - 1.81 microns), and K (2.00 - 2.41 microns) filters at the 3.8-m UKIRT telescope on Mauna Kea. The individual images frames are 256 x 256 pixels with a platescale of .286 arcsec/pixel, resulting in a 1.22 arc min field of view. This summer brought the IR photometry measurements nearly to a close. As indicated by the abstract above, I will present this work at the annual DPS meeting in October. In anticipation of the opening of the new Carl Sagan Laboratory for Cosmochemisty, of which I will be a participating member, I also devoted a considerable fraction of the summer to learning the biochemistry which underlies the experiments to be conducted. to put the end of the summary close to the beginning, it was a most productive summer.
Author
Photometry; Biochemistry; Field of View; Infrared Photometry; Infrared Radiation; Uranus (Planet)

19990021034 Oregon State Univ., Dept. of Exercise and Sports Physiology, Corvallis, OR USA
The Mars Gravity Simulation Project
Korienek, Gene, Oregon State Univ., USA; 1998 NASA-ASEE-Stanford Summer Faculty Fellowship Program; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Human beings who make abrupt transitions between one gravitational environment and another undergo severe disruptions of their visual perception and visual- motor coordination, frequently accompanied by "space sickness." Clearly, such immediate effects of exposure to a novel gravitational condition have significant implications for human performance. For example, when astronauts first arrive in Earth orbit their attempts to move about in the spacecraft and to perform their duties are uncoordinated, inaccurate, and inefficient. Other inter-gravitational transitions for which these difficulties can be expected include going from the 0 g of the spacecraft to the. 16 g of the Moon, from 0 g to the .38 g of Mars, and from 0 g back to the 1.0 g of Earth. However, after astronauts have actively interacted with their new gravitational environment for several days, these problems tend to disappear, evidence that some sort of adaptive process has taken place. It would be advantageous, therefore, if there were some way to minimize or perhaps even to eliminate this potentially hazardous adaptive transition period by allowing astronauts to adapt to

the altered gravitational conditions before actually entering them. Simultaneous adaptations to both the altered and the normal gravitational environment as a result of repeatedly adapting to one and readapting to the other, a phenomenon known as dual adaptation. The objective of the Mars Gravity Simulator (MGS) Project is to construct a simulation of the visual and bodily effects of altered gravity. This perceptual-motor simulation is created through the use of: 1) differential body pressure to produce simulated hypo-gravity and 2) treadmill-controlled virtual reality to create a corresponding visual effect. It is expected that this combination will produce sensory motor perturbations in the subjects. Both the immediate and adaptive behavioral (postural and ambulatory) responses to these sensory perturbations will be assessed.
Derived from text
Mars (Planet); Mars Environment; Simulation; Gravitational Effects; Virtual Reality; Human Performance; Human Beings

19990021042 San Jose State Univ., Dept. of Geology, CA USA
Use of Concept Mapping to Enhance and Update an Educational CD ROM About Mars
Metzger, Ellen P., San Jose State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Last year, the Center for Mars Exploration (CMEX) at NASA Ames Research Center issued its 'Return to Mars 1997' educational CD ROM. This CD, produced under the guidance of Dr. Geoffrey Briggs, summarized the on-going exploration of Mars and consisted of six sub-topics: (1) Life on Mars?; (2) Mars, The Red Planet; (3) Human Exploration; (4) Robotic Missions; (5) Atlas and Image Processing; and (6) Links for Teachers. Although the CD contained a wealth of information, its format does not allow ready retrieval of information on a specific topic or concept. CMEX is working with Dr. Alberto Canas and colleagues at the University of West Florida to improve the CD's user interface through the use of concept mapping.
Author
Mapping; Read-Only Memory Devices; Mars Exploration; Image Processing

19990021046 California State Univ., Dept. of Meteorology, San Jose, CA USA
Application of the Regional Atmospheric Modeling System to the Martian Atmosphere
Rafkin, Scot C. R., California State Univ., USA; Oct. 1998; 3p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The core dynamics of the Regional Atmospheric Modeling System (RAMS), a widely used and powerful mesoscale Earth model, is adapted to the Martian Atmosphere and applied in the study of aeolian surface features. In particular, research efforts focused on the substitution of Martian planetary and atmospheric properties such as rotation rate, and thermodynamic constants in place of hard-wired Earth properties. Application of the model was restricted to three-dimensional flow impinging upon impact craters, and the search for plausible wind patterns that could produce the so-called light and dark streaks downwind of topographic barriers.
Author
Atmospheric Chemistry; Atmospheric Models; Planetary Cores; Earth Core; Planetary Atmospheres; Meteorological Parameters; Mars Atmosphere

19990021051 Colorado Univ., Dept. of Computer Science, Colorado Springs, CO USA
Composing, Analyzing and Validating Software Models
Sheldon, Frederick T., Colorado Univ., USA; Oct. 1998; 2p; In English; Also announced as 19990021025; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

This research has been conducted at the Computational Sciences Division of the Information Sciences Directorate at Ames Research Center (Automated Software Engineering Grp). The principle work this summer has been to review and refine the agenda that were carried forward from last summer. Formal specifications provide good support for designing a functionally correct system, however they are weak at incorporating non-functional performance requirements (like reliability). Techniques which utilize stochastic Petri nets (SPNs) are good for evaluating the performance and reliability for a system, but they may be too abstract and cumbersome from the stand point of specifying and evaluating functional behavior. Therefore, one major objective of this research is to provide an integrated approach to assist the user in specifying both functionality (qualitative: mutual exclusion and synchronization) and performance requirements (quantitative: reliability and execution deadlines). In this way, the merits of a powerful modeling technique for performability analysis (using SPNs) can be combined with a well-defined formal specification language. In doing so, we can come closer to providing a formal approach to designing a functionally correct system that meets reliability and performance goals.
Derived from text
Software Engineering; Computer Programming; Functional Design Specifications; Proving

19990021063 Texas A&M Univ., Physical and Life Science Dept., Corpus Christi, TX USA

Geologic Mapping of Mars

Price, Katherine H., Texas A&M Univ., USA; Minority University-Space Interdisciplinary Network Conference Proceedings of the Seventh Annual Users' Conference; May 1998, pp. 403-416; In English; Also announced as 19990021057; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Planetary geologic mapping involves integrating a terrestrial-based understanding of surface and subsurface processes and mapping principles to investigate scientific questions. Mars mappers must keep in mind that physical processes, such as wind and flowing water on Mars, are or were different from terrestrial processes because the planetary atmospheres have changed differently over time. Geologic mapping of Mars has traditionally been done by hand using overlays on photomosaics of Viking Orbiter and Mariner images. Photoclinometry and shadow measurements have been used to determine elevations, and the distribution and size of craters have been used to determine the relative ages of surfaces- more densely cratered surfaces are older. Some mappers are now using computer software (ranging from Photoshop to ArcInfo) to facilitate mapping, though their applications must be carefully executed so that registration of the images remains true. Images and some mapping results are now available on the internet, and new data from recent missions to Mars (Pathfinder and Surveyor) will offer clarifying information to mapping efforts. This paper consists chiefly of pictures and diagrams.

Author

Geological Surveys; Mapping; Mars Photographs; Mars Surface; Photogrammetry; Planetary Mapping

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SOLAR PHYSICS

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

19990019163 National Optical Astronomy Observatories, Tucson, AZ USA

Multitaper Spectral Analysis and Wavelet Denoising Applied to Helioseismic Data

Komm, Rudolf, National Solar Observatory, USA; Hill, Frank, National Solar Observatory, USA; Gu, Yeming, National Solar Observatory, USA; Stark, Phil, California Univ., USA; Fodor, Imola, California Univ., USA; Dec. 1997; 8p; In English

Report No.(s): NOAO-Preprint-774; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Our goal is to improve the estimates of mode frequencies, amplitudes, and widths derived from helioseismic observations. to this end, we apply Multitaper Spectral Analysis (MTSA) to the observed time series to derive power spectrum estimates, and then we apply wavelet denoising to the log spectra to further improve the signal-to-noise ratio of the modes. The rationale behind this approach is that MTSA leads to a power spectrum estimate with reduced variance and better leakage properties than the conventional periodogram and that since the log multitaper spectrum is close to Gaussian distributed wavelet denoising is the optimum method to reduce the noise level in the calculated spectra. We applied MTSA and wavelet denoising to GONG and SOHO-SOI/MDI time series and found that a single m-v spectrum benefits greatly from MTSA plus wavelet denoising and that wavelet denoising by itself can be used to improve m-averaged spectra.

Author

Spectrum Analysis; Noise Reduction; Noise Intensity; Wavelet Analysis

19990019556 NASA Marshall Space Flight Center, Huntsville, AL USA

Evidence for Highly Inhomogeneous mm-Wave Sources During the Impulsive Flare of May 9, 1991

Hermann, R., NASA Marshall Space Flight Center, USA; Magun, A., NASA Marshall Space Flight Center, USA; Kaufmann, P., NASA Marshall Space Flight Center, USA; Correia, E., NASA Marshall Space Flight Center, USA; Costa, J. E. R., NASA Marshall Space Flight Center, USA; Machado, M. E., NASA Marshall Space Flight Center, USA; Fishman, G., NASA Marshall Space Flight Center, USA; Astronomy and Astrophysics; Jan. 1997; Volume 317, pp. 232-243; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper multiwavelength observations of an impulsive flare of May 9, 1991 are presented. This event was observed with the 48 GHz multibeam focal array used at the Itapetinga radio telescope, the microwave patrol telescopes at Bem and the BATSE high time resolution hard X-ray spectrometer on board CGRO. While spatially unresolved low sensitivity observations show two major impulsive peaks, the mm-wave observations with the ability of spatially high resolved tracking of the emission centroids suggest a primarily bipolar source configuration. For the first time two mm-wave sources with a spacing below the HPBW could be separated with the multibeam technique. The general features of the observations are explained as emission of partially trapped

electrons. Furthermore we present evidence for highly inhomogeneous substructures within one of the two mm-wave sources for which the positional scatter of the emission center, within 2s, is less than 2”.
Author
Millimeter Waves; Gamma Ray Bursts; Microwave Antennas; High Resolution; Bipolarity

19990019569 NASA Marshall Space Flight Center, Huntsville, AL USA
The Geometric Spreading of Coronal Plumes and Coronal Holes
Suess, S. T., NASA Marshall Space Flight Center, USA; Poletto, G., NASA Marshall Space Flight Center, USA; Wang, A. - H., NASA Marshall Space Flight Center, USA; Wu, S. T., NASA Marshall Space Flight Center, USA; Cuseri, I., NASA Marshall Space Flight Center, USA; Solar Physics; 1997; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The geometric spreading in plumes and in the interplume region in coronal holes is calculated, using analytic and numerical theoretical models, between 1.0 and 5.0 solar radius. We apply two scale approximation that permits the rapid local spreading at the base of plumes to be evaluated separately from the global spreading imposed by coronal hole geometry. We show that fl can be computed from a potential field model and fg can be computed from global magnetohydrodynamic simulations of coronal structure. The approximations are valid when the plasma beta is small with respect to unity and for a plume separation small with respect to a solar radius.
Author
Coronal Holes; Plumes; Spreading; Solar Wind; Potential Fields

19990019628 NASA Marshall Space Flight Center, Huntsville, AL USA
Evidence that the X-Ray Plasma in Microflares is in a Sequence of Subresolution Magnetic Tubes
Moore, Ronald L., NASA Marshall Space Flight Center, USA; Falconer, D. A., NASA Marshall Space Flight Center, USA; Porter, Jason G., NASA Marshall Space Flight Center, USA; 1998; 1p; In English, 26 May 1998, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We analyze the cooling of the X-ray emitting thermal plasma in microflares observed in active regions by the Yohkoh Soft X-ray Telescope. A typical microflare appears to be a transient brightening of an entire small magnetic loop, often having a diameter near the limit of resolution (approximately 2 x 10(exp 8) cm) (Shimizu 1995, PASJ, 47, 251). The X-ray plasma in the loop cools by emission of XUV radiation and by heat conduction to the cooler plasma at the feet of the loop. The cooling rate is determined by the plasma temperature and density and the loop length. The plasma density is determined from the observed X-ray brightness of the loop in combination with the temperature, the loop diameter, and the filling factor. The filling factor is the volume fraction of the loop occupied by the subset of magnetic tubes that is filled by the X-ray plasma and that contains practically all of the X-ray plasma present in the microflare loop. Taking typical values from the hundreds of microflares measured by Shimizu (1995) (X-ray brightness through the thin aluminum filter approximately 4 x 10(exp 3) DN/s/pixel, lifetime approximately 5 min, temperature approximately 6 x 10(exp 6) K, loop length approximately 10(exp 9) cm, loop diameter approximately 3 x 10(exp 8) cm), we find that for filling factors greater than approximately 1% (1) the cooling time is much shorter than the duration of the microflare, and (2) conductive cooling strongly dominates over radiative cooling. Because the cooling time is so short and because the conductive heat flux goes mainly into increasing the plasma density via chromospheric evaporation, we are compelled to conclude that (1) heating to X-ray temperatures continues through nearly the entire life of a microflare, (2) the heating keeps changing to different field lines, so that any one magnetic tube in the sequence of heated tubes emits X-rays only briefly in the life of the microflare, and (3) at any instant during the microflare the tubes filled with X-ray plasma occupy only a small fraction (less than approximately 10%) of the microflare loop. Hence, we expect that coronal X-ray images with spatial resolution 2-3 times better than from Yohkoh will show plenty of rapidly changing filamentary substructure in microflares.
Author
Plasmas (Physics); X Rays; Conductive Heat Transfer; Thermal Plasmas; Extreme Ultraviolet Radiation

19990019890 NASA Marshall Space Flight Center, Huntsville, AL USA
A Comparison of Wolf’s Reconstructed Record of Annual Sunspot Number with Schwabe’s Observed Record of Clusters of Spots for the Interval of 1826-1868, *1826-1868*
Wilson, Robert M., NASA Marshall Space Flight Center, USA; Solar Physics; 1998; Volume 182, pp. 217-230; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Samuel Heinrich Schwabe, the discoverer of the sunspot cycle, observed the Sun routinely from Desau, Germany during the interval of 1826-1869, averaging about 290 observing days per year. His yearly counts of ’clusters of spots’ (or, more correctly, the yearly number of newly appearing sunspot groups) provided a simple means for describing the overt features of the sunspot

cycle (i.e., the timing and relative strengths of cycle minimum and maximum). In 1848, Rudolf Wolf, a Swiss astronomer, having become aware of Schwabe's discovery, introduced his now familiar 'relative sunspot number' and established an international cadre of observers for monitoring the future behavior of the sunspot cycle and for reconstructing its past behavior (backwards in time to 1818, based on daily sunspot number estimates). While Wolf's reconstruction is complete (without gaps) only from 1849 (hence, the beginning of the modern era), the immediately preceding interval of 1818-1848 is incomplete, being based on an average of 260 observing days per year. In this investigation, Wolf's reconstructed record of annual sunspot number is compared against Schwabe's actual observing record of yearly counts of clusters of spots. The comparison suggests that Wolf may have misplaced (by about 1-2 yr) and underestimated (by about 16 units of sunspot number) the maximum amplitude for cycle 7. If true, then, cycle 7's ascent and descent durations should measure about 5 years each instead of 7 and 3 years, respectively, the extremes of the distributions, and its maximum amplitude should measure about 96 instead of 70. This study also indicates that cycle 9's maximum amplitude is more reliably determined than cycle 8's and that both appear to be of comparable size (about 130 units of sunspot number) rather than being significantly different. Therefore, caution is urged against the indiscriminate use of the pre-modern era sunspot numbers in long-term studies of the sunspot cycle, since such use may lead to specious results.
Author
Sunspot Cycle; Sunspots; Sun

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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.

19990019555 NASA Marshall Space Flight Center, Huntsville, AL USA
Are Abell Clusters Correlated with Gamma-Ray Bursts?
Hurley, K., NASA Marshall Space Flight Center, USA; Hartmann, D., NASA Marshall Space Flight Center, USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Fishman, G., NASA Marshall Space Flight Center, USA; Laros, J., NASA Marshall Space Flight Center, USA; Cline, T., NASA Marshall Space Flight Center, USA; Boer, M., NASA Marshall Space Flight Center, USA; Astrophysical Journal Letters; Apr. 1997; Volume 479, pp. L113; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A recent study has presented marginal statistical evidence that gamma-ray burst (GRB) sources are correlated with Abell clusters, based on analyses of bursts in the BATSE 3B catalog. Using precise localization information from the Third Interplanetary Network, we have reanalyzed this possible correlation. We find that most of the Abell clusters that are in the relatively large 3B error circles are not in the much smaller IPN/BATSE error regions. We believe that this argues strongly against an Abell cluster-GRB correlation.
Author
Galactic Clusters; Gamma Ray Bursts; Catalogs (Publications); Errors

19990019578 Universidad Nacional Autonoma de Mexico, Inst. de Astronomia, Mexico City, Mexico
On the High-Energy Emission of the Pulsar PSR B1055-52
Romero, Gustava E., Sao Paulo Univ., Brazil; Revista Mexicana de Astronomia y Astrofisica; Apr. 1998; ISSN 0185-1101; Volume 34, No. 1, pp. 29-35; In English; Sponsored in part by PMT-PICT
Contract(s)/Grant(s): PMT-PICT-0388; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

PSR B1055 52 is one of the very few pulsars detected at all energy bands, from radio to gamma-rays. It is also the pulsar with the highest efficiency for converting rotational energy in gamma-ray emission. In this paper, the main mechanisms that could generate the high-energy emission in this object are discussed and different predictions from the main models are compared with recent data obtained by ROSAT, ASCA, and Compton satellites. The dispersion measure distance to the pulsar is reconsidered in the light of the results.
Author
Energy Bands; Pulsars; Observation

19990019630 NASA Marshall Space Flight Center, Huntsville, AL USA

ROSAT X-Ray Observation of the Second Error Box for SGR 1900+14

Li, P., NASA Marshall Space Flight Center, USA; Hurley, K., NASA Marshall Space Flight Center, USA; Vrba, F., NASA Marshall Space Flight Center, USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Meegan, C. A., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Kulkarni, S., NASA Marshall Space Flight Center, USA; Frail, D., NASA Marshall Space Flight Center, USA; Astrophysical Journal; Dec. 1997; Volume 490, pp. 823; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The positions of the two error boxes for the soft gamma repeater (SGR) 1900+14 were determined by the ”network synthesis” method, which employs observations by the Ulysses gamma-ray burst and CGRO BATSE instruments. The location of the first error box has been observed at optical, infrared, and X-ray wavelengths, resulting in the discovery of a ROSAT X-ray point source and a curious double infrared source. We have recently used the ROSAT HRI to observe the second error box to complete the counterpart search. A total of six X-ray sources were identified within the field of view. None of them falls within the network synthesis error box, and a 3 sigma upper limit to any X-ray counterpart was estimated to be 6.35 x 10(exp -14) ergs/sq cm/s. The closest source is approximately 3 min. away, and has an estimated unabsorbed flux of 1.5 x 10(exp -12) ergs/sq cm/s. Unlike the first error box, there is no supernova remnant near the second error box. The closest one, G43.9+1.6, lies approximately 2.dg6 away. For these reasons, we believe that the first error box is more likely to be the correct one.

Author

ROSAT Mission; X Ray Sources; Gamma Ray Bursts; Infrared Spectra; Supernova Remnants; Infrared Radiation

19990019632 NASA Marshall Space Flight Center, Huntsville, AL USA

Gamma-Ray Burst Arrival Time Localizations: Simultaneous Observations by Mars Observer, Compton Gamma Ray Observatory and Ulysses, *4 Oct. 1992 - 1 Aug. 1994*

Laros, J. G., NASA Marshall Space Flight Center, USA; Boynton, W. V., NASA Marshall Space Flight Center, USA; Hurley, K., NASA Marshall Space Flight Center, USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; McCollough, M. L., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Meegan, C. A., NASA Marshall Space Flight Center, USA; Astrophysical Journal Supplement; May 1997; Volume 110, pp. 157; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Between 1992 October 4 and 1993 August 1, concurrent coverage by the Compton Gamma Ray Observatory (CGRO), Mars Observer (MO), and Ulysses spacecraft was obtained for 78 gamma-ray bursts (GRBs). Although most of these were below the MO and Ulysses thresholds, nine were positively detected by all three spacecraft, with data quality adequate for quantitative localization analysis. All were localized independently to approximately 2 deg accuracy by the CGRO Burst and Transient Source Experiment (BATSE). We computed arrival-time error boxes with larger dimensions ranging from a few arcminutes to the diameters of the BATSE-only boxes and with smaller dimensions in the arcminute range. Three events are of particular interest: GB 930704 (BATSE 2428) has been described as a possible repeater. The arrival-time information is consistent with that hypothesis, but only just so. The GB 930706 (2431) box, at approximately 1 min x 4 min, is the only one this small obtained since Pioneer Venus Orbiter (PVO) entered the Venusian atmosphere in 1992 October. Sensitive radio and optical observations of this location were made within 8 and 9 days of the burst, but no counterpart candidates were identified. GB 930801 (2477) is the first GRB that had its localization improved by taking into account BATSE Earth occultation.

Author

Gamma Ray Bursts; Time Measurement; Mars Observer; Radio Observation; Pioneer Venus 1 Spacecraft; Visual Observation

99
GENERAL

19990019751 Air Force Research Lab., Wright-Patterson AFB, OH USA

JAWS S3 98 Conference Las Vegas, NV 15-18 June 98 Volume 3

Jun. 1998; 496p; In English

Report No.(s): AD-A356185; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

This report contains presentations from the JAWS S3 98 Conference. Topics include: (1) meeting technology needs of the warfighter Y2K and beyond, (2) embedded computer resources, (3) ordnance on target, (4) information technology and Naval

aviation, (5) Army technology thrusts, (6) EW threat simulation, (7) ASW acoustic sensors, (8) software technology, (9) avionics, and (10) electronic combat.
DTIC
Conferences; Software Engineering; Avionics; Electronic Warfare

19990019752 Air Force Research Lab., Wright-Patterson AFB, OH USA
JAWS S3 98 Conference Las Vegas, NV 15-18 June 98 Volume 2
Jun. 1998; 427p; In English
Report No.(s): AD-A356186; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

This report contains presentations from the JAWS S3 98 Conference. Topics include: (1) avionics, (2) EPA issues, (3) atmospheric support for ground systems hit avoidance, (4) target to sensor vision, (5) sensor vision in degraded environments, (6) electronic warfare testing, (7) computerized simulation, (8) cost reduction methods for aircraft weapon acquisition, (9) software engineering, (10) electronic protection radio, and (11) preflight integration of munitions and electronic systems.
DTIC
Conferences; Avionics; Software Engineering; Computerized Simulation; Target Acquisition; Weather

19990019753 Air Force Research Lab., Wright-Patterson AFB, OH USA
JAWS S3 98 Conference Las Vegas, NV 15-18 June 98 Volume 1
Jun. 1998; 391p; In English
Report No.(s): AD-A356187; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

This report contains presentations from the JAWS S3 98 Conference. Topics include: (1) data compression, (2) fault tolerant computing, (3) partitioning protocol for systems integration, (4) relational avionics planning tool, (5) using RMA on an avionics product development life cycle, (6) legacy programs modeling and simulation, (7) information fusion, (8) SAR ATR algorithms, (9) software engineering, (10) electromagnetic radiation modeling, (11) real time embedded systems, (12) computer displays, and (13) distributed simulation testing.
DTIC
Conferences; Data Compression; Embedded Computer Systems; Computer Systems Design; Computer Programming; Fault Tolerance; Systems Integration; Avionics; Computerized Simulation

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