Scientific and Technical Aerospace Reports

STAR

Volume 37
September 27, 1999

National Aeronautics and
Space Administration
Langley Research Center

**Scientific and Technical
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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.

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Subject Divisions

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

Indexes

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

Subject Term Index

Personal Author Index

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Select a category to view the collection of records cited. N.A. means no abstracts in that category.

01 Aeronautics (General) 1

02 Aerodynamics 2

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 5

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 N.A.

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 8

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 N.A.

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 11

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 13

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) 14

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. N.A. means no abstracts in that category.

12 Astronautics (General) N.A.

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

13 Astrodynamics 16

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

14 Ground Support Systems and Facilities (Space) N.A.

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 16

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 17

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 19

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 20

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 23

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

20 Spacecraft Propulsion and Power 23

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

Subject Categories of the Division C. Chemistry and Materials

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

23 Chemistry and Materials (General) 27

24 Composite Materials 28

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

25 Inorganic and Physical Chemistry 34

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

26 Metallic Materials 41

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

27 Nonmetallic Materials 47

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 54

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 54

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

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

31 Engineering (General) 57

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

32 Communications and Radar 60

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 65

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 73

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 91

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 94

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

37 Mechanical Engineering 95

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

38 Quality Assurance and Reliability 100

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics 103

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. N.A. means no abstracts in that category.

42 Geosciences (General) 108

43 Earth Resources and Remote Sensing 109

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 116

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 117

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics 133

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

47 Meteorology and Climatology 143

Includes weather forecasting and modification.

48 Oceanography 153

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. N.A. means no abstracts in that category.

51 Life Sciences (General) 155

52 Aerospace Medicine 157

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

53 Behavioral Sciences 159

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

54 Man/System Technology and Life Support 163

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

55 Space Biology N.A.

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. N.A. means no abstracts in that category.

59 Mathematical and Computer Sciences (General) 165

60 Computer Operations and Hardware 166

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

61 Computer Programming and Software 166

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

62 Computer Systems 170

Includes computer networks and special application computer systems.

63 Cybernetics 172

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 175

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability 178

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

66 Systems Analysis 178

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics 179

Includes topology and number theory.

Subject Categories of the Division H. Physics

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

70 Physics (General) N.A.

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 180

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

72 Atomic and Molecular Physics 182

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics 188

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

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

75 Plasma Physics 195

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

76 Solid-State Physics 199

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

77 Thermodynamics and Statistical Physics 206

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

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

80 Social Sciences (General) 208

Includes educational matters.

81 Administration and Management 208

Includes management planning and research.

82 Documentation and Information Science 212

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 N.A.

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy 215

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

85 Urban Technology and Transportation 215

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

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

88 Space Sciences (General) N.A.

89 Astronomy 216

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

90 Astrophysics 222

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 227

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

92 Solar Physics 229

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

93 Space Radiation 234

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 238

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;
❻ Mar. 1996; 130p; In English
❼ Contract(s)/Grant(s): RTOP 505-68-70-04
❽ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❾ 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.
Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

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VOLUME 37, SEPTEMBER 27, 1999

01
AERONAUTICS (GENERAL)

19990064412 Physics and Electronics Lab. TNO, The Hague, Netherlands
SALOMO 4.0 User Manual ***Final Report***
Keijzers, J. G. M., Physics and Electronics Lab. TNO, Netherlands; vanElst, N. P., Physics and Electronics Lab. TNO, Netherlands; January 1999; 2p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KLu/627; TNO Proj. 26869
Report No.(s): TD98-0215; FEL-98-A319; Copyright; Avail: Issuing Activity, Hardcopy

On behalf of the Materiel Directorate of the Royal Netherlands Airforce (RNLAF) the TNO Physics and Electronics Laboratory has developed the Single Airbase LOgistics MOdel (SALOMO). This model, which runs on a personal computer, simulates the processes that are of logistic importance to keep F-16 jet fighters in service at an airbase during peace time. Main purpose of SALOMO is to give the user a better insight into the effect that the processes 'maintenance' (periodical inspections and repairs),'utilisation'(the actual flying), 'preparation' (inspections before and after a flight) and 'spare parts supply' have on both the readiness of F- 16's and the proficiency of pilots. This document is the user manual of the SALOMO 4.0 program. Besides the description of the interaction between SALOMO and the users, it also explains the used input data in relation to the model and the output data. SALOMO 4.0 contains a range of additional functionalities in comparison to SALOMO 3.0
Author
User Manuals (Computer Programs); Logistics; Computerized Simulation; Abilities

19990070316 Logistics Management Inst., McLean, VA USA
The Aviation System Analysis Capability Noise Impact Model ***Final Report***
Ege, Russell A., Logistics Management Inst., USA; Brown, Jerome, Logistics Management Inst., USA; Bradley, Kevin, Wyle Labs., Inc., USA; Grandi, Fabio, Wyle Labs., Inc., USA; July 1999; 120p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS2-14361; RTOP 538-16-11-01
Report No.(s): NASA/CR-1999-209356; NS807S1; NAS 1.26:209356; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

To meet its objective of assisting the US 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. to accomplish this, NASA is building an Aviation System Analysis Capability (ASAC). The Noise Impact Model (NIM) has been developed as part of the ASAC. Its primary purpose is to enable users to examine the impact that quieter aircraft technologies and/or operation might have on community noise impact and air carrier operating efficiency at any of 16 large and medium size US airports. The analyst chooses an airport and case year for study, selects a runway use configuration and set of flight tracks for the scenario, and has the option of reducing the noise of the aircraft that operate at the airport by 3, 6, and 10 decibels, NIM computes the resultant noise impact and estimates any airline operational improvements. Community noise impact is characterized in three ways: the size of the noise contour footprint, the number of people living within the contours, and the number of homes located in the same contours. Distance and time savings are calculated by comparing the noise abatement flight path length to a less circuitous alternated routing. For a more efficient runway use configuration, the increase in capacity and reduction in delay are shown.
Derived from text
Air Transportation; Systems Analysis; Aircraft Noise; Aircraft Industry

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.

19990064413 NASA Langley Research Center, Hampton, VA USA
X-33 Aerodynamic and Aeroheating Computations for Wind Tunnel and Flight Conditions
Hollis, Brian R., NASA Langley Research Center, USA; Thompson, Richard A., NASA Langley Research Center, USA; Murphy, Kelly J., NASA Langley Research Center, USA; Nowak, Robert J., NASA Langley Research Center, USA; Riley, Christopher J., NASA Langley Research Center, USA; Wood, William A., NASA Langley Research Center, USA; Alter, Stephen J., NASA Langley Research Center, USA; Prabhu, Ramadas K., Lockheed Martin Engineering and Sciences Co., USA; 1999; 18p; In English; Atmospheric Flight Mechanics, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 99-4163; Copyright; Avail: Issuing Activity, Hardcopy

This report provides an overview of hypersonic Computational Fluid Dynamics research conducted at the NASA Langley Research Center to support the Phase 11 development of the X-33 vehicle. The X-33, which is being developed by Lockheed-Martin in partnership with NASA, is an experimental Single-Stage-to-Orbit demonstrator that Is intended to validate critical technologies for a full-scale Reusable Launch Vehicle. As part of the development of the X-33, CFD codes have been used to predict the aerodynamic and aeroheating characteristics of the vehicle. Laminar and turbulent predictions were generated for the X-33 vehicle using two finite- volume, Navier-Stokes solvers. Inviscid solutions were also generated with an Euler code. Computations were performed for Mach numbers of 4.0 to 10.0 at angles-of-attack from 10 deg to 48 deg with body flap deflections of 0, 10 and 20 deg. Comparisons between predictions and wind tunnel aerodynamic and aeroheating data are presented in this paper. Aeroheating and aerodynamic predictions for flight conditions are also presented.
Author
X-33 Reusable Launch Vehicle; Computational Fluid Dynamics; Hypersonics; Research; Wind Tunnel Tests; Flight Conditions

19990064492 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
Numerical Simulations of Unsteady Low-Reynolds-Number Flows Over the APEX Airfoil
Tatineni, Mahidhar, California Univ., USA; Zhong, Xiao–Lin, California Univ., USA; 1998; 12p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC2-374; NASA Order H-2352
Report No.(s): AIAA Paper 98-0412; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Laminar and transitional separation bubbles are an important feature of low-Reynolds-number flows over airfoils. The separation bubbles are unsteady and have a significant impact on the aerodynamic properties of the airfoils. In this paper unsteady low-Reynolds-number separated flows over the APEX airfoil are calculated using a Navier-Stokes solver. The numerical results show the presence of unsteady separation bubbles in the flowfield. An analysis of the numerical results shows that flowfield disturbances are amplified significantly in the separation bubble, leading to periodic vortex shedding. A linear stability analysis of the separated boundary layer is performed and the results show that the dominant wavenumber and frequency in the numerical simulations agree with the most unstable wavenumber and frequency from the linear stability analysis. The numerical results also show the growth and interaction of disturbance waves in the separation bubble. For transonic flows over the APEX airfoil, the calculations show that the presence of shocks causes significant changes in the separation location and consequently, the overall flowfield.
Author
Unsteady Flow; Low Reynolds Number; Airfoils; Computational Fluid Dynamics; Navier-Stokes Equation; Subsonic Flow; Transonic Flow; Separated Flow; Flow Distribution; Two Dimensional Flow; Boundary Layer Separation

19990064493 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
Spurious Numerical Oscillations in Numerical Simulation of Supersonic Flows Using Shock Capturing Schemes
Lee, Theodore K., California Univ., USA; Zhong, Xiao–Lin, California Univ., USA; 1998; 16p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC2-374; NASA Order H-2353; F49620-97-1-0030
Report No.(s): AIAA Paper 98-0115; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The numerical simulation of transitional and turbulent processes in hypersonic boundary layers often involves a physical process of a shock-disturbance wave interaction in complex two-dimensional and three-dimensional flow fields. For such simulations, it is required that there be a high order of accuracy in capturing both the shock and the small disturbances. The purpose of

this paper is to evaluate the viability of using high order shock capturing schemes to track small disturbances in a multi-dimensional steady hypersonic flow. The numerical methods that are to be studied are the Total Variation Diminishing (TVD) scheme, and Essentially Non-Oscillatory (ENO) scheme. This paper shows that the presence of numerical oscillations in the flow field solution may drastically hinder any attempt at tracking the propagation of any physical disturbances. It has been found that the numerical oscillations that exist for shock capturing methods may be significant enough to pollute a flow field containing small physical disturbances. The effects of the refinement of the grid do not reduce the oscillations, but rather they decrease the wavelength of the oscillations. It is shown that by aligning the shock with the grid, the amplitude of these spurious oscillations may be greatly reduced.
Author
Essentially Non-Oscillatory Schemes; Oscillations; Supersonic Flow; TVD Schemes; Shock Wave Interaction; Computational Fluid Dynamics; Euler Equations of Motion; Two Dimensional Flow; Steady Flow; Hypersonic Flow

19990064495 University of South Alabama, Mechanical Engineering Dept., Mobile, AL USA
Shear-Layer Effects on Trailing Vortices
Zheng, Z. C., University of South Alabama, USA; Baek, K., University of South Alabama, USA; 1998; 10p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-1911
Report No.(s): AIAA Paper 98-0316; Copyright; Avail: Issuing Activity, Hardcopy

Crosswind shear can influence the trailing vortex trajectories significantly, according to both field measurement and numerical simulations. Point vortex models are used in this paper to study the fluid dynamic mechanism in the interactions between trailing vortex pair and shear layers. It has been shown that the shear-layer deformation causes the vortex descent history difference in the two vortices of the vortex pair. When a shear layer is below the vortex pair with the same sign as the left vortex, the right vortex descends less than the left vortex. When the same shear layer is above the vortex pair, the right vortex descends more. The descent altitudes of the two vortices are the same when they go through a constant, non-deformed shear layer. Those trends are in agreement with Navier-Stokes simulations.
Author
Shear Layers; Vortices; Trailing Edge Flaps; Wind Direction

19990064563 NASA Langley Research Center, Hampton, VA USA
X-33 Hypersonic Aerodynamic Characteristics
Murphy, Kelly J., NASA Langley Research Center, USA; Nowak, Robert J., NASA Langley Research Center, USA; Thompson, Richard A., NASA Langley Research Center, USA; Hollis, Brian R., NASA Langley Research Center, USA; Prabhu, Ramadas K., Lockheed Martin Engineering and Sciences Co., USA; 1999; 16p; In English; Atmospheric Flight Mechanics, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-4162; Copyright; Avail: Issuing Activity, Hardcopy

Lockheed Martin Skunk Works, under a cooperative agreement with NASA, will build and fly the X-33, a half-scale prototype of a rocket-based, single-stage-to-orbit (SSTO), reusable launch vehicle (RLV). A 0.007-scale model of the X-33 604B0002G configuration was tested in four hypersonic facilities at the NASA Langley Research Center to examine vehicle stability and control characteristics and to populate an aerodynamic flight database in the hypersonic regime, The vehicle was found to be longitudinally controllable with less than half of the total body flap deflection capability across the angle of attack range at both Mach 6 and Mach 10. At these Mach numbers, the vehicle also was shown to be longitudinally stable or neutrally stable for typical (greater than 20 degrees) hypersonic flight attitudes. This configuration was directionally unstable and the use of reaction control jets (RCS) will be necessary to control the vehicle at high angles of attack in the hypersonic flight regime. Mach number and real gas effects on longitudinal aerodynamics were shown to be small relative to X-33 control authority.
Author
X-33 Reusable Launch Vehicle; Hypersonic Vehicles; Hypersonic Flight; Hypersonic Speed; Wind Tunnel Tests; Aerodynamic Stability; Dynamic Stability; Flight Control

19990066626 NASA Ames Research Center, Moffett Field, CA USA
Chemical and Thermal Nonequilibrium Heat-Transfer Analysis for Hypervelocity, Low Reynolds Number Flow
Brown, Kevin G., NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermophysical Aspects of Re-Entry Flows; 1986; Volume 103, pp. 445-475; In English; 20th; Thermophysics, 19-21 Jun. 1985, Williamsburg, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 85-1033; ISBN 0-930403-10-X; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Chemical and thermal nonequilibrium phenomena are studied in the stagnation region of a hypervelocity blunt body. This investigation is motivated by the need to predict the heat-transfer rate to the leading edge of aeromaneuvering orbital transfer vehicles. Flight speeds of approximately 10 km/s at altitudes of approximately 80 km are considered for body radii of 1-50 cm. The analysis is based on continuum theory and is applicable to the viscous and incipient merged layer regimes of rarefied flow. A two-species, two-temperature gas model is assumed. Comparisons are made with previous theories, experimental data, and results based on the thermodynamic equilibrium assumption. The equation accounting for vibrational nonequilibrium is presented and its effects on flow properties are discussed. Parameters requiring further investigation are identified. Preliminary results indicate that the inclusion of vibrational relaxation has little effect on the heat-transfer rate for a fully catalytic surface. However, vibrational nonequilibrium may increase the heat-transfer rate to a noncatalytic surface, depending on the degree of nonequilibrium.
Author
Thermal Analysis; Heat Transfer; Nonequilibrium Conditions; Hypervelocity Flow; Research; Blunt Bodies; Thermodynamic Equilibrium

19990066688 Aerotech Engineering and Research, Lawrence, KS USA
Prediction of Antisymmetric Buffet Loads on Horizontal Stabilizers in Massively Separated Flows ***Final Report***
Farokhi, Saeed, Aerotech Engineering and Research, USA; Mirsafian, Saeid, Aerotech Engineering and Research, USA; Sherwood, Tom, Aerotech Engineering and Research, USA; Ewing, Mark, Aerotech Engineering and Research, USA; May 1999; 146p; In English
Contract(s)/Grant(s): DTRS57-95-C-00091
Report No.(s): AD-A365010; DOT/FAA/AR-99/27; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy
The Federal Aviation Administration (FAA) has a continuing program to collect data and develop predictive methods for aircraft flight loads. Some of the most severe and potentially catastrophic flight loads are produced by separated flows. Structural response to the aerodynamic excitation produced by separated flows is defined as buffeting. A low-cost technique for the prediction of full-scale buffet loads on horizontal stabilizers of aircraft is described. A 1/13-scale rigid generic wind tunnel model with a t-tail configuration (based on the Beech Super King Air 200) was constructed and tested at the Wichita State University 7x10 ft. subsonic wind tunnel. The test matrix included a dynamic pressure range of 25 to 45 psf; an angle-of-attack range of -5 to 20 degrees, and a sideslip range of 0 to 20 degrees. The stabilizer was instrumented with differential pressure transducers and strain gages. The measured pressure power spectra and cross-spectral densities were scaled and used to excite a full-scale aeroelastic finite element model which included the tail structure and aft tail cone. The computed horizontal stabilizer rolling moment power spectra are used to determine the number of exceedences (within a known probability) of a specified rolling moment level per a given maneuver (e.g., stall). Representative pressure, strain gage, and rolling moment power spectra are discussed as is a selected exceedence estimate.
DTIC
Separated Flow; Wind Tunnel Tests; Boundary Layer Separation; Finite Element Method; Stabilizers (Fluid Dynamics); Scale Models; Aerodynamic Loads; Aeroelasticity; Buffeting

19990067211 NASA Ames Research Center, Moffett Field, CA USA
Problems of Rate Chemistry in the Flight Regimes of Aeroassisted Orbital Transfer Vehicles
Park, Chul, NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 511-537; In English; 19th; Thermophysics, 25-28 Jun. 1984, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 84-1730; Copyright; Avail: Issuing Activity, Hardcopy
The dissociating and ionizing nonequilibrium flows behind a normal shock wave are calculated for the density and vehicle regimes appropriate for aeroassisted orbital transfer vehicles; the departure of vibrational and electron temperatures from the gas temperature as well as viscous transport phenomena are accounted for. From the thermodynamic properties so determined, radiative power emission is calculated using an existing code. The resulting radiation characteristics are compared with the available experimental data. Chemical parameters are varied to Investigate their effect on the radiation characteristics. It is concluded that the current knowledge of rate chemistry leads to a factor-of-4 uncertainty In nonequilibrium radiation intensities. The chemical parameters that must be studied to Improve the accuracy are identified.
Author
Orbit Transfer Vehicles; Aeroassist; Vibration; Normal Shock Waves

19990069620 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Defense Acquisitions: Progress of the F/A-18E/F Engineering and Manufacturing Development Program
Jun. 15, 1999; 28p; In English
Report No.(s): AD-A364757; GAO/NSIAD-99-127; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The F/A-18E/F program began, in 1992 to increase the operational capabilities of the current fleet of F/A-18 aircraft. The objectives of the program are to provide improved capabilities over current F/A-18s in the following key areas-range: payload, carrier recovery payload, growth capacity, and survivability. Congress capped the development effort at $4.88 billion (in fiscal year 1990 dollars) and directed that the ElF unit procurement cost not exceed 125 percent of current CID model costs. The F/A-18E/F development flight test program began in February 1996. The Integrated Test Team, using five single-seat E models and two 2-seat F models, is conducting the tests. Two early operational assessments of the ElF aircraft, using wind tunnel data and analytical models, were made in early 1996 and 1997. Two operational assessments of the E/F aircraft, based on data obtained during test flights using the engineering and manufacturing development aircraft, were conducted in November 1997 (OT-IIA) and in June through August 1998 (OT-IIB). The Navy's Operational Test and Evaluation Force (OPTEVFOR) conducted these assessments.
DTIC
Flight Tests; F-18 Aircraft; Design to Cost; Aircraft Design

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.

19990064541 Federal Aviation Administration, Aviation Security Human Factors, Atlantic City, NJ USA
Screener Readiness Tes - Validation Pilot Testing
Neiderman, E. C.; Fobes, J. L.; Apr. 1999; 20p; In English
Report No.(s): PB99-146425; DOT/FAA/AR-99/37; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Screener Readiness Test is a computer-based assessment instrument being developed to test new checkpoint screener candidates after they have been given their initial training. The instrument's computer interface was evaluated as part of the validation process and found to be relatively easy to use. Several revisions needed for the interface are described before the full-scale validation is undertaken.
NTIS
Human Performance; Computer Techniques

19990064562 NASA Ames Research Center, Moffett Field, CA USA
Reconstruction of the 1994 Pittsburgh Airplane Accident Using a Computer Simulation
Parks, Edwin K., Arizona Univ., USA; Bach, Ralph E., Jr., NASA Ames Research Center, USA; Shin, Jae Ho, Arizona Univ., USA; 1998; 8p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC2-329
Report No.(s): AIAA Paper 98-0503; Copyright; Avail: Issuing Activity, Hardcopy

On September 8, 1994, a Boeing 737-300 passenger airplane was on a downwind approach to the Pittsburgh International Airport at an altitude of 5000 feet above ground level (6000 feet MSL). While in a shallow left turn onto a downwind approach heading, the airplane crossed into the vortex trail of a Boeing 727 flying in the same approach pattern about 4 miles ahead. The B-737 airplane rolled and turned sharply to the left, exited the vortex wake and plunged into the ground. Weather was not a factor in the accident. The airplane was equipped with a 11+ channel digital Flight Data Recorder (FDR) and a multiple channel Cockpit Voice Recorder (CVR). Both recorders were recovered from the crash site and provided excellent data for the development of an accident scenario. Radar tracking of the two airplanes as well as the indicated air speed (IAS) perturbations clearly visible on the B-737 FDR recordings indicate that the upset was apparently initiated by the airplane's crossing into the wake of the B-727 flying ahead in the same traffic pattern. A 6 degree-of-freedom simulation program for the B-737 airplane using MATLAB and SIMULINK was constructed. The simulation was initialized at the stabilized flight conditions of the airplane about 13 seconds prior

to its entry into the vortex trail of the B-727 airplane. by assuming a certain combination of control inputs, it was possible to produce a simulated motion that closely matched that recorded on the FDR.
Author
Aircraft Accidents; Airspeed; Crashes; Crossings; Flight Recorders

19990067248 Science Applications International Corp., Arlington, VA USA
VFR Heliport Operations in an Obstacle-Rich Environment (ORE) ***Final Report***
Sawyer, Brian M., Science Applications International Corp., USA; Boiz, Eric H., Science Applications International Corp., USA; Daum, James M., Boeing Defense and Space Group, USA; Grenell, James F., Boeing Defense and Space Group, USA; Wilkinson, Paul R., Boeing Defense and Space Group, USA; Zmroczek, Leon A., Boeing Defense and Space Group, USA; May 1999; 272p; In English
Contract(s)/Grant(s): DTFA01-93-C-00030
Report No.(s): AD-A364938; ATSO-97R-2; DOT/FAA/ND-98/3; No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy

This investigation studied helicopter pilot performance and perception in a visual flight rule (VFR) heliport terminal obstacle-rich environment (ORE). Simulations were conducted in September and October 1996 as part of a larger effort focused on examining operational safety at U.S. heliports. Concerns raised by pilots operating at a city-center heliport motivated the study. Although none of the obstacles at this heliport protruded into the minimum recommended approach/departure airspace, pilots and their management complained of safety concerns when operating there. The ORE program was sponsored by the General Aviation and Vertical flight Program Office (AND-710) of the Federal Aviation Administration (FAA). As the primary support contractor to AND-7lO, Science Applications International Corporation's (SAIC) Air Transportation Systems Operation (ATSO) assembled a research team. Boeing Defense & Space Group, Helicopters Division, as simulation support subcontractor, lead the team conducting the simulation experiment.
DTIC
Pilots (Personnel); Visual Flight Rules; Vertical Flight; Helicopters

19990069723 Royal Aeronautical Society, London, UK
Future Development in Ice Protection: Proceedings
Operation in Snow and Icing Conditions-Reducing the Risk; 1998; In English; Future Development in Ice Protection, 21 May 1998, London, UK; See also 19990069724 through 19990069728; ISBN 1-85768-049-9; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

Contents include the following: operation in snow and icing conditions -reducing the risk; certification - the UK perspective; meteorological aspects of aircraft icing; ice protection system flight testing and compliance with the certification requirements; and icing operational issues for turboprop aircraft and helicopters.
CASI
Certification; Deicing; Ice Formation; Ice Prevention; Turboprop Aircraft; Procedures

19990069724 Defence Evaluation Research Agency, Rotary Wing Aircraft Dept., Boscombe Down, UK
Operation in Snow and Icing Conditions: Reducing the Risk
Curtis, Ray, Defence Evaluation Research Agency, UK; Future Development in Ice Protection: Proceedings; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

DERA Boscombe's experience in the field of clearing military rotorcraft for operation in snow and icing now spans almost 40 years, with virtually all UK Military helicopter types having undergone at least one winter season testing in these conditions at sites in North America or Europe, This paper will provide a little historical information based on my own recollections and involvement in these DERA trials and some undertaken by others. I shall include a very brief description of the difficulties we have found operating helicopters in snow and icing and will then give an insight into some of the more interesting findings, test techniques and instrumentation used. Such techniques and instrumentation were developed and employed by DERA to improve our understanding of the conditions and the affects on the aircraft in order to reduce the risk associated with any icing or snow flying clearance granted. The paper will then pose a few questions that stem from fixed and rotary wing aircraft incidents and accidents that have occurred in recent years. At its end, it will provide my personal "wish list" that perhaps if satisfied would enhance rotorcraft safety in snow and icing conditions; some of which may also have relevance to fixed wing aircraft.
Author
Clearances; Snow; Ice Formation; Safety; Risk; Histories

19990069725 Civil Aviation Authority, Gatwick, UK

Certification: The UK Perspective

Barrow, Cliff, Civil Aviation Authority, UK; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

This paper presents a brief review of the UK CAA's research and action over recent years in response to experience of accidents and incidents in the nineteen eighties. Three general areas are identified, namely icing atmosphere, ice detection, and pneumatic boot de-icing systems. The recent initiatives instigated under the FAA Icing Plan and the ARAC Harmonisation process have highlighted some of these areas which are now subject to comprehensive review with respect to developing revised and/or new airworthiness requirements. The UK CAA strongly supports this activity which has the potential for significant improvements in certification and operational standards. However, the tasks identified for this work will require fundamental examination of the implications of moving from the existing objective requirements to those of a more prescriptive nature, including their effect on certification of different aircraft types and the means of demonstrating compliance.

Author

Research; Deicers; Detection; Accident Prevention

19990069726 Meteorological Office, Bracknell, UK

Meteorological Aspects of Aircraft Icing

Brown, Roderick, Meteorological Office, UK; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

Renewed interest in aircraft icing has arisen because of the recent realization of the significant hazard posed by supercooled large drops (diameter greater than 100 microns). The processes governing the occurrence of supercooled water are reviewed. The two mechanisms for producing supercooled large drops (SLD) are described These are the melting of ice crystals followed by the resultant drop falling into a sub-zero layer and the coalescence of cloud drops to produce supercooled drizzle drops. The latter mechanism is now thought to be more widespread than the former. The EC funded EURICE project is described. This has involved the establishment of two data bases, one containing accident/incident reports and the other microphysical data. The existing microphysical data have been found to be mainly compatible with JAA/FAA Appendix C. Analysis of selected accidents/incidents over Europe suggests SLD involvement in many. New flights have also been undertaken on most of which some SLD were sampled. These were mainly associated with convection embedded in layer cloud or with gravity waves in layer cloud. Finally, recent work on forecasting is summarized.

Author

Aircraft Icing; Meteorological Parameters; Drop Size; Hazards; Crystals; Convection Clouds; Accidents

19990069727 British Aerospace Airbus Ltd., Woodford, UK

Ice Protection System Flight Testing and Compliance With the Certification Requirements

Future Development in Ice Protection: Proceedings; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

Despite improvements in design and test techniques, icing related accidents, incidents and operating problems continue to occur regularly in service. Current methods of analysis to predict ice accretions and their effect on aircraft handling and performance have limitations, even within the existing design envelope. There are also significant limitations with all methods of simulating in-flight icing. Whilst natural icing tests are the only method of realistically assessing the operation of an aircraft in icing conditions, due to its nature, icing is often extremely difficult to find and quantify. The opportunities to fly the aircraft in the extreme conditions which may cause accidents therefore rarely occur during flight testing. Changes in certification requirements now necessitate the manufacturer to carry out a much more in-depth assessment of the aircraft handling in icing conditions. However, it should be appreciated that it is still not possible to guarantee that testing has been carried out in the most extreme conditions which may be encountered in service. Consideration is currently being given to extending the envelope of design icing conditions. However, without major improvements in analytical techniques and methods of simulation there will be limited benefits

Author

Aircraft Icing; Design Analysis; Protective Coatings; Flight Tests; Certification

19990069728 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering and Transport Studies, UK

Icing Operational Issues for Turboprop Aircraft and Helicopters

Simpson, Mark P., Loughborough Univ. of Technology, UK; Render, Peter M., Loughborough Univ. of Technology, UK; Future Development in Ice Protection: Proceedings; 1998, pp. 7.1 - 7.11; In English; See also 19990069723; Copyright; Avail: Issuing

Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

The hazards associated with operating turboprop aircraft and helicopters in icing conditions are well known and documented. However, icing related incidents and accidents still occur. This paper presents information gathered from turboprop and helicopter manufacturers and operators in Europe and Canada on the certification and operation of turboprop aircraft and helicopters in icing conditions. The following recommendations are made; (1) Develop a low-cost icing training package applicable to both turboprop aircraft and helicopters. (2) Carry out an investigation as to whether ice bridging occurs with modern pneumatic boot designs. (3) That ice protection methods should be improved and that development costs be shared by a consortium of manufacturers, authorities and research organisations. (4) That an ice prediction probe be developed, which warns the aircrew that they will soon be entering icing conditions. (5) to make weather forecasts more accurate, reliable and descriptive as to how the aircraft will be affected by icing and to consider the installation of telemetry equipment on aircraft to provide information for ”now casts”. (6) That improvements be made to pilot training by increasing the fidelity of the icing model on turboprop and helicopter simulators.
Author

Ice Prevention; Certification; Weather Forecasting; Turboprop Aircraft; Ice Formation; Helicopters; Hazards; Deicing

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.

19990064384 North Carolina Agricultural and Technical State Univ., Dept. of Mechanical Engineering, Greensboro, NC USA
Structural Integrity of Discontinuous Stiffened Integrally Braided and Woven Composite Panels ***Final Report***
Shivakumar, K. N.; Sundaresan, M. J.; Avva, V. S.; Mar. 1999; 66p; In English
Contract(s)/Grant(s): FAA 95-G-013
Report No.(s): PB99-150088; DOT/FAA/AR-99/24; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The strength and failure modes of discontinuous blade stiffened panels made of textile perform composites (three-dimensional (3D) braided (0 deg +/-17 deg) and 3D orthogonal woven (0 deg/90deg/90deg)) were evaluated through 3D finite element analysis and test. Tests were conducted under quasi-static tensile and tension-tension fatigue conditions. The peel and shear stresses at the notch root were as high as 40% and 80% of the axial stress, and they caused failure initiation. Final static fracture in both braided woven composite panels were by net section tensile failure.
NTIS

Braided Composites; Composite Structures; Woven Composites; Aircraft Construction Materials; Panels; Stiffening

19990064483 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Kendali Roket dan Satelit, Jakarta, Indonesia
Effects of Maneuver Input Form and Noise Measurements on Dynamic Parameter Estimates from Flight Test Data ***Pengaruh Bentuk Input Manuver Dan Noise Pengukuran Terhadap Estimasi Parameter Dinamik Dari Data Uji Terbang***
Sofyan, Edi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April 1998; ISSN 0126-9754, No. 55, pp. 28-35; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper examines the effect of various input maneuvers to the results of the parameter identification process in extracting ASCD (Aerodynamic Stability and Control Derivatives) of DARSAT-1 (The RPV developed at The Division of Aerospace Technology Development, LAPAN) from flight data. In addition, the effect of the measured noise contained in the flight data was also studied. Linear regression and Maximum Likelihood algorithms were used in extracting the ASCD. The result of the analysis concluded that the type of input maneuver necessary to conduct dynamic flight test was not very strict Basically, any type of pulse or doublet input could be used to excite the motion under investigation, e.g. SPO or Dutch mode. Also, from the study of the presence of measurement noise in the flight data using the sensor characteristics which were obtained from calibrations, indicated that the quality of the sensor’s noise was acceptable to be used in measuring flight test data. The level of noise was not so significant to degrade the result of the parameter identification.
Author

Noise Measurement; Dynamic Tests; Flight Tests; Data Acquisition; Remotely Piloted Vehicles

19990064496 Mississippi State Univ., Dept. of Aerospace Engineering, Mississippi State, MS USA
Global-Local Analysis and Optimization of a Composite Civil Tilt-Rotor Wing
Rais–Rohani, Masound, Mississippi State Univ., USA; [1999]; 21p; In English
Contract(s)/Grant(s): NAG1-1571; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report gives highlights of an investigation on the design and optimization of a thin composite wing box structure for a civil tilt-rotor aircraft. Two different concepts are considered for the cantilever wing: (a) a thin monolithic skin design, and (b) a thick sandwich skin design. Each concept is examined with three different skin ply patterns based on various combinations of 0, +/-45, and 90 degree plies. The global-local technique is used in the analysis and optimization of the six design models. The global analysis is based on a finite element model of the wing-pylon configuration while the local analysis uses a uniformly supported plate representing a wing panel. Design allowables include those on vibration frequencies, panel buckling, and material strength. The design optimization problem is formulated as one of minimizing the structural weight subject to strength, stiffness, and d,vnamic constraints. Six different loading conditions based on three different flight modes are considered in the design optimization. The results of this investigation reveal that of all the loading conditions the one corresponding to the rolling pull-out in the airplane mode is the most stringent. Also the frequency constraints are found to drive the skin thickness limits, rendering the buckling constraints inactive. The optimum skin ply pattern for the monolithic skin concept is found to be (((0/+/-45/90/(0/90)(sub 2))(sub s))(sub s), while for the sandwich skin concept the optimal ply pattern is found to be ((0/+/-45/90)(sub 2s))(sub s).
Author
Design Analysis; Wing Panels; Aerodynamic Configurations; Mathematical Models; Mechanical Properties; Models; Optimization

19990064560 NASA Langley Research Center, Hampton, VA USA
Force and Moment Approach for Achievable Dynamics Using Nonlinear Dynamic Inversion
Ostroff, Aaron J., NASA Langley Research Center, USA; Bacon, Barton J., NASA Langley Research Center, USA; 1999; 14p; In English; Guidance, Navigation, and Control, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-4001; Copyright; Avail: Issuing Activity, Hardcopy

This paper describes a general form of nonlinear dynamic inversion control for use in a generic nonlinear simulation to evaluate candidate augmented aircraft dynamics. The implementation is specifically tailored to the task of quickly assessing an aircraft's control power requirements and defining the achievable dynamic set. The achievable set is evaluated while undergoing complex mission maneuvers, and perfect tracking will be accomplished when the desired dynamics are achievable. Variables are extracted directly from the simulation model each iteration, so robustness is not an issue. Included in this paper is a description of the implementation of the forces and moments from simulation variables, the calculation of control effectiveness coefficients, methods for implementing different types of aerodynamic and thrust vectoring controls, adjustments for control effector failures, and the allocation approach used. A few examples illustrate the perfect tracking results obtained.
Author
Dynamic Control; Aerodynamic Characteristics; Flight Characteristics; Inversions; Nonlinearity

19990064577 NASA Langley Research Center, Hampton,VA USA
Sensitivity Analysis for Coupled Aero-structural Systems
Giunta, Anthony A., NASA Langley Research Center, USA; August 1999; 23p; In English; Original contains color illustration
Contract(s)/Grant(s): RTOP 509-10-11-04
Report No.(s): NASA/TM-1999-209367; L-17890; NAS 1.15:209367; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A novel method has been developed for calculating gradients of aerodynamic force and moment coefficients for an aeroelastic aircraft model. This method uses the Global Sensitivity Equations (GSE) to account for the aero-structural coupling, and a reduced-order modal analysis approach to condense the coupling bandwidth between the aerodynamic and structural models. Parallel computing is applied to reduce the computational expense of the numerous high fidelity aerodynamic analyses needed for the coupled aero-structural system. Good agreement is obtained between aerodynamic force and moment gradients computed with the GSE/modal analysis approach and the same quantities computed using brute-force, computationally expensive, finite difference approximations. A comparison between the computational expense of the GSE/modal analysis method and a pure finite difference approach is presented. These results show that the GSE/modal analysis approach is the more computationally efficient technique if sensitivity analysis is to be performed for two or more aircraft design parameters.
Author
Design Analysis; Aerodynamic Forces; Aerodynamic Coefficients; Aircraft Design; Sensitivity; Structural Analysis

19990064639 Naval Postgraduate School, Monterey, CA USA

Enhancing Readiness of the Unmanned Aerial Vehicle (UAV) System via Use of Simulation Modeling and Contract Incentives

Kasal, Omer Emre; Jun. 1999; 138p; In English

Report No.(s): AD-A365340; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The two most important reasons for the inefficiency in the Unmanned Aerial Vehicle (UAV) test system of the Turkish Army Command are the failure to address life cycle cost (LCC) considerations during financial resource allocations and the absence of contract reliability incentives. These problems are not uncommon to newly developed major weapon systems. The objective of this thesis is to develop a life cycle cost based decision support tool and a performance incentive fee contracting model to improve the operational availability of the UAV system. This thesis integrates the spare parts, and repair and replacement cost considerations into life cycle cost calculation of the UAV system and establishes a methodology to determine these costs by exploring the relationship among spare level, service and failure rate in terms of readiness. An increase in the stock level does not improve the UAV system's efficiency in the long run. This thesis also provides a tool for the computation of a performance incentive fee by using modeling and simulation. This study presents a computer aided decision Support tool for more efficient and effective allocation of scarce resources.

DTIC

Pilotless Aircraft; Decision Support Systems; Life Cycle Costs; Computerized Simulation; Computer Techniques

19990066715 NASA Ames Research Center, Moffett Field, CA USA

A Coupled Aero-Structural Optimization Method for Complete Aircraft Configurations

Reuther, J., MCAT Inst., USA; Alonso, J. J., Stanford Univ., USA; Martins, J. R. R. A., Stanford Univ., USA; Smith, Stephen C., NASA Ames Research Center, USA; 1999; 64p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA

Contract(s)/Grant(s): NCC2-5226

Report No.(s): AIAA Paper 99-0187; Copyright; Avail: Issuing Activity, Hardcopy

This paper presents a new framework for the coupled optimization of aero-structural systems. The framework permits the use of high-fidelity modeling of both the aerodynamics and the structures and represents our first step in an effort towards the development of a high-fidelity multidisciplinary optimization capability. The approach is based on efficient analysis methodologies for the solution of the aerodynamics and structures subproblems, an adjoint solver to obtain aerodynamic sensitivities, and a multiprocessor parallel implementation. We have placed a geometry database representing the outer mold line (OML) of the configuration of interest at the core of our framework. Using this geometry description, the information exchange between aerodynamics and structures is accomplished through an independent coupling of each discipline with the OML database. The framework permits the later inclusion of other disciplines, such as heat transfer and radar signatures, with relative ease. Specific results from the coupling of a finite volume flow solver for the Euler and Reynolds Averaged Navier-Stokes equation with two different linear finite element structural models are explored. Care is taken in the treatment of the coupling of the disciplines such that a consistent and conservative scheme is achieved. Direct comparisons with wind-tunnel data are presented to demonstrate the importance of aeroelastic solutions. IN addition, simplified design examples are presented to illustrate the possible advantages of the new aero-structural design methodology in evaluating trade-offs between aerodynamic performance and structural weight for complete aircraft configurations.

Author

Couples; Aerodynamic Characteristics; Aircraft Configurations; Technology Assessment; Optimization; Structural Design

19990067843 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Analytical Calculations of Helicopter Torque Coefficient (CQ) and Thrust Coefficient (CT) Values for the Helicopter Performance (HELPE) Model *Final Report*

Kim, Ki C.; Jun. 1999; 29p; In English

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A365512; ARL-TR-1986; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A computer program for calculating helicopter torque coefficients (CQ) and thrust coefficients (CT) as a function of a vehicle's forward speed has been developed in conjunction with the helicopter performance assessment project. The model is based on the energy principle, in which helicopter power is broken into three components: induced power, profile power, and parasite power. This report documents the basic mathematical model used in the code, along with the numerical solution scheme used in implementing the model. Results are calculated for the UH-60A Black Hawk helicopter for hover and different forward speed settings and correlated with existing flight test data. The effects of different disk loading on helicopter power requirements are

also investigated. The present model agrees reasonably well with the flight test data, providing the author with a certain confidence in the helicopter aerodynamic model developed in the present study.
DTIC
Helicopter Performance; Performance Prediction; UH-60A Helicopter; Thrust; Torque; Flight Tests

19990069226 NASA Marshall Space Flight Center, Huntsville, AL USA
X-33 Program Overview
Naftel, J. Chris, NASA Marshall Space Flight Center, USA; May 17, 1999; In English; International Space University, 9-14 Aug. 1999, Nakhon Ratchasims, Thailand
Contract(s)/Grant(s): NCC8-115; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An X-33 program overview is presented in viewgraph form. The objective of the research was to build and test a 50% scale prototype of an operational Reusable Launch Vehicle in a realistic flight environment. Technologies to be demonstrated include reusable cryogenic tankage, composite structures, durable thermal protection systems, advanced avionics, reliable propulsion systems, and aircraft-like operations.
Derived from text
Prototypes; X-33 Reusable Launch Vehicle; Spacecraft Design; NASA Space Programs

19990069624 Rockwell International Corp., North American Aircraft, Seal Beach, CA USA
New Approaches to HSCT Multidisciplinary Design and Optimization ***Interim Report, Jan. 1996 - Jan. 1997***
Schrage, D. P., Rockwell International Corp., USA; Craig, J. I., Rockwell International Corp., USA; Fulton, R. E., Lockheed Aeronautical Systems Co., USA; Mistree, F., Lockheed Aeronautical Systems Co., USA; January 1997; 21p; In English
Contract(s)/Grant(s): NGT1-51102; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The successful development of a capable and economically viable high speed civil transport (HSCT) is perhaps one of the most challenging tasks in aeronautics for the next two decades. At its heart it is fundamentally the design of a complex engineered system that has significant societal, environmental and political impacts. As such it presents a formidable challenge to all areas of aeronautics, and it is therefore a particularly appropriate subject for research in multidisciplinary design and optimization (MDO). In fact, it is starkly clear that without the availability of powerful and versatile multidisciplinary design, analysis and optimization methods, the design, construction and operation of im HSCT simply cannot be achieved. The present research project is focused on the development and evaluation of MDO methods that, while broader and more general in scope, are particularly appropriate to the HSCT design problem. The research aims to not only develop the basic methods but also to apply them to relevant examples from the NASA HSCT R&D effort. The research involves a three year effort aimed first at the HSCT MDO problem description, next the development of the problem, and finally a solution to a significant portion of the problem.
Author
Supersonic Transports; Design Analysis; Optimization

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.

19990064401 Alabama Univ., Huntsville, AL USA
Experimental Analysis of a Rocket Based Combined Cycle (RBCC) Engine in a Direct-Connect Test Facility
Nelson, K., Alabama Univ., USA; Hawk, Clark W., Alabama Univ., USA; 19970929; In English; 34th; Airbreathing Propulsion Subcommittee meetings, 21-31 Oct. 1997, West Palm Beach, FL, USA; Sponsored by Department of the Army; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The object of this study is to investigate the operation of a RBCC at ramjet and scramjet flight conditions using a direct-connect test facility. The apparatus being tested is a single strut-rocket within a dual-mode ram/scramjet combustor. The gaseous hydrogen/oxygen, linear strut-rocket was supplied by Aerojet Propulsion Company. The hardware is being tested in the Direct Connect Supersonic Combustion Test Facility at NASA Langley Research Center. The test facilities hydrogen/oxygen vitiated heater is capable of flight total enthalpies to Mach 8. A Mach 2.5 facility nozzle mates the heater to the combustor duct. The rocket ejector will ordinarily operate in a fuel-rich mode. Additional fuel injection is provided by a pair of parallel injectors located at the base of the strut body. Instrumentation on the test apparatus includes a unique, direct thrust measurement system. Performance

predictions for the anticipated test conditions have been made using a one-dimensional, thermodynamic analysis code. Results from the code show the dependence of overall thrust and specific impulse on rocket chamber pressure, rocket fuel equivalence ratio, and overall fuel equivalence ratio. Once the experimental test series begins, the inferred combustion efficiency as a function of axial location and the thermal choke region (where applicable) can also be determined using this code. Upon completion of the experimental test series, measurements will be used to calculate thrust, specific impulse, etc. Measured and calculated values will be compared to those found analytically. If appropriate, the code will be tailored to better predict hardware operation. Conclusions will be drawn as to the fuel-rich rocket's overall effect on ramjet and scramjet performance. Also, comparisons will be made between the integrated thrust calculated from the static pressure taps located along the duct and the thrust measured by the direct thrust measurement system.
Author
Experimentation; Rocket Thrust; Flight Characteristics; Combustion Efficiency; Cycles; Performance Prediction; Supersonic Combustion Ramjet Engines

19990064479 NASA Dryden Flight Research Center, Edwards, CA USA
Future Flight Test Plans of an Axisymmetric Hydrogen-Fueled Scramjet Engine on the Hypersonic Flying Laboratory
Roudakov, Alexander S., Central Inst. of Aviation Motors, Russia; Semenov, Vyacheslav L., Central Inst. of Aviation Motors, Russia; Kopchenov, Valeriy I., Central Inst. of Aviation Motors, Russia; Hicks, John W., NASA Dryden Flight Research Center, USA; 1996; 10p; In English; 7th; Spaceplanes and Hypersonics Systems and Technology, 18-22 Nov. 1996, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 96-4572; Copyright; Avail: Issuing Activity, Hardcopy

Under a contract with NASA, a joint Central Institute of Aviation Motors (CIAM) and NASA team is preparing to conduct the fourth flight test of a dual-mode scramjet aboard the CIAM Hypersonic Flying Laboratory, "Kholod." Ground-launch, rocket boosted by a modified Russian SA-5 missile, the redesigned scramjet is to be accelerated to a new maximum velocity of Mach 6.5. This should allow for the first-time measurement of the fully supersonic combustion mode. The primary program objective is the flight-to-ground correlation of measured data with preflight analysis and wind-tunnel tests in Russia and potentially in the USA. This paper describes the development and objectives of the program as well as the technical details of the scramjet and SA-5 redesign to achieve the Mach 6.5 aim test condition. The purpose and value of joint Russian-American program to attain overall hypersonic air-breathing technology objectives are discussed. Finally, the current project status and schedules to reach the final flight launch are discussed.
Author
Flight Tests; Planning; Supersonic Combustion Ramjet Engines; Airborne Equipment; Evaluation; Schedules

19990064547 NASA Lewis Research Center, Cleveland, OH USA
Damage Tolerance and Reliability of Turbine Engine Components
Chamis, Christos C., NASA Lewis Research Center, USA; 1998; 16p; In English; SC.78: Qualification of Life Extension Schemes for Engine Components, 5-9 Oct. 1998, Corfu, Greece; Copyright; Avail: Issuing Activity, Hardcopy

A formal method is described to quantify structural damage tolerance and reliability in the presence of multitude of uncertainties in turbine engine components. The method is based at the materials behavior level where primitive variables with their respective scatters are used to describe that behavior. Computational simulation is then used to propagate those uncertainties to the structural scale where damage tolerance and reliability are usually specified. Several sample cases are described to illustrate the effectiveness, versatility, and maturity of the method. Typical results from these methods demonstrate that the methods are mature and that they can be used for future strategic projections and planning to assure better, cheaper, faster products for competitive advantages in world markets. These results also indicate that the methods are suitable for predicting remaining life in aging or deteriorating structures.
Author
Tolerances (Mechanics); Damage; Reliability; Engine Parts

19990067263 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Large Engine Uncontained Debris Analysis ***Final Report***
Franeknberger, C. E., III, Naval Air Warfare Center, USA; May 1999; 88p; In English
Contract(s)/Grant(s): DTFA03-95-X-90019
Report No.(s): AD-A364952; DOT/FAA/AR-99/11; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

Naval Air Warfare Center has conducted an analysis to define the characteristics of large commercial transport turbine engine uncontained debris. The objective of the analysis was to define the debris size, weight, exit velocity, and trajectory that can be

used to update Advisory Circular (AC) 20-128A. The effort was conducted by gathering historical data from uncontained engine failures. This data included, when available, phase of flight, engine operating condition, the failed engine component, aircraft damage location, and damage size. With this basic information, debris size was correlated to damage size. A methodology was developed to estimate debris exit velocity. Representative engine cases and cowls were defined and existing ballistic penetration equations used to calculate debris exit velocity. This analysis was conducted for disk and blade failures on fan, compressor, and turbine components. Results of the analysis provided some interesting insight to these events. Looking at the debris trajectories, the analysis shows that the trajectories defined in AC 20-128A are too narrow and should be expanded significantly. Also, the analysis highlights the fact that during an uncontained event the aircraft is subjected to multiple small fragment impacts, not just a single impact. It is the combined effects from the small fragments that pose the highest hazard potential to the aircraft.
DTIC
Debris; Damage Assessment; Turbine Engines; Aircraft Engines; Engine Failure; Engine Design

19990069225 NASA Plum Brook Reactor Facility, Sandusky, OH USA
Test Results of a Fixed Geometry RBCC Inlet
Goldman, A., Boeing Co., USA; Willis, B. P., NASA Plum Brook Reactor Facility, USA; May 13, 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-2589; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Twelve cowl configurations were tested over the range 2.8 is less than M is less than 6.0 for a fixed geometry sidewall compression inlet for a Rocket Based Combined Cycle Engine (RBCC). Start and unstart were determined and air capture measured for each test condition. Inlet starting Mach number was at or below expected value. Placing a slot in the cowl allowed the inlet to start where a solid cowl configuration was unable to start. Mass capture for the no cowl configuration exceeded pre-test predictions whereas mass capture was less than pre-test predictions for the various cowl lengths tested.
Author
Cowlings; Mach Number; Wind Tunnel Tests; Supersonic Speed; Inlet Pressure; Inlet Nozzles; Pressure Distribution; Side Inlets; Hypersonic Inlets; Engine Inlets; Liquid Propellant Rocket Engines; Integral Rocket Ramjets

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.

19990064385 Dayton Univ. Research Inst., Structural Integrity Div., OH USA
Evaluation of Methods to Separate Maneuver and Gust Load Factors from Measured Acceleration Time Histories *Final Report*
Rustenburg, J. W.; Skinn, D.; Tipps, D. O.; Apr. 1999; 44p; In English
Contract(s)/Grant(s): 437-25-14
Report No.(s): PB99-150070; UDR-TM-1998-00011; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The University of Dayton is supporting Federal Aviation Administration (FAA) research on the structural integrity requirements for the US commercial transport airplane fleet. The primary objective of this research is to support the FAA Airborne Data Monitoring Systems program by developing new and improved methods and criteria for processing and presenting large commercial transport airplane flight and ground loads usage data. The accelerations recorded in flight result from maneuver inputs initiated by the pilot and atmospheric turbulence. to determine the gust and maneuver load factor spectra from the recorded flight loads data, it is necessary to separate the gust and maneuver load factors. Various means to separate the accelerations due to pilot maneuvers and turbulence from measured acceleration time histories have been used. This report presents the results of a study to evaluate the validity and operational processing efficiency of three different methods for the separation of maneuvers and gusts from measured acceleration data obtained from Optical Quick Access Recorder (OQAR)-equipped commercial aircraft. Conclusions and recommendations for the use of a maneuver-gust separation method are also provided.
NTIS
Gust Loads; Data Systems; Acceleration (Physics); Aircraft Maneuvers; Data Acquisition

19990064521 NASA Langley Research Center, Hampton, VA USA
Computational Investigation of Fluidic Counterflow Thrust Vectoring
Hunter, Craig A., NASA Langley Research Center, USA; Deere, Karen A., NASA Langley Research Center, USA; 1999; In

English; 35th; Joint Propulsion, 20-23 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-2669; Copyright; Avail: Issuing Activity, Hardcopy

A computational study of fluidic counterflow thrust vectoring has been conducted. Two-dimensional numerical simulations were run using the computational fluid dynamics code PAB3D with two-equation turbulence closure and linear Reynolds stress modeling. For validation, computational results were compared to experimental data obtained at the NASA Langley Jet Exit Test Facility. In general, computational results were in good agreement with experimental performance data, indicating that efficient thrust vectoring can be obtained with low secondary flow requirements (less than 1% of the primary flow). An examination of the computational flowfield has revealed new details about the generation of a countercurrent shear layer, its relation to secondary suction, and its role in thrust vectoring. In addition to providing new information about the physics of counterflow thrust vectoring, this work appears to be the first documented attempt to simulate the counterflow thrust vectoring problem using computational fluid dynamics.
Author
Computational Fluid Dynamics; Counterflow; Fluidics; Turbulent Flow; Turbulence Models; Reynolds Stress; Reynolds Averaging; Navier-Stokes Equation; Secondary Flow

19990069616 California Univ., Dept. of Materials Science and Mineral Engineering, Berkeley, CA USA
Micromechanical Flying Insect (MFI). Year 1 Report May 1998 - May 1999, *May 1998 - May 1999*
Fearing, R. S.; Pister, K. S.; Sastry, S. S.; Dickinson, M. H.; Liepmann, D.; May 1999; 22p; In English
Contract(s)/Grant(s): N00014-98-1-0671
Report No.(s): AD-A364781; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose to develop a micromechanical flying insect (MFI), a 10-25 mm (wingtip-to-wingtip) device eventually capable of sustained autonomous flight. The goal of the MFI project is to use biomimetic principles to capture some of the exceptional flight performance achieved by true flies. The project is divided into four stages: 1) feasibility analysis, 2) structural fabrication, 3) aerodynamics and wing control, and 4) flight control and integration. Our design analysis shows us that piezoelectric actuators and flexible thorax structures can provide the needed power density and wing stroke, and adequate power can be supplied by solar cells. In the first year of this MURI grant, research has been concentrated in understanding fly flight aerodynamics and in analysis, design and fabrication of MFI structures.
DTIC
Micromechanics; Design Analysis; Aerodynamics; Fabrication; Insects

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).

19990064498 Florida Agricultural and Mechanical Univ., Tallahassee, FL USA
Development of Tools and Support for Measurements in the NASA 80x120 Foot Wind Tunnel
Lourenco, L., Florida Agricultural and Mechanical Univ., USA; [1999]; 7p; In English
Contract(s)/Grant(s): NAG2-1183; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report describes the first study leading to the application of Particle Image Velocimetry to diagnose rotor type flows in the NASA Ames 80x120-foot wind tunnel facility. The necessary steps towards the implementation of PIV to study rotor type flows were first investigated in the Army Rotor Hover Chamber. The model problem consisted of the three-dimensional flow generated by a two-blade rotor at different wake ages.
Author
Wind Tunnels; Particle Image Velocimetry; Flow Measurement

19990068494 Marine Corps, Washington, DC USA
Refresher Physiology in Aircraft Simulators (SIMPHYS)
Mason, R. P., Marine Corps, USA; Aeromedical Aspects of Aircrew Training; June 1999, pp. 18-1 - 18-2; In English; See also

19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of aircraft simulation in aviation training programs has increased significantly in recent years along with their capabilities and sophistication. Aircrew coordination training (ACT), aircraft systems checks, instrument rating checks, and emergency procedures training are currently being conducted in flight simulators. As flight simulator use and fidelity increases, the ability to replicate actual flight conditions and aeromedical safety issues are both enhanced. A simulator-based curriculum was developed by modifying the learning objectives from the existing rotary wing refresher aviation physiology and survival training curriculum to performance based objectives that could be demonstrated in a simulator-based curriculum, The AH-1W (Super Cobra) Weapons Systems Trainer (Device 2F136) at MCAS Camp Pendleton, CA was used as the simulator test bed. Fourteen pilots completed the prototype curriculum and were questioned on its efficacy. All fourteen pilots identified the simulator-based curriculum as superior to the existing curriculum and as more effective in meeting the curriculum's learning objectives. Substantial increases across all learning domains were demonstrated and a change in the pilots' attitudes towards refresher physiology training was noted. A simulator-based rotary wing refresher aviation physiology and survival training curriculum is feasible and should be adopted to provide effective aeromedical training for aircrew. Further evaluation is on going to determine the potential and effectiveness of a fast jet and transport simulator-based curricula.

Author

Flight Simulators; Education; Flight Crews; Aerospace Medicine; Computerized Simulation

19990069617 Little (Arthur D.), Inc., Cambridge, MA USA

Modular Aircraft Support System (MASS) Concept Validation

Hablanian, David A.; Dec. 1998; 87p; In English

Report No.(s): AD-A364771; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Modular Aircraft Support System (MASS) program is part of a research effort to improve the reliability, maintainability, operability, and deployability of aerospace ground equipment (AGE.) The purpose of Delivery Order 0003 was to perform further requirements gathering, conceptual design, and analysis of the six system concepts which were developed in Delivery Order 0002. The results of the analysis were used to perform a downselect to a single system that provides the most promise for the eventual MASS proof-of-concept unit. The single downselected concept incorporates elements of several of the initial six concepts. The key elelements of the new concept are: (1) diesel prime mover; (2) electrical power distribution between modules; (3) two or three carts; and, (4) no more than four distinct modules per cart. Layoutrdrawings and detailed life-cycle costs projections were developed for the MASS modules, chassis and carts.

DTIC

Support Systems; Modules; Ground Support Equipment

19990070304 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Performance Characteristics of a Free-Piston Shock Tube

Kihara, Hisashi, Kyushu Univ., Japan; Okinaka, Kazumi, Kyushu Univ., Japan; Aso, Shigeru, Kyushu Univ., Japan; Nishida, Michio, Kyushu Univ., Japan; Park, Jong–ho, Chungnam National Univ., Korea, Republic of; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 183-191; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes the performance test of a free-piston shock tube built in Department of Aeronautics and Astronautics, Kyushu University and some results of the performance test are shown. This shock tube was built for the purpose of investigating high temperature effect in shock heated gas. In this type of shock tube, the performance of a facility partly depends on the characteristics of a compression tube, so that, the characteristics of the compression tube were calculated and compared with the experiments. The comparison shows good agreement between the experiment and calculation concerning the compression process of the compression tube. It has been confirmed that the facility can produce shock Mach numbers of 11 to 24 for the initial test section pressures of 65.5 Pa to 1.33 kPa in nitrogen and air.

Author

Shock Tubes; Performance Tests; Shock Waves; Shock Heating; Hypersonic Flow; Magnetic Pistons

13
ASTRODYNAMICS

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

19990064548 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Penelitian Dasar and Uji Sistem, Jakarta, Indonesia

Restudy of Single-Stage HR-2 Ballistic Rocket Trajectories ***Kaji Ulang Trayektori Roket Balistik HR-2 Satu Tingkat***

Sembiring, Turah, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April 1998; ISSN 0126-9754, No. 55, pp. 10-14; In Malay-Indonesian; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The calculation of trajectory of ballistic rocket is done on angle of elevation 70 deg, 75 deg and 80 deg. From the static test is done by propulsion group have information that burning time rocket is 41 seconds, burning time of booster is 2,2 seconds, thrust force of rocket is 2210 kg and thrust force of booster is 4600 kg. From the structure and propellant group have information that the total weight of rocket is 846 kg, propellant weight is 440 kg, booster weight is 94 kg and payload weight is 115 kg. The total length of rocket is 8,3 m, the length of rocket is 7,3 m and the length of booster is 1 m. Data of propulsion and aerodynamics can be used for solving of equation of moved equation of rocket of HR-2 for angle of attacks 80 deg is : the height maximum rocket is 118 km, the distance of rocket is 102 km, the maximum velocity of rocket is 4,185 mach and the time of flight is 390 seconds. Author

Ballistic Trajectories; Computation; Propulsion; Propellants

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.

19990064511 Department of the Navy, Washington, DC USA

Guidance System

Perruzzi, Joseph J., Inventor; DiPaola, Michael, Inventor; Hilliard, Edward J., Jr, Inventor; Jan. 25, 1999; 34p; In English

Patent Info.: Filed 25 Jan. 99,; US-Patent-Appl-SN-09/246,212

Report No.(s): AD-D019351; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

This invention generally relates to trajectory control and more specifically to a method and apparatus for providing guidance parameters at launch that direct a pursuing vehicle from a launching vehicle to a target vehicle capable of evasive maneuvering after the target vehicle becomes alerted to the presence of the pursuing vehicle. Description of the Prior Art The trajectory control of a pursuing vehicle can be classified as post-launch or pre-launch control. In post-launch control, guidance information is sent from the launching vehicle to guide the pursuing vehicle to the target. The following USA Letters Patent disclose such post-launch trajectory control systems:

DTIC

Launch Vehicles; Launching; Maneuvers; Trajectory Control

19990064633 NASA Marshall Space Flight Center, Huntsville, AL USA

X-33/RLV System Health Management/Vehicle Health Management

Mouyos, William, Lockheed Sanders, Inc., USA; Wangu, Srimal, Lockheed Sanders, Inc., USA; 1998; 1p; In English; Defense and Civil Space Programs, 28-30 Oct. 1998, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC8-115; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

To reduce operations costs, Reusable Launch Vehicles (RLVS) must include highly reliable robust subsystems which are designed for simple repair access with a simplified servicing infrastructure, and which incorporate expedited decision-making about faults and anomalies. A key component for the Single Stage To Orbit (SSTO) RLV system used to meet these objectives is System Health Management (SHM). SHM incorporates Vehicle Health Management (VHM), ground processing associated with the vehicle fleet (GVHM), and Ground Infrastructure Health Management (GIHM). The primary objective of SHM is to provide an automated and paperless health decision, maintenance, and logistics system. Sanders, a Lockheed Martin Company, is leading the design, development, and integration of the SHM system for RLV and for X-33 (a sub-scale, sub-orbit Advanced Technology Demonstrator). Many critical technologies are necessary to make SHM (and more specifically VHM) practical, reliable, and cost effective. This paper will present the X-33 SHM design which forms the baseline for the RLV SHM, and it will

discuss applications of advanced technologies to future RLVs. In addition, this paper will describe a Virtual Design Environment (VDE) which is being developed for RLV. This VDE will allow for system design engineering, as well as program management teams, to accurately and efficiently evaluate system designs, analyze the behavior of current systems, and predict the feasibility of making smooth and cost-efficient transitions from older technologies to newer ones. The RLV SHM design methodology will reduce program costs, decrease total program life-cycle time, and ultimately increase mission success.
Author
Project Management; Systems Engineering; Systems Management; Design Analysis; X-33 Reusable Launch Vehicle

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

19990064504 NASA Marshall Space Flight Center, Huntsville, AL USA
Spaceliner Class Operability Gains Via Combined Airbreathing/ Rocket Propulsion: Summarizing an Operational Assessment of Highly Reusable Space Transports
Nix, Michael B., NASA Marshall Space Flight Center, USA; Escher, William J. d., Science Applications International Corp., USA; 1999; 2p; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-2355; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In discussing a new NASA initiative in advanced space transportation systems and technologies, the Director of the NASA Marshall Space Flight Center, Arthur G. Stephenson, noted that, ”It would use new propulsion technology, air-breathing engine so you don’t have to carry liquid oxygen, at least while your flying through the atmosphere. We are calling it Spaceliner 100 because it would be 100 times cheaper, costing $ 100 dollars a pound to orbit.” While airbreathing propulsion is directly named, rocket propulsion is also implied by, ”... while you are flying through the atmosphere.” In-space final acceleration to orbital speed mandates rocket capabilities. Thus, in this informed view, Spaceliner 100 will be predicated on combined airbreathing/rocket propulsion, the technical subject of this paper. Interestingly, NASA’s recently concluded Highly Reusable Space Transportation (HRST) study focused on the same affordability goal as that of the Spaceliner 100 initiative and reflected the decisive contribution of combined propulsion as a way of expanding operability and increasing the design robustness of future space transports, toward ”aircraft like” capabilities. The HRST study built on the Access to Space Study and the Reusable Launch Vehicle (RLV) development activities to identify and characterize space transportation concepts, infrastructure and technologies that have the greatest potential for reducing delivery cost by another order of magnitude, from $1,000 to $100-$200 per pound for 20,000 lb. - 40.000 lb. payloads to low earth orbit (LEO). The HRST study investigated a number of near-term, far-term, and very far-term launch vehicle concepts including all-rocket single-stage-to-orbit (SSTO) concepts, two-stage-to-orbit (TSTO) concepts, concepts with launch assist, rocket-based combined cycle (RBCC) concepts, advanced expendable vehicles, and more far term ground-based laser powered launchers. The HRST study consisted of preliminary concept studies, assessments and analysis tool development for advanced space transportation systems, followed by end-to-end system concept definitions and trade analyses, specific system concept definition and analysis, specific key technology and topic analysis, system, operational and economics model development, analysis, and integrated assessments. The HRST Integration Task Force (HITF) was formed to synthesize study results in several specific topic areas and support the development of conclusions from the study: Systems Concepts Definitions, Technology Assessment, Operations Assessment, and Cost Assessment. This paper summarizes the work of the Operations Assessment Team: the six approaches used, the analytical tools and methodologies developed and employed, the issues and concerns, and the results of the assessment. The approaches were deliberately varied in measures of merit and procedure to compensate for the uncertainty inherent in operations data in this early phase of concept exploration. In general, rocket based combined cycle (RBCC) concepts appear to have significantly greater potential than all-rocket concepts for reducing operations costs.
Author
Air Breathing Engines; Cost Reduction; Reusable Launch Vehicles; Single Stage to Orbit Vehicles; Space Transportation; Technology Assessment

19990066628 NASA Ames Research Center, Moffett Field, CA USA
Aerothermodynamic Heating Analysis of Aerobraking and Aeromaneuvering Orbital Transfer Vehicles
Menees, Gene P., NASA Ames Research Center, USA; Davies, Carol B., Informatics General Corp., USA; Wilson, John F., Infor-

matics General Corp., USA; Brown, Kevin G., NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 338-360; In English; 19th; Thermophysics, 25-28 Jun. 1984, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 84-1711; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The thermal-protection requirements of two aeroassisted orbital transfer vehicles (AOTVS) are analyzed for return missions between the geosynchronous and Shuttle orbits. One of the designs is a specialized version of a previously proposed generic aerobraking vehicle that Is capable of only delivery-type operations. The other Is a high-lift aeromaneuvering vehicle that is optimized for low Earth orbit sortie missions involving large, multiple plane-inclination changes. The aerothermal environment of the aerobraking vehicle is analyzed using state-of-the-art methods for nonequilibrium-radiative and convective heating that incorporate refinements unique to the configuration. The heating analysis of the aeromaneuvering vehicle required the development of a flowfield model for rarefied-hypersonic flow over a lifting surface at incidence. The predicted aerothermodynamic heating characteristics for both vehicles are correlated with thermal-control
Author

Aerothermodynamics; Heating; Aerobraking; Orbit Transfer Vehicles; Thermal Protection; Design Analysis; Models; Convective Heat Transfer; Aeromaneuvering; Rarefied Gas Dynamics

19990066629 NASA Ames Research Center, Moffett Field, CA USA

Design and Performance Analysis of a Conical Aerobrake Orbital Transfer Vehicle Concept

Menees, Gene P., NASA Ames Research Center, USA; Park, Chul, NASA Ames Research Center, USA; Wilson, John F., Informatics General Corp., USA; Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 286-308; In English; 22nd; Aerospace Sciences, 9-12 Jan. 1984, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 84-0410; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A Shuttle-compatible systems design based on the core concept of attachable modules for the major vehicle components is proposed. The principal features include a disposable cargo/extra-propellant tank module; a porous, radiative, back-scattering drag-brake surface material of thin silica cloth; and a lightweight carbon-composite support structure. The mission payload capability for delivery, retrieval, and combined operations is determined for a broad range of missions including NASA/DOD requirements and extending through cislunar space. The effects of finite-rate surface catalysis, negative lift, and multiple atmospheric passes in reducing the aerothermodynamic heating rates are also investigated. In addition, the structural and thermal protection problems of the drag-brake support apparatus are analyzed, and recommendations are proposed for future design refinements.
Author

Design Analysis; Performance Tests; Aerobraking; Conical Bodies; Orbit Transfer Vehicles; Reliability Analysis

19990067824 NASA Marshall Space Flight Center, Huntsville, AL USA

DUET: A Distributed Usability Lab Supporting Displays Development for Space Station

Dischinger, H. Charles, Jr., NASA Marshall Space Flight Center, USA; Tilghman, Neal C., Lockheed Martin Corp., USA; Hammons, Matthew, TRW, Inc., USA; Hale, Joseph P., III, NASA Marshall Space Flight Center, USA; 1999; 4p; In English; 43rd; Annual Meeting, 27 Sep. - 1 Oct. 1999, Houston, TX, USA; Sponsored by Human Factors and Ergonomics, USA; No Copyright; Avail: Issuing Activity, Hardcopy

A usability laboratory recently established at NASA's Marshall Space Flight Center will support the development of interfaces to on-board Payload displays on the International Space Station. An unusual feature of this facility is its ability to conduct usability testing over the Internet. Test subjects interact with the remote application displays using the remote-view and -control package Timbuktu Pro. Both test subject and developer facility are typically remote to the lab; the only site requirements are appropriate viewing hardware and software and an Internet drop. The lab, called the Distributed Usability Evaluation Tool (DUET), utilizes off-the-shelf hardware and software. Included are Space Station-type laptops (IBM Thinkpad 760 XD), Windows 95 OS, a usability data-collection package (WinWhatWhere), and Timbuktu Pro. Data on test subject commentary and reaction are collected through videoconferencing when available, and through teleconferencing otherwise. Developers gain access to the test facility through instructions and software obtained from the lab's web site. DUET also serves as a display development support tool. The web site includes usability guidelines and templates. Moreover the staff consult on usability and standards compliance via telephone and net communication. Prototypes are evaluated using an electronic whiteboard. This tool is connected to the developer's displays via the same networking approach as is used for the test: the developer connects to the lab through

Timbuktu Pro, the prototypes are displayed on the whiteboard, and comments and modifications are made collaboratively by the developer and the lab staff. Examples of support and test successes and issues will be presented.
Author
Computer Programs; Data Acquisition; Display Devices; Payloads; Video Communication

19990068008 NASA Marshall Space Flight Center, Huntsville, AL USA
Space Transportation Options for the 21st Century
Houts, Michael G., NASA Marshall Space Flight Center, USA; Schmidt, George R., NASA Marshall Space Flight Center, USA; Gerrish, Harold P., NASA Marshall Space Flight Center, USA; Martin, James J., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 36th; Space Conference, 27-30 Apr. 1999, Cape Canaveral, FL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Advanced space transportation options may eventually enable rapid, affordable access to any point in the solar system. Advanced propulsion systems with energy densities several orders of magnitude greater than state-of-the art systems may be available in the 21 st century. These propulsion systems include systems based on fission, fusion, antimatter annihilation and other advanced processes. Other transportation options propose using in-situ resources to enable rapid, affordable access to any point in the solar system using more conventional propulsion technologies. This presentation will summarize select space transportation options of current interest to NASA MSFC's Space Propulsion Branch, present progress being made towards developing each of the options, and discuss obstacles that must be overcome before any of the options can be implemented.
Author
Propulsion System Configurations; Propulsion System Performance; Space Transportation; Post Boost Propulsion System

19990070318 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA
The X-33 Flight Test Challenge
Borden, David, Lockheed Martin Corp., USA; Ramiscal, Ermin, Lockheed Martin Corp., USA; Howell, John, Lockheed Martin Corp., USA; 1999; 12p; In English, 16-20 Aug. 1999, Saint Louis, MO, USA; Sponsored by Society of Flight Test Engineers, USA
Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: Issuing Activity, Hardcopy

Low cost access to space has eluded present launch system technologies. Our objective is to reduce the cost of putting a payload into space from $10,000 per pound to $1000 per pound. In July 1996, a cooperative agreement was initiated between the Lockheed Martin Skunk Works and NASA to help accomplish this goal. The X-33 is the first step in the process to make low cost space access a reality. The X-33 is a suborbital, hypersonic lifting body, proof of concept of a reusable launch vehicle. The X-33 flight test program will validate technologies such as a metallic thermal protection system, Linear Aerospike Engines, use of tanks and struts as fundamental structural elements, as well as quick turnaround time. Flight testing will begin in July 2000, with launches originating from Edwards Air Force Base and initial landings at Michael Army Airfield in Utah. Data collected from these flight tests will aid in the decision to build an economically viable single stage to orbit reusable launch vehicle. This paper will explore the technical challenges facing the X-33 Flight Test Team.
Author
Flight Tests; X-33 Reusable Launch Vehicle; Cost Reduction; Low Cost; Payloads

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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.

19990064615 NASA Goddard Space Flight Center, Greenbelt, MD USA
Testing of the International Space Station and X-38 Crew Return Vehicle GPS Receiver
Simpson, James, NASA Goddard Space Flight Center, USA; Lightsey, Glenn, NASA Goddard Space Flight Center, USA; Campbell, Chip, NASA Goddard Space Flight Center, USA; Carpenter, Russell, NASA Goddard Space Flight Center, USA; Davis, George, NASA Goddard Space Flight Center, USA; Jackson, Larry, NASA Goddard Space Flight Center, USA; Davis, Ed, NASA Goddard Space Flight Center, USA; Kizhner, Semion, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Institute of Naviation (ION) GPS, 14-17 Sep. 1999, Nashville, TN, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper discusses the process and results of the performance testing of the GPS receiver planned for use on the International Space Station (ISS) and the X- 38CrewReturnVehicle(CRV). The receiver is a Force-19 unit manufactured by Trimble Navigation

and modified in software by NASA:s Goddard Space Flight Center (GSFC) to perform navigation and attitude determination in space. The receiver is the primary source of navigation and attitude information for ISS and CRV. Engineers at GSFC have developed and tested the new receiver with a Global Simulation Systems Ltd (GSS) GPS Signal Generator (GPSSG). This paper documents the unique aspects of ground testing a GPS receiver that is designed for use in space. A discussion of the design of tests using the GPSSG, documentation, data capture, data analysis, and lessons learned will precede an overview of the performance of the new receiver. A description of the challenges that were overcome during this testing exercise will be presented. Results from testing show that the receiver will be within or near the specifications for ISS attitude and navigation performance. The process for verifying other requirements such as Time to First Fix, Time to First Attitude, selection/deselection of a specific GPS satellite vehicles (SV), minimum signal strength while still obtaining attitude and navigation, navigation and attitude output coverage, GPS week rollover, and Y2K requirements are also given in this paper.
Author
Performance Tests; Global Positioning System; Receivers; Ground Tests; Simulation

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.

19990067284 NASA Goddard Space Flight Center, Greenbelt, MD USA
Miniature Heat Transport System for Nanosatellite Technology
Douglas, Donya M,, NASA Goddard Space Flight Center, USA; [1999]; In English; Two Phase 1999 Workshop, 17-19 May 1999, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The scientific understanding of key physical processes between the Sun and the Earth require simultaneous measurements from many vantage points in space. Nano-satellite technologies will enable a class of constellation missions for the NASA Space Science Sun-Earth Connections. This recent emphasis on the implementation of smaller satellites leads to a requirement for development of smaller subsystems in several areas. Key technologies under development include: advanced miniaturized chemical propulsion; miniaturized sensors; highly integrated, compact electronics; autonomous onboard and ground operations; miniatures low power tracking techniques for orbit determination; onboard RF communications capable of transmitting data to the ground from far distances; lightweight efficient solar array panels; lightweight, high output battery cells; lightweight yet strong composite materials for the nano-spacecraft and deployer-ship structures. These newer smaller systems may have higher power densities and higher thermal transport requirements than seen on previous small satellites. Furthermore, the small satellites may also have a requirement to maintain thermal control through extended earth shadows, possibly up to 8 hours long. Older thermal control technology, such as heaters, thermostats, and heat pipes, may not be sufficient to meet the requirements of these new systems. Conversely, a miniature two-phase heat transport system (Mini-HTS) such as a Capillary Pumped Loop (CPL) or Loop Heat Pipe (LBP) is a viable alternative. A Mini-HTS can provide fine temperature control, thermal diode action, and a highly efficient means of heat transfer. The Mini-HTS would have power capabilities in the range of tens of watts or less and provide thermal control over typical spacecraft ranges. The Mini-HTS would allow the internal portion of the spacecraft to be thermally isolated from the external radiator, thus protecting the internal components from extreme cold temperatures during an eclipse. The Mini-HTS would transport the beat from these components to a radiator during their operational modes, and it would be shutdown during non-operational or eclipse modes. Shutdown of the Mini-HTS would be accomplished with small heaters and has been successfully demonstrated on numerous occasions, both in the lab and on flight experiments. Efforts are now underway to miniaturize two-phase heat transport systems for the Nanosatellite project, with potential application to other small satellite programs. ’ne goal of this project is to design, build, and test miniature heat transport systems (MHTS) that would demonstrate the feasibility of a small Capillary Pumped Loop (CPL) or Loop Heat Pipe (LBP).
Author
Heat Transfer; Communication Equipment; Ground Operational Support System; Heat Pipes; Miniaturization; Nanosatellites

19990067627 NASA Marshall Space Flight Center, Huntsville, AL USA
Electrodynamic Tether Reboost of the International Space Station
Johnson, Les, NASA Marshall Space Flight Center, USA; [1997]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The International Space Station (ISS) will require periodic reboost due to atmospheric aerodynamic drag. This is nominally achieved through the use of thruster firings by the attached Progress M spacecraft. Many Progress Flights to the ISS are required annually. Electrodynamic tethers provide an attractive alternative in that they can provide periodic reboost or continuous drag cancellation using no consumables, propellant nor conventional propulsion elements. The system could also serve as an emergency backup reboost system used only in the event resupply and reboost are delayed. Electrodynamic tethers have been demonstrated in space previously with the Plasma Motor Generator (PMG) experiment and the Tethered Satellite System (TSS-IR). The advanced electrodynamic tether proposed for this application has significant advantages over previous systems in that higher thrust is achievable with significantly shorter tethers and without the need for an active current collection device, hence making the system simpler and much less expensive.
Author
International Space Station; Propulsion; Tethering; Tetherlines; Electrodynamics

19990067639 NASA Goddard Space Flight Center, Greenbelt, MD USA
MEMS Louvers for Thermal Control
Champion, J. L., Johns Hopkins Univ., USA; Osiander, R., Johns Hopkins Univ., USA; Darrin, M. A. Garrison, Johns Hopkins Univ., USA; Swanson, T. D., NASA Goddard Space Flight Center, USA; Sep. 15, 1998; 9p; In English; Integrated Micro/Nano Technology for Spacecraft Applications, 11-15 Apr. 1998, USA
Report No.(s): PCN-545-91486; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Mechanical louvers have frequently been used for spacecraft and instrument thermal control purposes. These devices typically consist of parallel or radial vanes, which can be opened or closed to vary the effective emissivity of the underlying surface. This project demonstrates the feasibility of using Micro-Electromechanical Systems (MEMS) technology to miniaturize louvers for such purposes. This concept offers the possibility of substituting the smaller, lighter weight, more rugged, and less costly MEMS devices for such mechanical louvers. In effect, a smart skin that self adjusts in response to environmental influences could be developed composed of arrays of thousands of miniaturized louvers. Several orders of magnitude size, weight, and volume decreases are potentially achieved using micro-electromechanical techniques. The use of this technology offers substantial benefits in spacecraft/instrument design, integration and testing, and flight operations. It will be particularly beneficial for the emerging smaller spacecraft and instruments of the future. In addition, this MEMS thermal louver technology can form the basis for related spacecraft instrument applications. The specific goal of this effort was to develop a preliminary MEMS device capable of modulating the effective emissivity of radiators on spacecraft. The concept pursued uses hinged panels, or louvers, in a manner such that heat emitted from the radiators is a function of louver angle. An electrostatic comb drive or other such actuator can control the louver position. The initial design calls for the louvers to be gold coated while the underlying surface is of high emissivity. Since, the base MEMS material, silicon, is transparent in the InfraRed (IR) spectrum, the device has a minimum emissivity when closed and a maximum emissivity when open. An initial set of polysilicon louver devices was designed at the Johns Hopkins Applied Physics Laboratory in conjunction with the Thermal Engineering Branch at NASA's Goddard Space Flight Center.
Author
Louvers; Microelectromechanical Systems; Temperature Control; Spacecraft Equipment; Microminiaturization; Spacecraft Shielding

19990067834 NASA Goddard Space Flight Center, Greenbelt, MD USA
Two Phase Technology Development Initiatives
Didion, Jeffrey R., NASA Goddard Space Flight Center, USA; Apr. 27, 1999; 1p; In English; Two-Phase Technology, 17-19 May 1999, College Park, MD, USA
Contract(s)/Grant(s): NAG1-1774; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Three promising thermal technology development initiatives, vapor compression thermal control system, electronics cooling, and electrohydrodynamics applications are outlined herein. These technologies will provide thermal engineers with additional tools to meet the thermal challenges presented by increased power densities and reduced architectural options that will be available in future spacecraft. Goddard Space Flight Center and the University of Maryland are fabricating and testing a 'proto-flight' vapor compression based thermal control system for the Ultra Long Duration Balloon (ULDB) Program. The vapor compression system will be capable of transporting approximately 400 W of heat while providing a temperature lift of 60C. The system is constructed of 'commercial off-the-shelf' hardware that is modified to meet the unique environmental requirements of the ULDB. A demonstration flight is planned for 1999 or early 2000. Goddard Space Flight Center has embarked upon a multi-discipline effort to address a number of design issues regarding spacecraft electronics. The program addressed the high priority design issues concerning the total mass of standard spacecraft electronics enclosures and the impact of design changes on thermal performance. This presentation reviews the pertinent results of the Lightweight Electronics Enclosure Program. Electronics cooling is

a growing challenge to thermal engineers due to increasing power densities and spacecraft architecture. The space-flight qualification program and preliminary results of thermal performance tests of copper-water heat pipes are presented. Electrohydrodynamics (EHD) is an emerging technology that uses the secondary forces that result from the application of an electric field to a flowing fluid to enhance heat transfer and manage fluid flow. A brief review of current EHD capabilities regarding heat transfer enhancement of commercial heat exchangers and capillary pumped loops is presented. Goddard Space Flight Center research efforts applying this technique to fluid management and fluid pumping are discussed.
Author
Electrohydrodynamics; Heat Exchangers; Temperature Control; Temperature Effects; Vapors; Compressing; Spacecraft Electronic Equipment; Cooling

19990068022 Utah Univ., Mechanical Engineering Dept., Salt Lake City, UT USA
Experimental and Theoretical Results in Output Trajectory Redesign for Flexible Structures
Dewey, J. S., Utah Univ., USA; Leang, K., Utah Univ., USA; Devasia, S., Utah Univ., USA; Transactions of the ASME; December 1998; Volume 120, pp. 456-461; In English
Contract(s)/Grant(s): NAG2-1042; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we study the optimal redesign of output trajectories for linear invertible systems. This is particularly important for tracking control of flexible structures because the input-state trajectores, that achieve tracking of the required output may cause excessive vibrations in the structure. We pose and solve this problem, in the context of linear systems, as the minimization of a quadratic cost function. The theory is developed and applied to the output tracking of a flexible structure and experimental results are presented.
Author
Dynamic Control; Trajectories; Inversions; Linear Systems

19990068740 Aerojet-General Corp., Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Performance Verification Reports: Final Comprehensive Performance Test Report, P/N: 1356006-1, S.N: 202/A2
Platt, R.; November 1998; 400p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-209224; NAS 1.26:209224; AEROJET-11336; CDRL-208; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

This is the Performance Verification Report. the process specification establishes the requirements for the comprehensive performance test (CPT) and limited performance test (LPT) of the earth observing system advanced microwave sounding unit-A2 (EOS/AMSU-A2), referred to as the unit. The unit is defined on drawing 1356006.
Derived from text
Performance Tests; Advanced Microwave Sounding Unit

19990069975 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA
Autonomous Intact Abort System for the X-34
Tragesser, Steven G., Draper (Charles Stark) Lab., Inc., USA; Barton, Gregg H., Draper (Charles Stark) Lab., Inc., USA; 1999; 10p; In English; Atmospheric Flight Mechanics, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-4253; No Copyright; Avail: Issuing Activity, Hardcopy

Autonomous algorithms are developed which provide trajectory guidance for horizontally landing vehicles such as the X-34 under a variety of abort conditions. The nominal guidance system of the X-34 is incapable of directing the vehicle to a safe landing for many possible situations in which trajectory is far away from nominal conditions (as in the case of an engine failure). To minimize the risk of losing the vehicle, the autonomous intact abort system considers multiple landing sites and redesigns certain guidance inputs in order to adapt to the new conditions presented by the abort. The abort system design is demonstrated in a high-fidelity simulation to prove the feasibility of the concept for various engine-out These abort algorithms are being incorporated into the X-34 vehicle to flight test this new technology as a part of the Future X Pathfinder Flight Demonstration Program.
Author
Autonomy; X-34 Reusable Launch Vehicle; Abort Apparatus; Systems Engineering; Design Analysis; Aircraft Design

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SPACECRAFT INSTRUMENTATION

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

19990069905 NASA Goddard Space Flight Center, Greenbelt, MD USA
Thermal Assessment of LANDSAT-7 ETM+ Radiative Cooler in Instrument and Spacecraft Thermal Vacuum Tests and in Flight
Choi, Michael K., NASA Goddard Space Flight Center, USA; 1999; 6p; In English; 34th; Intersociety Energy Conversion Engineering, 1-5 Aug. 1999, Vancouver, British Columbia, Canada; Sponsored by Society of Automotive Engineers, Inc., USA
Report No.(s): SAE-1999-01-2628; Copyright; Avail: Issuing Activity, Hardcopy

During the radiative cooler cool-down phase of the LANDSAT-7 Enhanced Thematic Mapper Plus (ETM+) instrument thermal vacuum test #3, the coldest temperature that the Cold Focal Plane Array (CFPA) achieved was 89.5 K. The cold stage/CFPA temperature decreased from 315 K to 89.5 K in 80 hours. In the spacecraft and instrument integrated thermal vacuum test, the cold stage/CFPA temperature decreased from 315 K to 86.9 K in 80 hours, and was still decreasing at a rate of 0.08 K/hr when the cool-down was terminated. The cool-down was faster, and a colder CFPA temperature was obtained. In flight, the cooler cool-down was even faster, and colder. The cold stage/CFPA temperature decreased from 315 K to 89.7 K in 33 hours, and was still decreasing at a rate of 1 K/hr when cool- down was terminated at 89.7 K. The factors that affected the ETM+ cooler cool-down are the radiation heat sink temperature for the cold stage and intermediate stage, parasitic radiation heat load to the cooler, parasitic conduction heat load to the cooler, and cooler outgas time preceding cooler cool-down.
Author
Thermal Vacuum Tests; Assessments; Thematic Mappers (LANDSAT); Focal Plane Devices; Spacecraft Instruments

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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.

19990064341 NASA Marshall Space Flight Center, Huntsville, AL USA
Propulsive Small Expendable Deployer System (ProSEDS) Experiment
Johnson, Les, NASA Marshall Space Flight Center, USA; Estes, Robert, Smithsonian Astrophysical Observatory, USA; Lorenzini, Enrico, Smithsonian Astrophysical Observatory, USA; Gilchrist, Brian, Michigan Univ., USA; 1999; In English; 10th; Advanced Space Propulsion, 5-8 Apr. 1999, Huntsville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

ProSEDS is a secondary (i.e. piggyback) payload on a Delta-11 GPS 8 mission scheduled for launch in August 2000. It will test the feasibility of generating generate electrodynamic thrust without propellant using a 5 kilometer conducting wire (tether). The ProSEDS obtains thrust as the tether cuts across the magnetic field, a voltage is induced across the wire. Electrons are attracted to the positively based far end of the wire. Electrons flow downward through the conductive tether. Earth's magnetic field exerts a drag force on the current in the tether segments, that is mechanically transferred via the wire to the stage. The primary objective for the ProSEDs mission is to demonstrate that a significant, measurable electrodynamic thrust through a tether in space. The primary mission will last one day, as the primary battery assures at least three orbits of data will be collected, the remaining power will be provided by the secondary battery, which uses tether generated power to recharge. The extended mission begins using the power provided through the tether, and wil terminate when a system ceases to function; (i.e., either degradation of the tether,through Atomic Oxygen contact, a micrometeoroid or other debris impact, or another malfunction.) The technology has many potential applications. Amongst the applications, which are reviewed in detail, are: (1) satellite deorbit, (2) reboost of the International Space Station, (3) propellantless reusable Orbit Transfer Vehicles, (4) Propulsion and power generation for future Jovian missions.
CASI
Electrons; Geomagnetism; Tethering; Wire; Tetherlines; Earth Magnetosphere; Planetary Magnetic Fields; Spacecraft Power Supplies

19990064465 Pennsylvania State Univ., University Park, PA USA
Rocket Ejector Studies for Application to RBCC Engines: An Integrated Experimental/CFD Approach
Pal, S., Pennsylvania State Univ., USA; Merkle, C. L., Pennsylvania State Univ., USA; Anderson, W. E., Pennsylvania State Univ.,

USA; Santoro, R. J., Pennsylvania State Univ., USA; 1997; 1p; In English; 34th; Airbreathing Propulsion Subcommittee meetings, 21-31 Oct. 1997, West Palm Beach, FL, USA; Sponsored by Department of the Army
Contract(s)/Grant(s): NAS8-40890; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent interest in low cost, reliable access to space has generated increased interest in advanced technology approaches to space transportation systems. A key to the success of such programs lies in the development of advanced propulsion systems capable of achieving the performance and operations goals required for the next generation of space vehicles. One extremely promising approach involves the combination of rocket and air- breathing engines into a rocket-based combined-cycle engine (RBCC). A key element of that engine is the rocket ejector which is utilized in the zero to Mach two operating regime. Studies of RBCC engine concepts are not new and studies dating back thirty years are well documented in the literature. However, studies focused on the rocket ejector mode of the RBCC cycle are lacking. The present investigation utilizes an integrated experimental and computation fluid dynamics (CFD) approach to examine critical rocket ejector performance issues. In particular, the development of a predictive methodology capable of performance prediction is a key objective in order to analyze thermal choking and its control, primary/secondary pressure matching considerations, and effects of nozzle expansion ratio. to achieve this objective, the present study emphasizes obtaining new data using advanced optical diagnostics such as Raman spectroscopy and CFD techniques to investigate mixing in the rocket ejector mode. A new research facility for the study of the rocket ejector mode is described along with the diagnostic approaches to be used. The CFD modeling approach is also described along with preliminary CFD predictions obtained to date.
Author
Ejectors; Engine Design; Research; Rocket Engines; Propulsion System Configurations; Performance Prediction

19990064486 NASA Marshall Space Flight Center, Huntsville, AL USA
Rocket-Based Combined Cycle Activities in the Advanced Space Transportation Program Office
Hueter, Uwe, Core Technologies; Turner, James, DRACO; Jun. 01, 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics
Report No.(s): AIAA Paper 99-2352; Copyright; Avail: Issuing Activity, Hardcopy

NASA's Office of Aero-Space Technology (OAST) has established three major goals, referred to as, "The Three Pillars for Success". The Advanced Space Transportation Program Office (ASTP) at the NASA's Marshall Space Flight Center (MSFC) in Huntsville, Ala. focuses on future space transportation technologies Under the "Access to Space" pillar. The Core Technologies Project, part of ASTP, focuses on the reusable technologies beyond those being pursued by X-33. One of the main activities over the past two and a half years has been on advancing the rocket-based combined cycle (RBCC) technologies. In June of last year, activities for reusable launch vehicle (RLV) airframe and propulsion technologies were initiated. These activities focus primarily on those technologies that support the decision to determine the path this country will take for Space Shuttle and RLV. This year, additional technology efforts in the reusable technologies will be awarded. The RBCC effort that was completed early this year was the initial step leading to flight demonstrations of the technology for space launch vehicle propulsion.
Author
X-33 Reusable Launch Vehicle; Space Transportation; Propulsion; Airframes

19990064503 NASA Marshall Space Flight Center, Huntsville, AL USA
The Performance Constraints of Gain-Limited Propulsion Systems
Schmidt, G. R., NASA Marshall Space Flight Center, USA; Thio, Y. F., NASA Marshall Space Flight Center, USA; Chakrabarti, S., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 35th, 20-25 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Rapid transportation of human crews to destinations throughout the solar system will require propulsion systems having not only very high exhaust velocities (i.e., I(sub sp) greater or equal to 10(exp 4) to 10(exp 5) sec) but also extremely low mass-power ratios (i.e., alpha less than or equal to 10(exp -2) kg/kW). These criteria are difficult to meet with electric propulsion and other power-limited systems, but may be achievable with propulsion concepts that use onboard power to produce a net gain in energy via fusion or some other nuclear process. This paper compares the fundamental performance of these gain-limited systems with that of power-limited systems, and determines from a generic power balance the gains required for ambitious planetary missions ranging up to 100 AU. Results show that energy gain reduces the required effective mass-power ratio of the system, thus enabling shorter trip times than those of power-limited concepts.
Author
Propulsion System Performance; Exhaust Velocity; Mass Ratios; Rangefinding; Electric Propulsion

19990064624 NASA Marshall Space Flight Center, Huntsville, AL USA

Demonstrating the Performance Benefits of the Strutjet RBCC for Space Launch Architectures

Siebenhaar, Adam, GenCorp Aerojet, USA; Bulman, Mel, GenCorp Aerojet, USA; Johnson, Richard, GenCorp Aerojet, USA; Fazah, Mike, NASA Marshall Space Flight Center, USA; May 12, 1999; In English; 14th; International Symposium on Airbreathing Engines (ISABE), 5-10 Sep. 1999, Florence, Italy

Contract(s)/Grant(s): RTOP 242-72-01; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Rocket Based Combined Cycle (RBCC) engine synergistically combines the best elements of airbreathing and rocket propulsion to benefit a wide range of future reusable launch vehicles (RLV). Aerojet's Strutjet RBCC offers high Isp during mid-phase acceleration, and high thrust for boost and final ascent phases. The result is a relatively low gross weight vehicle that reduces thrust requirements compared with all-rocket solutions. Relative to combination propulsion systems, the integrated propulsive elements of the Strutjet reduce engine weight and complexity. This paper will summarize the results of tests demonstrating our latest hydrogen-fueled Strutjet RBCC engine performance, including inlet operability and performance over a range of conditions, sea level static and Mach 2.4 rocket thrust augmentation, ramjet and scramjet performance, combined scramjet/rocket performance at Mach 8, and ascent mode rocket performance. These tests have significantly advanced the technology readiness of the Strutjet engine and substantiate the performance benefits of RBCC engines for reusable launch vehicle applications. A companion paper provides a focus on Strutjet as a basis for advanced air and space architecture, covering hydrogen and hydrocarbon fuels and cooled structures.

Author

Ramjet Engines; Turbojet Engines; Rocket Engines; Reusable Launch Vehicles; Spacecraft Launching; Propulsion System Configurations; Propulsion System Performance

19990066648 Kaiser Marquardt, Van Nuys, CA USA

Catalyst Development for Hydrogen Peroxide Rocket Engines

Morlan, P. W., Kaiser Marquardt, USA; Wu, P.–K., Kaiser Marquardt, USA; Ruttle, D. W., Kaiser Marquardt, USA; Fuller, R. P., Kaiser Marquardt, USA; Nejad, A. S., Kaiser Marquardt, USA; Anderson, W. E., Orbital Sciences Corp., USA; 1999; 35th; Joint Propulsion, 20-23 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics

Contract(s)/Grant(s): NAS8-98040

Report No.(s): AIAA Paper 99-2740; Copyright; Avail: Issuing Activity, Hardcopy

The development of various catalysts of hydrogen peroxide was conducted for the applications of liquid rocket engines. The catalyst development includes silver screen technology, solid catalyst technology, and homogeneous catalyst technology. The silver screen technology development was performed with 85% (by weight) hydrogen peroxide. The results of this investigation were used as the basis for the catalyst design of a pressure-fed liquid-fueled upper stage engine. Both silver-plated nickel 200 screens and pure silver screens were used as the active metal catalyst during the investigation, The data indicate that a high decomposition efficiency (greater than 90%) of 85% hydrogen peroxide can be achieved at a bed loading of 0.5 lbm/sq in/sec with both pure silver and silver plated screens. Samarium oxide coating, however, was found to retard the decomposition process and the catalyst bed was flooded at lower bed loading. A throughput of 200 lbm of hydrogen peroxide (1000 second run time) was tested to evaluate the catalyst aging issue and performance degradation was observed starting at approximately 400 seconds. Catalyst beds of 3.5 inch in diameter was fabricated using the same configuration for a 1,000-lbf rocket engine. High decomposition efficiency was obtained with a low pressure drop across the bed. Solid catalyst using precious metal was also developed for the decomposition of hydrogen peroxide from 85% to 98% by weight. Preliminary results show that the catalyst has a strong reactivity even after 15 minutes of peroxide decomposition. The development effort also includes the homogeneous catalyst technology. Various non-toxic catalysts were evaluated with 98% peroxide and hydrocarbon fuels. The results of open cup drop tests indicate an ignition delay around 11 ms.

Author

Catalysts; Drop Tests; Fabrication; Liquid Propellant Rocket Engines; Hydrogen Peroxide

19990067274 NASA Marshall Space Flight Center, Huntsville, AL USA

Real Time Optima Tracking Using Harvesting Models of the Genetic Algorithm

Baskaran, Subbiah, Raytheon Co., USA; Noever, D., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Advanced Space Propulsion, 5 Apr. 1999, Huntsville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Tracking optima in real time propulsion control, particularly for non-stationary optimization problems is a challenging task. Several approaches have been put forward for such a study including the numerical method called the genetic algorithm. In brief, this approach is built upon Darwinian-style competition between numerical alternatives displayed in the form of binary strings, or by analogy to 'pseudogenes'. Breeding of improved solution is an often cited parallel to natural selection in.evolutionary or

soft computing. In this report we present our results of applying a novel model of a genetic algorithm for tracking optima in propulsion engineering and in real time control. We specialize the algorithm to mission profiling and planning optimizations, both to select reduced propulsion needs through trajectory planning and to explore time or fuel conservation strategies.
Author
Real Time Operation; Trajectory Planning; Propulsion; Dynamic Control

19990067280 NASA Wallops Flight Facility, Wallops Island, VA USA
GPS Sounding Rocket Developments
Bull, Barton, NASA Wallops Flight Facility, USA; [1999]; In English; 13th Small Satellites, 23-26 Aug. 1999, Logan, UT, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Sounding rockets are suborbital launch vehicles capable of carrying scientific payloads several hundred miles in altitude. These missions return a variety of scientific data including; chemical makeup and physical processes taking place In the atmosphere, natural radiation surrounding the Earth, data on the Sun, stars, galaxies and many other phenomena. In addition, sounding rockets provide a reasonably economical means of conducting engineering tests for instruments and devices used on satellites and other spacecraft prior to their use in more expensive activities. The NASA Sounding Rocket Program is managed by personnel from Goddard Space Flight Center Wallops Flight Facility (GSFC/WFF) in Virginia. Typically around thirty of these rockets are launched each year, either from established ranges at Wallops Island, Virginia, Poker Flat Research Range, Alaska; White Sands Missile Range, New Mexico or from Canada, Norway and Sweden. Many times launches are conducted from temporary launch ranges in remote parts of the world requi6ng considerable expense to transport and operate tracking radars. An inverse differential GPS system has been developed for Sounding Rocket. This paper addresses the NASA Wallops Island history of GPS Sounding Rocket experience since 1994 and the development of a high accurate and useful system.
Derived from text
Global Positioning System; Sounding Rockets; Fabrication; Launch Vehicles; Accuracy

19990068037 GenCorp Aerojet, Sacramento, CA USA
Design of a Novel Gaseous Hydrogen-Oxygen Rocket Injector Element
Glenn, Dennis, GenCorp Aerojet, USA; 1999; In English; Fluent Users, 26 May 1999, Danvers, MA, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS8-40891; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An overview of activities supporting the design of a gaseous hydrogen-oxygen rocket injector element is presented in viewgraph form. The purpose of the research was to find a viable design for a rocket gas-gas injector that mixes fuel and oxidizer thoroughly and quickly. Computational fluid dynamics analyses were used with reacting flow to evaluate design options for mixing, temperature distribution, and combustion efficiency. A design was found that is an improvement over designs derived from liquid systems and is far better than traditional shear-coax.
CASI
Hydrogen Oxygen Engines; Rocket-Based Combined-Cycle Engines; Injectors; Rocket Engine Design; Computational Fluid Dynamics; Engine Parts; Fuel Injection

19990068449 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
2D Simulations of Hall Thrusters *Annual Report*
Fernandez, Eduardo, Stanford Univ., USA; Cappelli, Mark, Stanford Univ., USA; Mahesh, Krishnan, Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 81-90; In English; See also 19990068442; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The objectives of this work are to evaluate the modeling of electron diffusion, test the scaling mode frequency with neutral velocity and develop alternative approaches. The investigators interest is to the experimentally observed emergence of a virulent ionization instability in the current saturation part of the I-V curve for these electric propulsion engines.
CASI
Two Dimensional Models; Hall Accelerators; Hall Effect; Electric Current; Electron Diffusion

19990069944 Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA USA
Reusable Rocket Engine Advanced Health Management System. Architecture and Technology Evaluation: Summary
Pettit, C. D., Boeing Co., USA; Barkhoudarian, S., Boeing Co., USA; Daumann, A. G., Jr., Boeing Co., USA; Provan, G. M., Rockwell International Science Center, USA; ElFattah, Y. M., Rockwell International Science Center, USA; Glover, D. E., Intel-

ligent Systems Technology, Inc., USA; 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-45000
Report No.(s): AIAA Paper 99-2527; Copyright; Avail: Issuing Activity, Hardcopy

In this study, we proposed an Advanced Health Management System (AHMS) functional architecture and conducted a technology assessment for liquid propellant rocket engine lifecycle health management. The purpose of the AHMS is to improve reusable rocket engine safety and to reduce between-flight maintenance. During the study, past and current reusable rocket engine health management-related projects were reviewed, data structures and health management processes of current rocket engine programs were assessed, and in-depth interviews with rocket engine lifecycle and system experts were conducted. A generic AHMS functional architecture, with primary focus on real-time health monitoring, was developed. Fourteen categories of technology tasks and development needs for implementation of the AHMS were identified, based on the functional architecture and our assessment of current rocket engine programs. Five key technology areas were recommended for immediate development, which (1) would provide immediate benefits to current engine programs, and (2) could be implemented with minimal impact on the current Space Shuttle Main Engine (SSME) and Reusable Launch Vehicle (RLV) engine controllers.
Author
Health; Medical Services; Telemedicine; Information Systems; Management Systems

19990069945 Boeing Co., Huntington Beach, CA USA
Solar Thermal Upper Stage Cryogen System Engineering Checkout Test
Olsen, A. D, Boeing Co., USA; Cady, E. C., Boeing Co., USA; Jenkins, D. S., Boeing Co., USA; 1999; 14p; In English; 35th; Joint Propulsion, 20-23 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC8-61
Report No.(s): AIAA Paper 99-2604; Copyright; Avail: Issuing Activity, Hardcopy

The Solar Thermal Upper Stage technology (STUSTD) program is a solar thermal propulsion technology program cooperatively sponsored by a Boeing led team and by NASA MSFC. A key element of its technology program is development of a liquid hydrogen (LH2) storage and supply system which employs multi-layer insulation, liquid acquisition devices, active and passive thermodynamic vent systems, and variable 40W tank heaters to reliably provide near constant pressure H2 to a solar thermal engine in the low-gravity of space operation. The LH2 storage and supply system is designed to operate as a passive, pressure fed supply system at a constant pressure of about 45 psia. During operation of the solar thermal engine over a small portion of the orbit the LH2 storage and supply system propulsively vents through the enjoy at a controlled flowrate. During the long coast portion of the orbit, the LH2 tank is locked up (unvented). Thus, all of the vented H2 flow is used in the engine for thrust and none is wastefully vented overboard. The key to managing the tank pressure and therefore the H2 flow to the engine is to manage and balance the energy flow into the LH2 tank with the MLI and tank heaters with the energy flow out of the LH2 tank through the vented H2 flow. A moderate scale (71 cu ft) LH2 storage and supply system was installed and insulated at the NASA MSFC Test Area 300. The operation of the system is described in this paper. The test program for the LH2 system consisted of two parts: 1) a series of engineering tests to characterize the performance of the various components in the system: and 2) a 30-day simulation of a complete LEO and GEO transfer mission. This paper describes the results of the engineering tests, and correlates these results with analytical models used to design future advanced Solar Orbit Transfer Vehicles.
Author
Liquid Hydrogen; Cryogenic Rocket Propellants; Cryogenics; Liquid Fuels; Solar Thermal Propulsion; Propulsion System Performance; Systems Engineering; Checkout

23
CHEMISTRY AND MATERIALS (GENERAL)

19990064571 Iowa State Univ. of Science and Technology, Dept. of Mechanical Engineering, Ames, IA USA
Miscibility, Solubility, Viscosity, and Density Measurements for R-236ea with Four Different Exxon Lubricants ***Final Report, Mar. 1995 - Mar. 1997***
Kang, H. M.; Pate, M. B.; Jun. 15, 1999; 86p; In English
Report No.(s): PB99-150302; EPA/600/R-99/052; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

The report discusses miscibility, solubility, viscosity, and density data for the refrigerant hydrofluorocarbon (HFC)-236ea (or R-236ea) and four lubricants supplied by Exxon Corporation. The miscibility tests were performed in a test facility consisting

of a series of miniature test cells submerged in a constant temperature bath, precisely controlled over a range of -50 to 90 C. Critical solution temperatures obtained from the miscibility data are presented for each refrigerant/lubricant combination. Data for the R-236ea in each of the test lubricants have been collected for refrigerant concentrations of 10-90%. The raw data have been presented, and the results have been summarized. Solubility, viscosity, and density data were also obtained for R-236ea mixed with the same four oils for a refrigerant concentration range of 0-40 wt% refrigerant over a temperature range of 30-100 C.
NTIS
Solubility; Viscosity; Density Measurement; Lubricants

19990064638 Naval Academy, Dept. of Physics, Annapolis, MD USA
Dynamics in Propylene Carbonate and Propylene Carbonate Containing LiPF6
Fontanella, J. J.; Wintersgill, M. C.; Immel, J. J.; Jul. 01, 1999; 37p; In English; Prepared for publication in Journal of Chemical Physics.
Contract(s)/Grant(s): N00014-99-AF-00002; Proj-99PRO4042-00
Report No.(s): AD-A365189; TR-20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Electrical Conductivity and differential scanning calorimetry studies (DSC) have been carried out on 1 M LiPF6 in propylene carbonate (PC) from 187 to 296 K. The electrical conductivity data are analyzed in terms of Vogel-Tammann-Fulcher (VTF), Williams-Landel-Ferry (WLF) and Bendler-Shlesinger (BENSH) formalisms. In addition, literature data for viscosity and relaxation times for PC (not containing salt) are analyzed using the same formalisms. Large, systematic variations are found in both the VTF and WLF fitting parameters with temperature interval. The large variation of the parameters with temperature demonstrates the failure of both formalisms and shows that care must be taken when utilizing the VTF/WLF parameters to draw conclusions concerning the behavior of systems. One conclusion which can be reached is that the VTF results indicate a significant difference between the molecular motions in PC and PC-containing LiPF6. Another is that the WLF parameter, C1 is about 11 for low temperature data, referenced to the DSC glass transition temperature, T(sub g), which shows that for PC and PC-based liquids the value of all three dynamical quantities at T(sub g) is about 11 decades smaller than the value predicted for very high temperatures. Finally, all data are found to be better fit by the BENSH equation.
DTIC
Electrical Resistivity; Lithium Compounds; Organic Compounds; Heat Measurement; Propylene; Carbonates; Phosphorus Compounds

19990066693 Charles Univ., Prague, Stredocesky, Czechoslovakia
Pyrylium and Pyridinium Compounds and Porphyrin Complexes for 2-D Molecular Grids ***Final Report***
Pecka, Jaroslav, Charles Univ., Prague, Czechoslovakia; May 1999; 12p; In English
Contract(s)/Grant(s): F61775-98-W-E008
Report No.(s): AD-A365330; EOARD-SPC-98-4018; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report results from a contract tasking Department of Organic Chemistry, Charles University as follows: The contractor will investigate the preparation of improved compounds in particular, more strictly linear couplers than currently available expected to be useful in the construction of regular planar molecular grids.
DTIC
Amines; Organic Compounds; Porphyrins

24
COMPOSITE MATERIALS

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

19990064363 NASA Glenn Research Center, Cleveland, OH USA
Characterizing the Properties of a Woven SiC/SiC Composite Using W-CEMCAN Computer Code
Murthy, Pappu L. N., NASA Glenn Research Center, USA; Mital, Subodh K., Toledo Univ., USA; DiCarlo, James A., NASA Glenn Research Center, USA; June 1999; 20p; In English
Contract(s)/Grant(s): NCC3-524; RTOP 537-04-22
Report No.(s): NASA/TM-1999-209173; NAS 1.15:209173; E-11680; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A micromechanics based computer code to predict the thermal and mechanical properties of woven ceramic matrix composites (CMC) is developed. This computer code, W-CEMCAN (Woven CEramic Matrix Composites ANalyzer), predicts the properties of two-dimensional woven CMC at any temperature and takes into account various constituent geometries and volume fractions. This computer code is used to predict the thermal and mechanical properties of an advanced CMC composed of 0/90 five-harness (5 HS) Sylramic fiber which had been chemically vapor infiltrated (CVI) with boron nitride (BN) and SiC interphase coatings and melt-infiltrated (MI) with SiC. The predictions, based on the bulk constituent properties from the literature, are compared with measured experimental data. Based on the comparison. improved or calibrated properties for the constituent materials are then developed for use by material developers/designers. The computer code is then used to predict the properties of a composite with the same constituents but with different fiber volume fractions. The predictions are compared with measured data and a good agreement is achieved.
Author
Ceramic Matrix Composites; Woven Composites; Chemical Vapor Infiltration; Silicon Carbides

19990064364 NASA Glenn Research Center, Cleveland, OH USA
Novel Approach for Positioning Sensor Lead Wires on SiC-Based Monolithic Ceramic and FRCMC Components/Subcomponents Having Flat and Curved Surfaces
Kiser, J. Douglas, NASA Glenn Research Center, USA; Singh, Mrityunjay, DYNACS Engineering Co., Inc., USA; Lei, Jin–Fen, NASA Glenn Research Center, USA; Martin, Lisa C., NASA Glenn Research Center, USA; June 1999; 20p; In English
Contract(s)/Grant(s): RTOP 523-21-13
Report No.(s): NASA/TM-1999-209197; NAS 1.15:209197; E-11712; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A novel attachment approach for positioning sensor lead wires on silicon carbide-based monolithic ceramic and fiber reinforced ceramic matrix composite (FRCMC) components has been developed. This approach is based on an affordable, robust ceramic joining technology, named ARCJoinT, which was developed for the joining of silicon carbide-based ceramic and fiber reinforced composites. The ARCJoinT technique has previously been shown to produce joints with tailorable thickness and good high temperature strength. In this study, silicon carbide-based ceramic and FRCMC attachments of different shapes and sizes were joined onto silicon carbide fiber reinforced silicon carbide matrix (SiC/ SiC) composites having flat and curved surfaces. Based on results obtained in previous joining studies. the joined attachments should maintain their mechanical strength and integrity at temperatures up to 1350 C in air. Therefore they can be used to position and secure sensor lead wires on SiC/SiC components that are being tested in programs that are focused on developing FRCMCs for a number of demanding high temperature applications in aerospace and ground-based systems. This approach, which is suitable for installing attachments on large and complex shaped monolithic ceramic and composite components, should enhance the durability of minimally intrusive high temperature sensor systems. The technology could also be used to reinstall attachments on ceramic components that were damaged in service.
Author
Ceramic Matrix Composites; Reinforcing Fibers; Woven Composites; Silicon Carbides

19990064377 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Inclusion of In-Plane Stresses in Delamination Criteria
Fenske, Matthew T., NASA Goddard Space Flight Center, USA; 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy

A study of delamination failure was conducted with emphasis on delamination criteria. Evidence is presented which supports the inclusion of the in-plane stresses in addition to the interlaminar stress terms in delamination criteria. The delamination is characterized as the failure of a resin rich region in between ply sets. The entire six component stress state in this resin layer is calculated through a finite element analysis, averaged over a dimension of 1.75 ply thicknesses, and used in a Modified von Mises Delamination Criterion. This criterion builds onto previous criteria by including all six stress components in the interply resin layer. The MVMDC shows good correlation to experimental data. The results show that the treatment of delamination as the failure of a finite interply resin layer is a valid method and that the MVMDC, considering the full stress state, accurately indicates delamination for different laminate families.
Author
Delaminating; Interlaminar Stress; Laminates; Failure Analysis; Plane Stress; Plane Strain

19990064447 NASA Goddard Space Flight Center, Greenbelt, MD USA
Mechanical Behavior of Fabric-Film Laminates
Said, Magdi S., NASA Goddard Space Flight Center, USA; 1999; 3p; In English; ANTEC99, 2-6 May 1999, New York, NY, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Inflatable structures are gaining wide support in planetary scientific missions as well as commercial applications. For such applications a new class of materials made of laminating thin homogenous films to lightweight fabrics are being considered us structura1 gas envelops. The emerging composite materials are a result of recent advances in the manufacturing cf 1ightweight, high strength fibers, fabrics and scrims. The lamination of these load-carrying members with the proper gas barrier film results in wide range of materials suitable for various loading and environmental conditions. Polyester - based woven fabrics laminated to thin homogeneus film of polyester (Maylar) is an example of this class. This fabric/ film laminate is being considered for the development a material suitable for building large gas envelopes for use in the NASA Ultra Long Duration Balloon Program (ULDB). Compared to commercial homogeneus films, the material provides relatively high strength to weight ratio as well as better resistance to crack and tear propagation. The purpose of this papers is to introduce the mechanical behavior of this class of multi-layers composite and to highlight some of the concerns observed during the characterization of these laminate composites.
Author
Fabrics; Crack Propagation; Laminates; Loads (Forces); Manufacturing; Mechanical Properties; Polyesters

19990064497 Arizona Univ., Dept. of Aerospace and Mechanical Engineering, Tucson, AZ USA
Development of Analysis Methods for Designing with Composites
Madenci, E., Arizona Univ., USA; July 1999; 15p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-1652; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The project involved the development of new analysis methods to achieve efficient design of composite structures. We developed a complex variational formulation to analyze the in-plane and bending coupling response of an unsymmetrically laminated plate with an elliptical cutout subjected to arbitrary edge loading as shown in Figure 1. This formulation utilizes four independent complex potentials that satisfy the coupled in-plane and bending equilibrium equations, thus eliminating the area integrals from the strain energy expression. The solution to a finite geometry laminate under arbitrary loading is obtained by minimizing the total potential energy function and solving for the unknown coefficients of the complex potentials. The validity of this approach is demonstrated by comparison with finite element analysis predictions for a laminate with an inclined elliptical cutout under bi-axial loading.The geometry and loading of this laminate with a lay-up of [-45/45] are shown in Figure 2. The deformed configuration shown in Figure 3 reflects the presence of bending-stretching coupling. The validity of the present method is established by comparing the out-of-plane deflections along the boundary of the elliptical cutout from the present approach with those of the finite element method. The comparison shown in Figure 4 indicates remarkable agreement. The details of this method are described in a manuscript by Madenci et al. (1998).
Derived from text
Prediction Analysis Techniques; Composite Structures; Stress Analysis; Plates (Structural Members); Deformation

19990064507 NASA Marshall Space Flight Center, Huntsville, AL USA
Nanoporous Silica Thermal Insulation for Space Shuttle Cryogenic Tanks: A Case Study
Noever, David A., NASA Marshall Space Flight Center, USA; 7th International Conference on Molecular Nanotechnology Proceedings; 1999; 1p; In English; 7th; Molecular Nanotechnology, 1 Jun. 1999, Palo Alto, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Nanoporous silica (with typical 10-50 nm porous radii) has been benchmarked for thermal insulators capable of maintaining a 150 K/cm temperature gradient. For cryogenic use in aerospace applications, the combined features for low-density, high thermal insulation factors, and low temperature compatibility are demonstrated in a prototype sandwich structure between two propulsion tanks. Theoretical modelling based on a nanoscale fractal structure suggest that the thermal conductivity scales proportionally (exponent, 1.7) with the material density-lower density increases the thermal insulation rating. Computer simulations, however, support the optimization tradeoff between material strength (Young moduli, proportional to density with exponent, 3.7), the characteristic (colloidal silica, less than 5 nm) particle size, and the thermal rating. The results of these simulations indicate that as nanosized particles are incorporated into the silica backbone, the resulting physical properties will be tailored by the smallest characteristic length and their fractal interconnections (dimension and fractal size). The application specifies a prototype panel which takes advantage of the processing flexibility inherent in sol-gel chemistry.
Author
Silicon Dioxide; Porosity; Thermal Insulation; Sandwich Structures; Mechanical Properties; Computerized Simulation

19990064528 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA
Damage Tolerance of Sandwich Plates with Debonded Face Sheets
Avery, John L., III, Florida Univ., USA; Sankar, Bhavani V., Florida Univ., USA; [1998]; 32p; In English

Contract(s)/Grant(s): NAG1-1887; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Axial compression tests were performed on debonded sandwich composites made of graphite/epoxy face-sheets and aramid fiber honeycomb core. The sandwich beams were manufactured using a vacuum baccrin2 process. The face-sheet and the sandwich beam were co-cured. Delamination between one of the face sheets and the core was introduced by using a Teflon layer during the curing process. Axial compression tests were performed to determine the ultimate load carrying capacity of the debonded beams. Flatwise tension tests and Double Cantilever Beam tests were performed to determine. respectively, the strength and fracture toughness of the face-sheet/core interface. From the test results semi-empirical formulas were derived for the fracture toughness and ultimate compressive load carrying capacity in terms of the core density. core thickness. face-sheet thickness and debond length. Four different failure modes and their relation to the structural properties were identified. Linear buckling analysis was found to be inadequate in predicting the compressive load carrying capacity of the debonded sandwich composites.
Author

Damage; Tolerances (Mechanics); Sandwich Structures; Compression Tests; Compressive Strength; Compression Loads; Graphite-Epoxy Composites

19990064576 NASA Langley Research Center, Hampton,VA USA

An Experimental Study of a Stitched Composite with a Notch Subjected to Combined Bending and Tension Loading

Palmer, Susan O., NASA Langley Research Center, USA; Nettles, Alan T., NASA Langley Research Center, USA; Poe, C. C., Jr., NASA Langley Research Center, USA; August 1999; 31p; In English; Original contains color illustration

Contract(s)/Grant(s): RTOP 538-10-11-05

Report No.(s): NASA/TM-1999-209511; L-17884; NAS 1.15:209511; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A series of tests was conducted to measure the strength of stitched carbon/epoxy composites containing through-thickness damage in the form of a crack-like notch. The specimens were subjected to three types of loading: pure bending, pure tension, and combined bending and tension loads. Measurements of applied loads, strains near crack tips, and crack opening displacements (COD) were monitored in all tests. The transverse displacement at the center of the specimen was measured using a Linear Variable Differential Transformer (LVDT). The experimental data showed that the outer surface of the pure tension specimen failed at approximately 6,000 microstrain, while in combined bending and tension loads the measured tensile strains reached 10,000 microstrain.
Derived from text

Crack Opening Displacement; Epoxy Matrix Composites; Notches; Bending

19990064648 NASA Marshall Space Flight Center, Huntsville, AL USA

Composites for Cryotank Structures. Present and Future: MSFC Perspective

Vaughn, Timothy P., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 10th; Advanced Aerospace Materials and Processes, 21-24 Jun. 1999, Dayton, OH, USA

Contract(s)/Grant(s): NCC8-81; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The development of reusable launch vehicle systems for a single stage to orbit vehicle requires vehicles at liftoff with 85% to 94% of its mass consisting exclusively of propellants. These dry mass requirements drive designs to utilize stronger, lighter weight materials for structures. This technology development focus has allowed the introduction of composite materials in lieu of conventional metallic materials due to their higher specific strengths. Composite materials were successfully used for the liquid hydrogen tanks for the DC-XA, and a multi-lobed liquid hydrogen tank will be employed for the X-33. Another potential non-traditional application for composite materials is for liquid oxygen tanks, which is still being investigated. Traditionally, organic materials have been avoided wherever possible, due the potential fire hazard and the fact that composites fail conventional oxygen compatibility requirements. However, the potential weight savings warrant the investigation of the use of polymeric composite materials in oxygen environments. Since composites fail the conventional, time-proven test methods because they are considered flammable by test, we have embarked on an innovative approach to oxygen compatibility testing and evaluation focused on the use environments and attempts to eliminate or ”design away” all potential ignition sources. Oxygen compatibility is defined as the ability of a material to coexist with oxygen and potential ignition sources with an acceptable, manageable degree of risk.
Author

X-33 Reusable Launch Vehicle; Liquid Propellant Rocket Engines; Single Stage to Orbit Vehicles; Storage Tanks; Space Storage; Fuel Tanks; Propellant Tanks; Propellant Storage; Storable Propellants

19990067254 Sensor Systems Group, Inc., Wilmington, MA USA

Ultralightweight, Low Expansion, Fiber Reinforced SiC Composite Lithography Stage ***Final Report, 17 Dec. 1998 - 17 Jun. 1999***

Robichaud, Joseph L.; Jun. 17, 1999; 32p; In English

Contract(s)/Grant(s): DAAH01-99-C-R055

Report No.(s): AD-A364675; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

During our Phase I SBIR, SSG has integrated a number of advanced Silicon Carbide (SiC) materials to produce an innovative, lightweight, fracture tough, dimensionally stable, composite mask platen for use on an SVGL Micralign instrument. The fiber reinforced SiC material used has several critical advantages when compared to other competing materials: significantly improved lightweighting (SiC provides a specific stiffness which can be 8x better than aluminum, 8x better than Zerodur, and 2x better than carbon fiber/graphite epoxy based composite materials); excellent long term dimensional stability (through low CTE and no moisture absorption); superior damping (20x better than aluminum 2x better than carbon fiber/graphite epoxy). All of these advantages combine to yield an optimal material for high speed translation stage applications. During our Phase I SBIR SSG has designed, modeled, fabricated, and tested an ultralightweight composite SiC reticle platen which is currently being integrated onto an SVGL Micralign instrument. The platen is ultralightweight (4 lbs with overall dimensions of approx. 18” x 10” x 1.5”) and stiff (first resonant mode at 770 Hz), and meets all of SVG’s operational and functional requirements. SVGL has supported our Phase I effort by provided co-funding during Phase I, this support is intended to continue through Phase II.

DTIC

Fiber Composites; Silicon Carbides; Photolithography

19990069900 NASA Marshall Space Flight Center, Huntsville, AL USA

C/SiC Component & Material Analysis, Attachment Verification, & Blisk Turbopump Testing

Effinger, Michael R., NASA Marshall Space Flight Center, USA; Genge, Gary, NASA Marshall Space Flight Center, USA; Gregg, Wayne, NASA Marshall Space Flight Center, USA; Jordan, William, NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; Composite Materials and Structures, 25-29 Jan. 1999, Cocoa Beach, FL, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Ceramic composite blisk components constructed of carbon fibers & silicon carbide ceramic matrix have been fabricated and tested. Room and cryogenic torque testing have verified the attachment configuration. The polar and quasi-isotropic blisks have been proof spun, balanced, and tested in the Simplex turbopump. Foreign particle impact analysis was conducted for C/SiC. Data and manufacturing lessons learned are significantly benefiting the development of the Reusable Launch Vehicle’s ceramic matrix composite integrally bladed disk.

Author

Ceramic Matrix Composites; Silicon Carbides; Turbine Pumps

19990069916 Feng Chia Univ., Dept. of Textile Engineering, Taichung, Taiwan, Province of China

Crushing Characteristics of 3-D Braided Composite Square Tubes

Chiu, C. H., Feng Chia Univ., Taiwan, Province of China; Lu, C. K., Feng Chia Univ., Taiwan, Province of China; Wu, C. M., National Sun Yat-Sen Univ., China; Journal of Composite Materials; 1997; ISSN 0021-9983; Volume 31, No. 22, pp. 2309-2327; In English

Contract(s)/Grant(s): NSC 85-2216-E-035-018

Report No.(s): LC-68-7102; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Although textile composites have been studied for some time, the crushing failure modes and energy absorption data have been limited. In this study, static crushing tests were conducted on 3-D carbon/epoxy and Kevlar/epoxy braided composite square tubes to investigate the failure modes and energy absorption capability of those materials. During crushing test the carbon/epoxy braided composite square tubes sprayed first, then bent until final failure. In contrast, the Kevlar/epoxy braided composite square tubes exhibited a stable progressive folding failure. The failure modes of the crush tests of carbon/epoxy braided composite tubes included compressive shear failure, bending, local buckling of the axials, shear and tensile failure of the braiders, matrix crush, interface debonding and open mode crack propagation. The specific energy absorption capability of carbon braided composite tube is higher than Keviar braided composite tube, but Kevlar tube has good post-crush structural integrity. In the 3-D braided composite tubes, the axial yarns are the main supplier for energy absorption whereas the braider yarns determine the crushing failure mode.

Author

Crushing; Three Dimensional Composites; Experimentation; Energy Absorption; Crack Propagation; Failure Modes; Pipes (Tubes)

19990069917 Wyoming Univ., Composite Materials Research Group, Laramie, WY USA

Analysis of Thickness-Tapered Unidirectional Composite Compression Specimens

Adams, Donald F., Wyoming Univ., USA; Finley, Garth A., Wyoming Univ., USA; Journal of Composite Materials; 1997; ISSN 0021-9983; Volume 31, No. 22, pp. 2283-2308; In English

Contract(s)/Grant(s): FAA-94-G-009

Report No.(s): LC-68-7102; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Four different thickness-tapered compression specimen geometries were modeled using a three-dimensional finite element analysis. Shear-. end-, and combined- loading conditions were used to simulate specimen testing in the Illinois Institute of technology Research Institute (IITRI) and the Wyoming End-Loaded, Side-Supported (ELSS) compression test fixtures. Both carbon/epoxy and glass/epoxy unidirectional composite materials were simulated. From the results of twelve finite element analysis models, predictions were made concerning optimum thickness-tapered compression specimen geometry and the influence of loading conditions. These predictions were then correlated with experimental results for axial compressive strength, modulus, and failure modes in thickness-tapered Hercules AS4/3501-6 carbon/epoxy and CYTEC S2/5216 glass/epoxy, unidirectional composite specimens.

Author

Specimen Geometry; Thickness; Failure Modes; Epoxy Matrix Composites; Compressive Strength; Compression Tests

19990069918 Samsung Electronics Co. Ltd., Seoul, Korea, Republic of

Development of an Autoclave Cure Cycle with Cooling and Reheating Steps for Thick Thermoset Composite Laminates

Kim, Jin Soo, Samsung Electronics Co. Ltd., Korea, Republic of; Lee, Dai Gil, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Journal of Composite Materials; 1997; ISSN 0021-9983; Volume 31, No. 22, pp. 2264-2282; In English

Report No.(s): LC-68-7102; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this study, an autoclave cure cycle for thick thermosetting resin matrix composite materials was developed to reduce the temperature overshoot. To predict the temperature distribution of thick thermosetting composite laminates during cure, the heat transfer equation, including the heat generation term, was simulated by the finite difference method (FDM). Using the simulated results, the cure cycle was obtained by modifying the conventional cure cycle. The steps of cooling and reheating, which were determined by the cure rate and temperature at the midpoint of the laminate, were introduced into the conventional cure cycle. The developed cure cycle was used to cure 15 and 30 mm (100 and 200 ply) thick laminates and was found to be effective for the reduction of temperature overshoot.

Author

Autoclaves; Heating; Laminates; Thermosetting Resins

19990069919 Iowa Univ., Dept. of Biomedical Engineering, Iowa City, IA USA

Moisture Ingression In Honeycomb Core Sandwich Panels: Directional Aspects

Cise, D. M., Iowa Univ., USA; Lakes, R. S., Iowa Univ., USA; Journal of Composite Materials; 1997; ISSN 0021-9983; Volume 31, No. 22, pp. 2249-2262; In English

Report No.(s): LC-68-7102; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Moisture ingression was studied in several composite sandwich panels.No observable ingression was found in a panel with HRP core of density 0.13 g/cc (8.0 lb/ft'). Significant moisture ingression occurred in a panel with Korex 3.0-lb core with density 0,048 g/cc, (3.0 lb/cu ft). It was as faster in the Y-axis (core ribbon) direction, per unit distance than in other directions.

Author

Moisture; Honeycomb Cores; Experimentation

19990070340 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA

Thermoelastic Behavior of PEEK Thermoplastic Composite During Cooling from Forming Temperatures

Wang, C., Purdue Univ., USA; Sun, C. T., Purdue Univ., USA; Journal of Composite Materials; 1997; ISSN 0021-9983; Volume 31, No. 22, pp. 2230-2248; In English

Contract(s)/Grant(s): NSF CDR-88-03017

Report No.(s): LC-68-7102; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In the forming of advanced thermoplastic composite structures, the stresses generated during cooling have a profound effect on the distortion and strength of the formed parts. In this paper, the thermoelastic behavior of a PEEK matrix thermoplastic composite during cooling was investigated. A procedure for determining temperature dependent thermal expansion coefficients using off-axis composite specimens was introduced. A simple thermoelastic constitutive model was used to calculate thermal stresses

during cooling. Based on this model, an explanation of a strong scissoring effect on the thermal expansion behavior of symmetric [+/- 45](sub ns) laminates and a calculation of warping in a non-symmetric laminate were presented.
Author
Thermoelasticity; Cooling; Temperature Dependence; PEEK; Mathematical Models; Thermal Expansion; Coefficients

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.

19990064418 Old Dominion Univ., Norfolk, VA USA
Measurement of Oxygen A Band Line Parameters by Using Modulation Spectroscopy with Higher Harmonic Detection ***Final Report, Period ending 16 Mar. 1999***
Dharamsi, Amin, Old Dominion Univ., USA; 1999; 19p; In English
Contract(s)/Grant(s): NAG1-1869
Report No.(s): ODURF-170251; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Wavelength modulation spectroscopy is used to demonstrate that extremely weak absorption lines can be measured even when these lines suffer from interference from the wings of adjacent stronger lines. It is shown that the use of detection at several harmonics allows such interference to be examined clearly and conveniently. The results of experimental measurements on a weak magnetic dipole driven, spin-forbidden line in the oxygen A band, which experiences interference from the wings of a pair of adjacent lines towards the blue and red regions of line center, are presented. A comparison of the experimental results to theory is given.
Author
Oxygen; Modulation; Harmonics; Magnetic Dipoles; Line Spectra

19990064470 Naval Academy, Dept. of Physics, Annapolis, MD USA
Complex Impedance Studies of Proton-Conducting Membranes, ***1 Jun. 1998 - 31 May 1999***
Edmondson, C. A.; Stallworth, P. E.; Chapman, M. E.; Wintersgill, M. C.; Fontanella, J. J.; Jul. 01, 1999; 16p; In English
Contract(s)/Grant(s): N00014-99-A-F00002
Report No.(s): AD-A365266; TR-19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Complex impedance studies have been carried out on Dow 800, Dow 1000 and Nafion 117 membranes at various water contents and a variety of temperatures and pressures. At room temperature and pressure a gradual decrease in electrical conductivity with decreasing water content is observed. Apparent activation volumes as large as 54 cm3/mol are obtained. In addition, there is a tendency for smaller equivalent weights (same side chains) or larger side chains to have larger activation volumes. Additionally, ambient-pressure, variable-temperature 2H T1 and linewidth measurements imply a heterogeneous environment of the water molecules. Proton pulsed field gradient NMR studies in saturated Dow membranes verify the expectation that ionic conductivity is determined primarily by diffusion of water molecules.
DTIC
Impedance; Protons; Membranes

19990064475 Clemson Univ., Dept. of Chemical Engineering, SC USA
Supercritical Fluid Extraction for High Thermal Conductivity Carbon Fibers ***Final Report, Sep. 1994 - Feb. 1999***
Thies, Mark C.; Mar. 28, 1999; 17p; In English
Contract(s)/Grant(s): DAAH04-94-G-0244
Report No.(s): AD-A365287; ARO-33506.20-MS-DPS; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The goal of this project was to evaluate the potential of supercritical extraction (SCE) for producing a high-quality mesophase suitable for conversion into high-performance carbon fibers with excellent thermal and/or mechanical properties. Mesophase pitch fractions were produced by fractionation of an isotropic pitch with supercritical toluene in a region of liquid-liquid equilibrium. Results indicate that SCE provides greater product flexibility and uses less solvent than conventional solvent extraction. In particular, several 100% mesophase fractions with significantly different yields, softening points, and chemical compositions were made. Selected supercritically extracted mesophase fractions were melt-spun into both round and ribbon-shaped fibers. To facilitate the evaluation of these mesophases, a new method (i.e., Z-values by WAXD) was investigated for predicting the properties of final fibers from those of as-spun fibers. Lower Z-values of as-spun fibers yielded, upon identical heat treatment, improve-

ments in tensile properties, crystallographic parameters, and thermal conductivities for the associated final fibers. Even though the heat treatment of the as-spun fibers was not optimized, final fibers with thermal conductivities equal to Amoco's P- 120 fibers were produced by graphitizing at only 2400 C. Finally, a preliminary design analysis indicates that producing mesophase by SCE is economically competitive with today's best commercial processes.
DTIC
Supercritical Fluids; Thermal Conductivity; Carbon Fibers; Solvent Extraction

19990064476 Naval Academy, Dept. of Physics, Annapolis, MD USA
Electrical Conductivity and NMR Studies of PEG and PPG Containing Lithium Salts, *1 Jun. 1998 - 31 May 1999*
Fontanella, J. J.; Wintersgill, M. C.; Stallworth, P. E.; Newman, S. A.; Chung, S. H.; Jul. 01, 1999; 16p; In English
Contract(s)/Grant(s): N00014-99-WK-20433; N00014-99-AF-00002
Report No.(s): AD-A365289; TR-21; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Complex impedance, differential scanning calorimetry (DSC) and 7Li nuclear magnetic resonance (NMR) studies have been carried out on electrolytes such as poly(propylene glycol) (PPG) and poly(ethylene glycol) mono-methyl-ether (PEG) containing lithium salts. The impedance studies were made over a range of frequencies, temperatures and pressures and were used to obtain values of electrical conductivity. It is shown that the Bendler-Shlesinger (BENSH) formalism is a better representation of the data than the Vogel-Tammann-Fulcher (VTF) equation (or mathematically equivalent Williams-Landel-Ferry (WLF) equation). For both the PEG and PPG based electrolytes the electrical conductivity decreases as pressure increases and the activation volume decreases strongly as temperature increases. However, the activation volume is smaller for the PEG based material and the curvature is opposite for the two materials. All results for the electrolytes are explained qualitatively in terms of free volume.
DTIC
Electrical Resistivity; Nuclear Magnetic Resonance; Glycols; Methyl Compounds; Lithium

19990064524 New Mexico State Univ., Dept. of Chemistry and Biochemistry, Las Cruces, NM USA
Integrated Chemical and Microorganism Monitoring of Air Using Gas Chromatography/Ion Mobility Spectometry: Toward an Expanded-Use Volatile Organic Analyzer (VOA) *Final Report*
Eiceman, G. A., New Mexico State Univ., USA; Jul. 15, 1999; 15p; In English
Contract(s)/Grant(s): NAGw-4558; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work described in this research program originated with the choice by NASA of an ion mobility spectrometer for air quality monitoring on-board the international spacestation. Though the gas chromatograph-ion mobility spectrometer analyzer known as VOA met or exceeded expectations, limitations in the basic understanding of response and the utilization of foundational principles into usable technology was considered unacceptable. In this research program, a comprehensive model for the origins of mobility spectra was proposed, tested and verified. The principles considered responsible for the appearance of mobility spectra have now been elucidated through this project. This understanding has been applied in automated identification of mobility spectra using neural networks and routine procedures for this now exist. Finally, the limitation on linear range has been shown to be a technical limitation and not a fundamental limitation so that a hardware component was crafted to extend the linear range of a mobility spectrometer by 10X. This project has led to one Ph.D. dissertation and one MS thesis. In addition, over ten public presentations at professional meetings and six journal publications have resulted from this program of research. The findings are so plentiful that total analysis of the findings may require four to six years or more. The findings confirm that the decision to use VOA was sound and that the chemical and physical principles of mobility spectrometry are both understandable and predictable.
Author
Air Quality; Gas Chromatography; Microorganisms; Spectrometers; Research

19990064569 Waterloo Univ., Ontario Canada
Biotransformation of Gasoline-Contaminated Groundwater under Mixed Electron-Acceptor Conditions *Final Report*
Barbaro, J. R.; Butler, B. J.; Barker, J. F.; Feb. 1999; 142p; In English
Report No.(s): PB99-139677; EPA/600/R-99/012; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This report summarizes research conducted using both laboratory batch microcosms and field-scale sheet-piling cells to evaluate whether bioremediation of monoaromatic fuel hydrocarbons can be enhanced using mixed rather than single electron acceptors. The studies focused on nitrate for anaerobic bioremediation and oxygen for aerobic bioremediation, and experiments were designed to test the hypothesis that low levels of oxygen may enhance biodegradation of more recalcitrant compounds (such as

benzene) under denitrifying conditions. The findings from this project are directly applicable to the field-scale remediation of subsurface environments contaminated by petroleum hydrocarbons.
NTIS
Gasoline; Contamination; Ground Water; Acceptor Materials; Electron Transfer

19990064572 Tetra Tech Environmental Management, Inc., Cincinnati, OH USA
Zenon Environmental, Inc.: ZenoGem (Trade Name) Biological and Ultrafiltration Technology. Innovative Technology Evaluation Report. Superfund Innovative Technology Evaluation
Apr. 1999; 110p; In English
Report No.(s): PB99-155251; EPA/540/R-95/503; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

Zenon Environmental Inc. (Zenon), of Burlington, Ontario, Canada had developed an innovative wastewater treatment technology called the ZenoGem (trademark) technology. The ZenoGem (trademark) technology integrates biological treatment with membrane-based ultrafiltration to treat wastewater with high concentrations of organic contaminants that cause elevated concentrations of chemical oxygen demand (COD). The Superfund Innovative Technology Evaluation (SITE) demonstration occurred between September and December 1994 at the Nascolite Superfund site (Nascolite) in Millville, Cumberland County, New Jersey. During the SITE demonstration, critical and noncritical measurements were evaluated. Critical measurements consisted of sample analyses and process measurements that directly impacted meeting the project's primary technical objective. Critical measurements included collection of liquid and air samples for MMA and VOC analyses; liquid samples to evaluate COD; and flow rate measurements of the influent and effluent liquid streams. Noncritical, or system condition measurements, provided information on operating ranges, reliability, variability, cost-effectiveness, and full-scale remediation potential of the technology.
NTIS
Biotechnology; Environmental Cleanup; Waste Water

19990064608 Utah State Univ., Logan, UT USA
Investigation of the Cleavage of the Ester Bond in Phosphate Monoesters: Enzymatic and Solution Studies of Phosphoryl Transfer Reactions and Comparison with Analogous Sulfuryl Transfer Reactions
Hoff, Richard H.; Jan. 1999; 262p; In English
Report No.(s): AD-A365158; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The phosphate ester bond is a ubiquitous species in biochemical systems. Prior studies have elucidated many details of the mechanisms by which this bond is broken. Here this system was further studied through the evaluation of the kinetics of the ester bond cleavage in solution and in enzymatic reactions. The role of solvation was explored by a series of experiments using the extrathermodynamic assumption, which allowed a detailed thermodynamic accounting for the effects of solvent on the reaction. Insights gained into the structure of the transition state through these studies were then applied to the evaluation of several enzymatic systems. The principal enzyme examined was the protein tyrosine phosphatase from Yersinia. Kinetic isotope effects, which provide information on the extent of bond cleavage and charge delocalization in the transition state, were the primary tools of this phase of the study. The mechanism was elucidated through the use of site-directed mutagenesis, which allowed the identification of key roles of particular residues in this enzyme. Further kinetic isotope effect studies were performed with the serine/threonine protein phosphatase-2C, serine/threonine protein phosphatase Lambda, and dual specific vaccinia-Hi-related enzymes for comparison with the Yersinia protein tyrosine phosphatase. The chemistry of sulfation has an important role in biochemical systems, but it is not as ubiquitous as that of phosphoryl transfer. The sulfate ester bond has long been held as a close relative of the phosphate ester bond, and it has been proposed that the mechanism of cleavage is similar in spite of a marked difference in activation parameters. In order to broaden the base of knowledge on these related mechanisms, kinetic and kinetic isotope effect studies were conducted with p-nitrophenyl sulfate to parallel many of those done with the phosphate.
DTIC
Enzyme Activity; Chemical Reactions; Sulfur Compounds; Phosphorylation; Phosphates; Enzymes; Esters; Solvation

19990064637 Colorado State Univ., Dept. of Chemistry, Fort Collins, CO USA
Sol-Gel-Based Template Synthesis and Li-Insertion Rate Performance of Nanostructured Vanadium Pentoxide
Patrissi, Charles J.; Martin, Charles R.; Jun. 01, 1999; 26p; In English
Contract(s)/Grant(s): N00014-91-J-1201
Report No.(s): AD-A365183; TR-28; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have prepared nanostructured electrodes of orthohombic V205 using the template synthesis method. These electrodes were used to investigate the effects of Li-ion diffusion distance and surface area on V2O5 rate capability. Nanowires of V2O5

were prepared by depositing a precursor into the pores of microporous polycarbonate filtration membranes. This procedure yielded an ensemble of 115 nm diameter, 2 micrometers long nanowires of V2O5 which protruded from a V2O5 surface layer like the bristles of a brush. The galvanostatic discharge performance of these nanostructured V2O5 electrodes was compared to a thin film electrode of similar V2O5 mass and geometric area. The Li(+) storage capacity of the thin film electrode was equivalent to that of the nanostructured electrode at low (C/20) discharge rates. However, at a rate of 200 C, the nanostructured electrode delivered three times the capacity of the thin film electrode. Above 500 C the nanostructured electrode delivered four times the capacity of the thin film control electrode.
DTIC
Sol-Gel Processes; Electric Batteries; Vanadium Compounds; Nanostructures (Devices); Polycarbonates; Electrodes

19990066650 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
Burner Emissions Associated with Lobed and Non-Lobed Fuel Injectors
Mitchell, M. G., California Univ., USA; Smith, L. L., California Univ., USA; Karagozian, A. R., California Univ., USA; Smith, O. I., California Univ., USA; Twenty-Seventh International Symposium on Combustion; 1998, pp. 1825-1831; In English; Combustion, 1998, Unknown; Sponsored by Combustion Inst., USA; Original contains color illustrations
Contract(s)/Grant(s): NCC2-374; N00014-93-1-1383; NASA Order H-2356; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The present experimental study examines NO(sub x), and CO emissions associated with three alternative fuel-injector geometries. These injectors mix fuel and air and strain their interfaces to differing extents and thus create different local equivalence ratios within flow regions upstream of flame ignition and stabilization. Two of the devices studied are lobed fuel injectors, in which molecular mixing of reactants is associated with streamwise vorticity generation, while the third one is a non-lobed fuel injector. Results show that rapid mixing allowed both lobed injector geometries to produce very lean premixed flame structures, with a lower achievable turn-down or fuel/air mass flux ratio than for the analogous non-lobed injector, which largely, produced distinct diffusion flames. All three injectors exhibited some level of sooting near walls and in the far-field region, with the non-lobed injector sooting to the greatest extent. At low fuel flow rates, in which the lobed injectors created locally very lean premixed conditions, there resulted lower NO(sub x) emissions as compared with non-lobed injector emissions. Yet at higher fuel-air mass flux ratios, NO(sub x) emissions from the lobed injectors were actually higher than for the nonlobed injector, likely due to reduced sooting and hence reduced radiative heat losses associated with enhanced mixing. For both lobed injector geometries examined here, CO emissions became high for low values of the fuel/air mass flux ratio, again consistent with locally premixed combustion behavior, despite the fact that fuel was injected separately from air directly into the burner test section. The present study demonstrates that, for fuel-air mixing enhancement devices, control of the local equivalence ratio is critical in order to optimize burner emissions.
Author
Fuel Injection; Injectors; Soot; Lobes; Combustion Efficiency; Combustion Products; Burners; Aircraft Engines

19990066690 Naval Academy, Dept. of Physics, Annapolis, MD USA
Pressure and Temperature Variation of the Electrical Conductivity of Poly(propylene glycol) Containing LiCF3SO3, *1 Jun. 1998 - 31 May 1999*
Fontanella, J. J., Naval Academy, USA; Jul. 01, 1999; 35p; In English
Contract(s)/Grant(s): N00014-99-AF00002
Report No.(s): AD-A365311; TR-22; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Electrical conductivity, dielectric relaxation and DSC studies have been carried out on poly(propylene glycol) (PPG, average molecular weight 1025) and PPG containing LiCF3SO3. The complex impedance studies were made at frequencies from about 1 mHz to 100 MHz at pressures up to 0.3 GPa (3 kbar) over the temperature range 215-365K. Both the complex impedance and DSC studies were carried out in vacuum or at atmospheric pressure over a temperature range of about 100-375K. The inadequacy of the widely used Vogel Tammann Filcher (VTF) or Williams Landel Ferry (WLF) equations to describe the vacuum electrical conductivity data is discussed. It is shown that the Bendler-Shlesinger (BENSH) formalism is a better representation of the data, particularly in the region close to the glass transition. The first pressure derivative of the electrical conductivity decreases strongly with temperature giving rise to a large decrease in the apparent activation volume as temperature increases.
DTIC
Electrical Resistivity; Lithium Compounds; Electric Batteries; Glycols

19990067825 NASA Marshall Space Flight Center, Huntsville, AL USA

Experimental and Numerical Investigation of Adsorption/Desorption in Packed Sorption Beds Under Ideal and Non-Ideal Flows

Mohamadinejad, H., Boeing Aerospace Co., USA; Knox, J. C., NASA Marshall Space Flight Center, USA; Smith, James E., Alabama Univ., USA; [1999]; 30p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The importance of the wall effect on packed beds in the adsorption and desorption of carbon dioxide, nitrogen, and water on molecular sieve 5A of 0.127 cm in radius is examined experimentally and with one-dimensional computer simulations. Experimental results are presented for a 22.5-cm long by 4.5-cm diameter cylindrical column with concentration measurements taken at various radial locations. The set of partial differential equations are solved using finite differences and Newman's method. Comparison of test data with the axial-dispersed, non-isothermal, linear driving force model suggests that a two-dimensional model (submitted to Separation Science and Technology) is required for accurate simulation of the average column breakthrough concentration. Additional comparisons of test data with the model provided information on the interactive effects of carrier gas coadsorption with CO2, as well as CO2-H2O interactions.

Author

Adsorption; Sorption; Computerized Simulation; Flow Velocity; Wall Flow; Partial Differential Equations; One Dimensional Flow; Mathematical Models

19990068443 Stanford Univ., Center for Turbulence Research, Stanford, CA USA

Direct Numerical Simulation of Turbulent Non-Premixed Combustion with Realistic Chemistry ***Annual Report***

Bushe, W. K., Stanford Univ., USA; Bilger, R. W., Sydney Univ., Australia; Annual Research Briefs, 1998; December 1998, pp. 3-22; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Combustion is an important phenomenon in many engineering applications; combustion of hydrocarbons is still by far the most common source of energy in the world. In virtually every application of combustion processes, the flow in which the chemical reactions are taking place is turbulent. Furthermore, the combustion process itself is usually described by a very large system of elementary chemical reactions. These chemical kinetic mechanisms are usually extremely stiff and involve, for long-chain hydrocarbon species, perhaps hundreds of chemical species (which, if the combustion process is to be completely simulated, implies a need to solve hundreds of partial differential equations simultaneously). The governing equations describing the chemical composition are closely coupled to those describing the turbulent transport. Also, the chemical reaction rates are non-linear and strongly depend on the instantaneous composition and temperature. For these reasons, a full understanding of the many processes at work in devices such as furnaces, diesel engines, and gas turbines has been lacking. In this present study, a reduced kinetic mechanism has been incorporated into a fully compressible DNS (Direct Numerical Simulation) code. The results of the simulations will be used for the validation and, hopefully, improvement of current combustion models.

Derived from text

Combustion Physics; Combustible Flow; Turbulent Combustion; Turbulent Flow; Turbulence Models; Direct Numerical Simulation; Computational Fluid Dynamics; Large Eddy Simulation

19990068446 Stanford Univ., Center for Turbulence Research, Stanford, CA USA

Direct Simulation of a Jet Diffusion Flame ***Annual Report***

Boersma, B. J., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 47-56; In English; See also 19990068442; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this project we aim to perform a numerical simulation of a non-premixed turbulent diffusion flame. The objective is to shed light on one of the important processes in combustion that have been mentioned above, namely turbulent mixing, which is an essential link in the modeling of combustion. In the past researchers and designers have used so-called Reynolds-averaged turbulence models to predict the combustion in various appliances. However, these models have their weaknesses, especially in the complicated environment of a flame, and they have, in general, failed to produce acceptable results. A factor contributing to this failure has been the fact that it is very difficult to perform measurements in the hostile environment of a combustion flame, and such measurements are needed for validating and developing turbulence models. Therefore, the problem of turbulent mixing within the combustion process is to be considered as unsolved. Recently, new methods have become available for combustion research as a result of increasing computer power (especially due to the appearance of parallel computers). Two very powerful new methods are direct numerical simulation (DNS) and large eddy simulation (LES). The first technique (DNS) solves the governing equations for the combustion without any model. In the second method, a model is used for the small scales of motion. The first method is computationally very expensive but gives in general very reliable results. The second method (LES) is much

cheaper, but the modeling of the small scales introduces an error. In this paper we will use DNS; there is also LES and experimental work going on for the same problem.
Derived from text
Direct Numerical Simulation; Computational Fluid Dynamics; Turbulent Flow; Turbulence Models; Reynolds Averaging; Large Eddy Simulation; Premixed Flames; Turbulent Flames; Turbulent Diffusion; Turbulent Mixing; Reacting Flow

19990068447 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
On the use of Interpolating Wavelets in the Direct Numerical Simulation of Combustion ***Annual Report***
Prosser, R., Stanford Univ., USA; Bushe, W. K., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 57-64; In English; See also 19990068442; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this paper, we discuss the generalization to two spatial dimensions of an existing wavelet based scheme intended for combustion problems (Prosser & Cant 1998a). The approach adopts a collocation strategy but, unlike traditional collocation methods, the solution to the set of governing equations is obtained on a grid of collocation points located in a hierarchy of wavelet subspaces. The solution is only returned to the physical space in order to evaluate non-linear inertial and chemical reaction rate terms. The key advantage of this approach, and the motivation for its derivation, is that while the solution is expressed in terms of the wavelet spaces, it is possible to develop an elegant algorithm to exploit the sparsity of the representation in order to reduce both the amount of storage required and the computational effort expended in resolving the chemistry fields.
Derived from text
Direct Numerical Simulation; Computational Fluid Dynamics; Wavelet Analysis; Combustion; Computational Grids; Grid Generation (Mathematics); Mathematical Models

19990068448 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
On the use of a Dynamically Adaptive Wavelet Collocation Algorithm in DNS of Non-Premixed Turbulent Combustion ***Annual Report***
Vasilyev, Oleg V., Stanford Univ., USA; Bushe, W. Kendal, Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 65-80; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The objective of this report is to present initial results which demonstrate the potential benefits of the use of the dynamically adaptive wavelet collocation algorithm in turbulent combustion simulations. The use of wavelets in modeling complex physical phenomena is something of a novelty, and as a first step to achieve the ambitious goal of efficient numerical simulations of non-premixed turbulent flames, we consider a simple model of laminar flame-vortex interaction.
Derived from text
Direct Numerical Simulation; Computational Fluid Dynamics; Premixed Flames; Turbulent Flames; Turbulent Combustion; Flame Propagation; Turbulent Flow

19990068750 Minnesota Univ., Dept. of Chemistry, Minneapolis, MN USA
Electronically Non-Adiabatic Dynamics and Resonance Lifetimes
Truhlar, Donald G., Minnesota Univ., USA; Molecular Quantum States at Dissociation; 1998, pp. 59-61; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

We are engaged in several projects addressing questions in the quantum mechanical and semiclassical treatment of electronically non-adiabatic molecular processes. We are studying the creation of practical diabatic representations and their use for converged quantum dynamics calculations. We have developed an accurate diabatic potential set for NaFH and an improved diabatic potential set for NaH2. In both cases the potentials are based on accurate ab initio calculations of adiabatic potential surfaces, and the fits are based on valence bond configuration mixing models. We have found that our new potential energy surface set for NaFH leads to good agreement with experiment for photo-depletion of NaFH Van der Waals molecules. We are also testing the accuracy of nonadiabatic transition state theory and existing trajectory surface hopping and self-consistent potential methods applied to unimolecular lifetimes and product distributions for decay of metastable exciplex resonances and applied to state-to-state transition probabilities in bimolecular collisions.
Derived from text
Nonadiabatic Theory; Energy Dissipation; Energy Transfer; Nonadiabatic Conditions; Heat Transfer

19990068974 Southampton Univ., Dept. of Chemistry, UK
Microwave Spectroscopy of Ionic Complexes at the Dissociation Limit
Carrington, A., Southampton Univ., UK; Gammie, D. I., Southampton Univ., UK; Page, J. C., Southampton Univ., UK; Shaw, A. M., Southampton Univ., UK; Molecular Quantum States at Dissociation; 1998, pp. 1-4; In English; ISBN 0-9522736-5-9;

Copyright; Avail: Issuing Activity, Hardcopy

This purpose of this paper is to study the investigation of the energy levels near a dissociation limit in the hydrogenic species H2(+), HD(+), and D2(+). This investigation lead to the determination of the entire interaction potential for the diatomic systems studied and has simulated considerable interest in the ab initio calculations of surfaces for these molecules.

CASI

Dissociation; Electromagnetic Radiation; Microwave Spectra; Microwave Spectrometers

19990069082 University of Southern California, Dept. of Chemistry, Los Angeles, CA USA

Signal Processing as a Computational Tool for Chemical Dynamics

Taylor, Howard S., University of Southern California, USA; Molecular Quantum States at Dissociation; 1998, pp. 22-28; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

The purpose of this paper is to study the signal processing method (SPM) as a computational tool for chemical dynamics. The SPM has two basic components, signal generation (SG) and signal processing (SP). SG involves the heavy calculation characteristic of chemical dynamics. The SP part of the problem extracts the residues and poles that is needed to determine the Green's function of OMEGA (or H) evaluated between PHI(sub alpha) and PHI(sub beta).

CASI

Signal Processing; Signal Generators; Reaction Kinetics

19990069605 Illinois Univ., Urbana-Champaign, IL USA

Initiation of Energetic Solids: The First Nanosecond ***Final Report, 1 Apr. 1996 - 31 Mar. 1999***

Dlott, Dana D.; Mar. 31, 1999; 9p; In English

Contract(s)/Grant(s): DAAH04-96-1-0038

Report No.(s): AD-A365126; ARO-34924.20-CH; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The goal is to understand what occurs at the molecular level during shock initiation of energetic materials. We have developed the nanoshock technique, which lets us shock any solid material and study its molecules using ultrafast vibrational spectroscopy with 25 ps time resolution. Test experiments were conducted with anthracene to verify the performance of this technique, which was subsequently extended to energetic materials including RDX and NTO. A related theoretical effort looked at orientation effects in initiation. A related project is understanding the role of molecular vibrational energy transfer processes in initiation. Since we know little about energy transfer, we are concentrating on simple model systems under non shock conditions. We have used a new experimental apparatus which uses a infrared-Raman technique with 1 ps resolution to study nitromethane and other simpler liquids. A minor effort relates to technology transfer from our ARO-funded shock wave program to industry. in particular we have used ultrafast microscopy and shock wave generation techniques to improve laser photothermal imaging processes used in graphic arts by incorporating energetic materials into the imaging media.

DTIC

Solids; Composite Materials

19990069901 NASA Marshall Space Flight Center, Huntsville, AL USA

Tetragonal Chicken Egg White Lysozyme Solubility in Sodium Chloride Solutions

Forsythe, Elizabeth L., Universities Space Research Association, USA; Judge, Russell A., Alliance for Microgravity Materials Science and Applications, USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The solubility of chicken egg white lysozyme, crystallized in the tetragonal form was measured in sodium chloride solutions from 1.6 to 30.7 C, using a miniature column solubility apparatus. Sodium chloride solution concentrations ranged from 1 to 7% (w/v). The solutions were buffered with 0.1 M sodium acetate buffer with the solubility being measured at pH values in 0.2 pH unit increments in the range pH 4.0 to 5.4, with data also included at pH 4.5. Lysozyme solubility was found to increase with increases in temperature and decreasing salt concentration. Solution pH has a varied and unpredictable effect on solubility.

Author

Chickens; Eggs; Lysozyme; Solubility; Sodium Chlorides; Crystallization

19990069931 NASA Marshall Space Flight Center, Huntsville, AL USA

Laser-Induced Optical Pumping Measurements of Cross Section for Fine- and Hyperfine-Structure Transitions in Sodium Induced by Collisions with Helium and Argon Atoms

Dobson, Chris C., NASA Marshall Space Flight Center, USA; Sung, C. C., Army Aviation and Missile Command, USA; Physical Review A; May 1999; ISSN 1050-2947; Volume 59, No. 5, pp. 3402-3407; In English; Copyright; Avail: Issuing Activity, Hardcopy

Optical pumping of the ground states of sodium can radically alter the shape of the laser-induced fluorescence excitation spectrum, complicating measurements of temperature, pressure, etc., which are based on these spectra. Modeling of the fluorescence using rate equations for the eight hyperfine states of the sodium D manifolds can be used to quantify the contribution to the ground state pumping of transitions among the hyperfine excited states induced by collisions with buffer gas atoms. This model is used here to determine, from the shape of experimental spectra, cross sections lor DELTA.F transitions of the P(sub 3/2) state induced by collisions with helium and argon atoms, for a range of values assumed for the P(sub 1/2), DELTA.F cross sections. The hyperfine cross sections measured using this method, which to our knowledge is novel, are compared with cross sections for transitions involving polarized magnetic substates m(sub F) measured previously using polarization sensitive absorption. Also, fine-structure transition cross sections were measured in the pumped vapor, giving agreement with previous measurements made in the absence of pumping.

Author

Laser Induced Fluorescence; Optical Pumping; Sodium; Shapes

19990070319 NASA Marshall Space Flight Center, Huntsville, AL USA

Overview of NASA's Space Environments and Effects (SEE) Program

Minor, Jody, NASA Marshall Space Flight Center, USA; Kauffman, Billy, NASA Marshall Space Flight Center, USA; 1999; 9p; In English; Space Technology, 28-30 Sep. 1999, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-4590; Copyright; Avail: Issuing Activity, Hardcopy

The return of the Long Duration Exposure Facility (LDEF) in 1990 brought a wealth of space exposure data on materials, paints, solar cells, etc., and data on the many space environments. The effects of the harsh space environments can provide damaging or even disabling effects on a spacecraft, its materials, and its instruments. In partnership with industry, academia, and other government agencies, the National Aeronautics & Space Administration's (NASA's) Space Environments and Effects (SEE) Program defines the space environments and provides technology development to accommodate or mitigate these harmful environments on the spacecraft. This program provides a very comprehensive and focused approach to understanding the space environment, defines the best techniques for both flight and ground-based experimentation, updates the models which predict both the environments and the environmental effects on spacecraft, and finally, ensures that this information is properly maintained and inserted into spacecraft design programs. This paper will describe the current SEE Program and will present potential technology development activities for the future.

Author

National Aerospace Plane Program; Damage; Environment Effects; Exposure; Paints; Solar Cells

26
METALLIC MATERIALS

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

19990064335 NASA Marshall Space Flight Center, Huntsville, AL USA

Real Time Characterization of Solid/Liquid Interfaces During Directional Solidification

Sen, S., Universities Space Research Association, USA; Kaukler, W. K., Alabama Univ., USA; Curreri, P. A., NASA Marshall Space Flight Center, USA; Peters, P., NASA Marshall Space Flight Center, USA; 1997; In English; 3rd; Advanced Materials and Processes, 12-16 Jul. 1998, Honolulu, HI, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A X-Ray Transmission Microscope (XTM) has been developed to observe in real time and in-situ solidification phenomenon at the solid/liquid interface. Recent improvements in the horizontal Bridgman furnace design provides real-time magnification (during solidification) up to 12OX. The increased magnification has enabled for the first time the XTM imaging of real-time growth of fibers and particles with diameters of 3-6 micrometers. Further, morphological transitions from planar to cellular interfaces have also been imaged. Results from recent XTM studies on Al-Bi monotectic system, Al-Au eutectic system and interaction of insoluble particles with s/I interfaces in composite materials will be presented. An important parameter during directional solid-

ification of molten metal is the interfacial undercooling. This parameter controls the morphology and composition at the s/I interface. Conventional probes such as thermocouples, due to their large bead size, do not have sufficient resolution for measuring undercooling at the s/I interface. Further, the intrusive nature of the thermocouples also distorts the thermal field at the s/I interface. to overcome these inherent problems we have recently developed a compact furnace which utilizes a non-intrusive technique (Seebeck) to measure undercooling at the S/I interface. Recent interfacial undercooling measurements obtained for the Pb-Sn system will be presented. The Seebeck measurement furnace in the future will be integrated with the XTM to provide the most comprehensive tool for real time characterization of s/I interfaces during solidification.
Author
Real Time Operation; Liquid-Solid Interfaces; Fabrication; Microscopes; X Ray Analysis; Directional Solidification (Crystals)

19990064398 NASA Marshall Space Flight Center, Huntsville, AL USA
Real-Time X-Ray Transmission Microscopy for Fundamental Studies Solidification
Curreri, Peter A., NASA Marshall Space Flight Center, USA; Kaukler, William F., Alabama Univ., USA; Sen, Subhayu, Universities Space Research Association, USA; Peters, Palmer, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Space Technolgy and Applications, 25-29 Jan. 1998, Albuquerque, NM, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

High resolution real-time X-ray Transmission Microscopy, XTM, has been applied to obtain information fundamental to solidification of optically opaque metallic systems. We have previously reported the measurement of solute profile in the liquid, phase growth, and detailed solid-liquid interfacial morphology of aluminum based alloys with exposure times less than 2 seconds. Recent advances in XTM furnace design have provided an increase in real-time magnification (during solidification) for the XTM from 4OX to 16OX. The increased magnification has enabled for the first time the XTM imaging of real-time growth of fibers and particles with diameters of 5 micrometers. We have applied this system to study of the kinetics of formation and morphological evolution of secondary fibers and particles in Al-Bi monotectic alloys to observe a previously unreported velocity dependent thermo-capillary depletion mechanism for Bi rich liquid which can penetrate many fiber diameters into the solid-liquid interface. In this talk we will discuss application of the XTM to the study the fundamentals of monotectic and eutectic solidification, the enhancement of XTM data with precise solid liquid interfacial temperature and thermal gradient measurement techniques, and the application of this technology to the study of the fundamentals of solidification in microgravity,
Author
X Rays; Real Time Operation; Transmission Rate (Communications); Microscopy; Solidification; Imaging Techniques; Research

19990064464 Lockheed Martin Michoud Space Systems, New Orleans, LA USA
Microstructure Characterization and Stress Corrosion Evaluation of Autogenous and Hybrid Friction Stir Welded Al-Cu-Li 2195 Alloy
Li, Zhixian, Lockheed Martin Michoud Space Systems, USA; Arbegast, William J., Lockheed Martin Michoud Space Systems, USA; Meletis, Efstathios I., Louisiana State Univ., USA; 1997; In English; 5th; Welding Trends, Jun. 1998, Pine Mountain, GA, USA; Sponsored by American Welding Society
Contract(s)/Grant(s): NAS8-36200; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Friction stir welding process is being evaluated for application on the Al-Cu-Li 2195 Super-Light Weight External Tank of the Space Transportation System. In the present investigation Al-Cu-Li 2195 plates were joined by autogenous friction stir welding (FSW) and hybrid FSW (friction stir welding over existing variable polarity plasma arc weld). Optical microscopy and transmission electron microscopy (TEM) were utilized to characterize microstructures of the weldments processed by both welding methods. TEM observations of autogenous FSW coupons in the center section of the dynamically-recrystallized zone showed an equiaxed recrystallized microstructure with an average grain size of approx. 3.8 microns. No T(sub 1), precipitates were present in the above-mentioned zone. Instead, T(sub B) and alpha precipitates were found in this zone with a lower population. Alternate immersion, anodic polarization, constant load, and slow strain tests were carried out to evaluate the general corrosion and stress-corrosion properties of autogenous and hybrid FSW prepared coupons. The experimental results will be discussed.
Author
Microstructure; Stress Corrosion; Evaluation; Friction Welding; Characterization

19990064477 Florida State Univ., Office of Research, Tallahassee, FL USA
Processing of Sm-Co Films in High Magnetic Field for Inducing Texture and Anisotropy ***Final Report, 15 Aug. 1998 - 14 Feb. 1999***
Shaheen, Shahid A.; Feb. 14, 1999; 7p; In English
Contract(s)/Grant(s): DAAG55-98-1-0450

Report No.(s): AD-A365295; FSU-1335-542-27; ARO-39058.1-MS; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The objectives of this study were to induce texture and anisotropy in the film plane by crystallizing amorphous Sm-Co films below the magnetic ordering temperature in the presence of high magnetic field along the film plane. Magnetically isotropic amorphous films were grown by magnetron sputtering and were crystallized at 450-600 C (below the magnetic ordering of Sm-Co alloys) in magnetic fields up to 29 T. However, no texture or anisotropy along the magnetic field direction was observed. The experiments were also conducted on anisotropic Sm-Co films that were grown on Cr/Ag/Si templates and had a significant in-plane anisotropy. When these films were subjected to high magnetic field up to 29 T, with their easy axis aligned along the magnetic field, and heated to 450-600 C no enhancement in magnetic anisotropy due to magnetic field effect was observed, rather already existing magnetic anisotropy was lost due to thermal treatment. These experiments lead to the conclusion that magnetic energy term is insignificant relative to the other energies involved in the process in this temperature range. However, at higher temperatures, the magnetic energy term may become significant. Further experiments at elevated temperatures are planned in this context.
DTIC

Magnetic Fields; Thin Films; Anisotropy; Textures; Samarium; Cobalt Alloys

19990064506 NASA Marshall Space Flight Center, Huntsville, AL USA

Effects of an Applied Magnetic Field on the Directional Solidification of Hg(1-x)Zn(x)Se Alloys

Cobb, S. D., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Szofran, F. R., NASA Marshall Space Flight Center, USA; Jones, K. S., Florida Univ., USA; 1999; 1p; In English; Gravitational Effects in Physico-Chemical Systems, 27 Jun. - 2 Jul. 1999, Henniker, NH, USA; Sponsored by Gordon Research Conferences, Inc., USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Directionally solidified Hg(0.9)Zn(0.1)Se alloys were studied as an alternative to HgCdTe for the detection of electromagnetic radiation because of predicted improvements in lattice stability. Several boules were grown using a modified Bridgman-Stockbarger method and in an applied magnetic field. Axial compositional profiles showed mass transfer was primarily diffusion controlled. Radial compositional variations were greatly reduced when solidification occurred in an applied magnetic field. Microstructural characteristics and dislocation etch pit densities were greatly improved over HgTe based alloys. The extreme importance of processing conditions on defect generation was illustrated by comparing ampoule configurations and thermal profiles.
Author

Gravitational Effects; Physical Chemistry; Mercury Cadmium Tellurides; Electromagnetic Radiation; Directional Solidification (Crystals); Diffusion; Bridgman Method

19990064527 NASA Glenn Research Center, Cleveland, OH USA

Surface Segregation in Multicomponent Systems: Modeling of Surface Alloys and Alloy Surfaces

Bozzolo, Guillermo, Ohio Aerospace Inst., USA; Ferrante, John, Cleveland State Univ., USA; Noebe, Ronald D., NASA Glenn Research Center, USA; Good, Brian, NASA Glenn Research Center, USA; Honecy, Frank S., NASA Glenn Research Center, USA; Abel, Phillip, NASA Glenn Research Center, USA; July 1999; 52p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TM-1999-209042; NAS 1.15:209042; E-11569; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The study of surface segregation, although of great technological importance, has been largely restricted to experimental work due to limitations associated with theoretical methods. However, recent improvements in both first-particle and semi-empirical methods are opening, the doors to an array of new possibilities for surface scientists. We apply one of these techniques, the Bozzolo, Ferrante and Smith (BFS) method for alloys, which is particularly suitable for complex systems, to several aspects of the computational modeling of surfaces and segregation, including alloy surface segregation, structure and composition of alloy surfaces, and the formation of surface alloys. We conclude with the study of complex NiAl-based binary, ternary and quaternary thin films (with Ti, Cr and Cu additions to NiAl). Differences and similarities between bulk and surface compositions are discussed, illustrated by the results of Monte Carlo simulations. For some binary and ternary cases, the theoretical predictions are compared to experimental results, highlighting the accuracy and value of this developing theoretical tool.
Author

Metal Surfaces; Thin Films; Surface Stability; Alloys; Separation

19990064556 California Univ., San Diego, La Jolla, CA USA

(Dynamic Behavior of Brittle Materials) Response and Failure Modes of Silicon Nitride ***Final Report, 1 Sep. 1995 - 28 Feb. 1999***

Nemat–Nasser, Sia; May 01, 1999; 17p; In English

Contract(s)/Grant(s): DAAH04-95-1-0609

Report No.(s): AD-A365296; ARO-34579.2-MS; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Silicon nitride is a potential candidate for several high temperature structural applications, like heat engine components, cutting tool inserts, bearings, and wear parts. In use, the ceramic component is often subject to dynamic loading conditions at elevated temperatures. Hence, it is necessary to evaluate the performance of the material under dynamic loading conditions over a range of temperatures. This research project focused on the behavior of in situ reinforced silicon nitride, under dynamic compressive loading, over a range of temperatures. Novel experimental (the Split Hopkinson Compression Bar) and analytical (Differential Strain Measurement) techniques have been developed to aid the evaluation of the dynamic properties of in situ reinforced silicon nitride over a range of temperatures. The properties (primarily, the elastic modulus and the failure stress) of the material has been studied from room temperature to 1000 C. The experimental work has been supplemented by microstructural studies, both before and after testing, in order to gain an insight into the mechanisms of failure.

DTIC

Failure Modes; Silicon Nitrides; Dynamic Characteristics; Brittle Materials; Dynamic Response

19990064642 NASA Marshall Space Flight Center, Huntsville, AL USA

Metals for Cryotank Structures. Present and Future: MSFC Perspective

Vaughn, Timothy P., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 10th; Advanced Aerospace, 21-24 Jun. 1999, Dayton, OH, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Cryogenic Tank Technology Program (CTTP) program has been a cooperative effort between NASA LARC, NASA MSFC, NASA Headquarters, and industry (Lockheed Martin Aeronautics, Lockheed Martin Manned Space Systems, Wyman Gordon, and Ladish). The scope of the CTTP is to develop state-of-the-art, flight-size, flight-quality, low cost hardware, and use this hardware to design, fabricate and test an all aluminum-lithium, all near net shape-component 14' diameter cryogenic tank with a unique low profile bulkhead design. The logical conclusion to the CTTP is to validate these various technologies to a Technology Readiness Level (TRL) of 6 through the proposed structural test program. The CTTP supports the advancement of key enabling technologies required for aluminum lithium cryogenic tanks. The technologies are focused towards innovative and low cost manufacturing processes such as near net shape technologies: one piece spun formed domes, extruded barrel panels, and one piece roll forged ring frames. Other innovative technologies include the friction stir weld process and weight-efficient low profile bulkhead designs. All of these technologies are of primary importance for NASA's mission plan for reusable and expendable launch vehicles. This program fills the niche for an all 2195 aluminum lithium alloy cryogenic tank which is not being covered by existing NASA technology work.

Author

Cryogenic Fluid Storage; Launch Vehicles; Fuel Tanks; Space Storage; Storage Tanks; Propellant Storage; Storable Propellants; Tank Geometry; Design Analysis

19990067252 University of Southern California, Los Angeles, CA USA

Fabrication of Bulk Ultrafine-Grained Materials through Intense Plastic Straining

Berbon, Patrick B.; Tsenev, Nikolai K.; Valiev, Ruslan Z.; Furukawa, Minoru; Horita, Zenji; Sep. 1998; 8p; In English

Contract(s)/Grant(s): DAAH04-96-1-0332; NSF DMR-96-25969; NSF INT-96-02919

Report No.(s): AD-A364589; ARO-34391.24-MS; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Ultrafine grain sizes were introduced into samples of an Al-3 pct Mg solid solution alloy and a cast Al-Mg-Li-Zr alloy using the process of equal-channel angular (ECA) pressing. The Al-3 pct Mg alloy exhibited a grain size of approx. 0.23 micrometers after pressing at room temperature to a strain of approx. 4, but there was significant grain growth when the pressed material was heated to temperatures above approx. 450 K. The Al-Mg-Li-Zr alloy exhibited a grain size of approx. 1.2 micrometers, and the microstructure was heterogeneous after pressing to a strain of approx. 4 at 673 K and homogeneous after pressing to a strain of approx. 8 at 673 K with an additional strain of approx. 4 at 473 K. The heterogeneous material exhibited superplastic-like flow, but the homogeneous material exhibited high-strain-rate superplasticity with an elongation of is greater than 1000 pct at 623 K at a strain rate of 0.01 per sec. It is concluded that a homogeneous microstructure is required, and therefore a high pressing strain, in order to attain high-strain-rate superplasticity (HSR SP) in ultrafine-grained materials.

DTIC

Fabrication; Grain Size; Strain Rate

19990068026 Elf Aquitaine, Pau, France

Duplex 22-05 Stainless Steel Manifold Fabrication ***Realisation de Collecteurs Petroliers en Acier Inoxydable Duplex 22-05: Experience du Projet Nkossa***

Sauvage, M., Elf Aquitaine, France; Materials and Techniques; 1996; ISSN 0032-6895, Nos. 9-10, pp. 3-10; In French; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For Nkossa project, a total of about 1500 tonnes of duplex stainless steel has been used for the fabrication of one sealine, piping and pressure vessels. It's because of its high mechanical resistance and good corrosion resistance that duplex stainless steel has been chosen. This paper describes material procurement, welding procedure and construction of stainless steel manifolds.
Author

Fabrication; Pressure Vessels; Stainless Steels

19990068503 Kurume Coll. of Technology, Fukuoka, Japan

Bonds of Spheroidal Graphite Cast Iron to Structural Steel, Report 1, Effects of Bonding Conditions on the Bondability

Masumoto, Hirohisa, Kurume Coll. of Technology, Japan; Asada, Akihiro, Kurume Coll. of Technology, Japan; Nishio, Kazumasa, Kurume Coll. of Technology, Japan; Mukae, Shizuo, Kurume Coll. of Technology, Japan; Bulletin of Kurume Institute of Technology; 1992; ISSN 0389-6897, No. 16, pp. 1-6; In Japanese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Diffusion bonding has been applied to the joint of cast iron to dissimilar metals which is very difficult to bond by fusion welding because the cold cracking in the weld metal and heat affected zone. Diffusion bonding of spheroidal graphite cast iron to structural steel was carried out in vacuum at the temperature range of 730 C approx. 980 C and the time range of 0.3 ks approx. 7.2 ks under the bonding pressure range of 1 MPa approx. 20 MPa. The result obtained as follows: (1) When tensile strength of the base metal of the spheroidal graphite cast iron was 500 to 750 MPa, the joint strength generally increased as an increasing the bonding temperature. On the other hand, in direct bonding and Ni foil used, the bonding strength of the joint with Ni foil was higher than direct bonding; (2) Fatigue limit of the joints with Ni foil were almost the same as that of base metal of spheroidal graphite cast iron; and (3) In the joint with Ni foil, the joint strength increased as an increase in post-heat treatment temperature of 820 C.
Author

Graphite; Spherical Shells; Cast Alloys; Steels; Diffusion Welding; Metal Bonding

19990068994 Osaka Univ., Dept. of Nuclear Engineering, Osaka, Japan

Fundamental Reaction Behavior of Selenium and Tellurium in Super High Temperature Method

Uno, Masayoshi, Osaka Univ., Japan; Kinoshita, Hajime, Osaka Univ., Japan; Nakai, Toshiki, Osaka Univ., Japan; Horie, Misato, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2322, pp. 181-190; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A fundamental behavior of Se and Te in the super high temperature method was studied. by this method, HLLW is to be reprocessed to obtain a metal and an oxide phases. The metal phase which mainly consists of platinum group metals, Mo, Fe, Cr and Ni is to be recovered, and the oxide phase which consists of alkaline earth elements, rare earth elements, Zr, actinides and Ti is to be disposed as an oxide waste form. Through TG-DTA technique, it was revealed that SeO2, Se, TeO2 and Te evaporated completely under the condition of this method (1873 K) without any additives. The reaction behavior of Se, Te and components of the metal phase with and without TiN were studied. by XRD and EPMA analysis, it was confirmed that Se and Te existed in both metal and oxide phases of the Products forming alloys and compounds, respectively. It was revealed that Se formed Pd-Se and Mo-Se alloys, and Te formed Pd-Te, Fe-Te, Mo-Ru-Te and Mo-Rh-Te alloys with components of metal phase, and that Se formed Ti-Se compounds, and Te formed Ti-Te-O compound with Ti which was the main element of the oxide matrix.
Author

Selenium; Tellurium; Chemical Reactions; High Temperature; Rare Earth Elements

19990068995 Osaka Univ., Dept. of Nuclear Engineering, Osaka, Japan

Temperature Dependence of Mechanical Properties of Uranium Intermetallic Compounds

Tsuzuki, Tatsuya, Osaka Univ., Japan; Yamanaka, Shinsuke, Osaka Univ., Japan; Yamada,Kazuhiro, Osaka Univ., Japan; Katsura, Masahiro, Osaka Univ., Japan; Hoshino, Yasushi, Osaka Univ., Japan; Saiki, Wataru, Mitsubishi Materials Co. Ltd., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2321, pp. 175-180; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The average thermal expansion coefficient of UFe2 was estimated from the high temperature X-ray diffraction, and the heat capacity of UFe2 was evaluated with the thermal expansion data, the Debye temperature and the bulk modulus. The changes in the longitudinal sound velocities in UFe2, UNi2, URu3, URh3, UPd3 and UNi5 with temperature were measured by an ultrasonic

pulse-echo method. The temperature dependence of the Young's, shear and bulk moduli in the intermetallic compounds was estimated from the sound velocities. The elastic moduli decreased as the temperature increased, except for UFe2.
Author
Temperature Dependence; Uranium Compounds; Intermetallics; Mechanical Properties; Thermal Expansion; High Temperature

19990069000 Hokkaido Univ., Faculty of Engineering, Sapporo, Japan
Evaluation of Hydrogen Absorption and Desorption for Ti-6Al-4V Alloy with Low Activation Property as a Vacuum Vessel
Aihara, Yasuki, Hokkaido Univ., Japan; Hirohata, Yuko, Hokkaido Univ., Japan; Hino, Tomoaki, Hokkaido Univ., Japan; Yamashina, Toshiro, Hokkaido Univ., Japan; Miki, Nobuharu, Hokkaido Univ., Japan; Nakagawa, Satoshi, Hokkaido Univ., Japan; Bulletin of the Faculty of Engineering, Hokkaido University; May 1996; ISSN 0385-602X, No. 177, pp. 11-14; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Since the vacuum vessel and components are exposed to fast neutrons with the energy of 14.1 MeV due to D-T reaction in a fusion device, it is advisable to use low activation materials such a components. It is reported that the dose rate of Ti 6Al 4V alloy at 1 year after the shutdown is two orders of magnitude smaller than that of SS316 or Inconel 625. However, it is also reported that the strength of Ti-6Al-4V alloy become small over the hydrogen concentration of 1000 ppm. So, it is worried the embrittlement of the alloy due to the absorption of fuel hydrogen. Although the properties of hydrogen absorption for titanium metal have been evaluated, there are little studies for titanium alloy. In this study, we investigated the hydrogen absorption properties of the Ti-6Al-4V alloy under the condition of low pressure (0.03 100 Pa) and the temperature ranging from 507 to 819 K. The absorption amount was measured by using a technique of Thermal Desorption Spectroscopy (TDS). The initial concentration (C(sub 0)) of Ti 6Al-4V alloy was measured as 90+/-1Oppm. The temperature dependence to the hydrogen absorption amount was evaluated under the pressure of 0.3 and 10 Pa. In the case of the pressure of 0.3 Pa for 20 hr, no change of the hydrogen concentration (C(sub H2)) was observed, i.e., C(sub H2) is almost same to C(sub 0). In the case of the pressure of 10 Pa at 819K, the C(sub H2) increases with absorption time. At 20 hr, the C(sub H2) become constant, 490 ppm which was smaller than the critical concentration of the embrittlement. The pressure dependence to absorption amount was evaluated at 819 K. The C(sub H2) was proportional to the square root of absorption pressure, i.e. for the Sieverts' law.
Author
Titanium Alloys; Aluminum Alloys; Vanadium Alloys; Desorption; Hydrogen

19990069618 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
The Performance of Three Alternative Coatings to Electroplated Cadmium for Corrosion Protection in Fastener Applications
Peterson, Sean; Wechsler, Gary; Pepi, Marc; May 1999; 100p; In English
Report No.(s): AD-A364764; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The Army uses cadmium over a broad range of applications, including the production, maintenance, and repair of weapons systems and related components. The useful properties of this element have made it the number one choice for fasteners and similar components where corrosion resistance and lubricity are a concern. However, cadmium is a known carcinogen and poses health risks to those coming in contact with it. Executive Order 12856, "Federal Compliance With Right-to-Know Laws and Pollution Prevention Requirements," was enacted in 1993 with the intent of reducing the total release of toxic chemicals into the environment by 50% by 1999. As such, intense research efforts have been underway to develop a coating or coating system that provides similar, if not better, properties than cadmium. ARL examined three alternatives to cadmium for corrosion protection in AH-64 fastener applications, including ion-vapor-deposited (IVD) aluminum, a MIL-T-83483 antiseize compound, and a MIL-C-16173 corrosion preventative compound. It was concluded that the antiseize compound and the corrosion preventative compound were not adequate replacements for cadmium based upon unacceptable fastener and aluminum block corrosion. IVD was deemed comparable to cadmium based upon the torque values, fastener corrosion, and block corrosion results.
DTIC
Corrosion Resistance; Electroplating; Coatings; Corrosion Prevention; Fasteners; Toxicity; Pollution Control; Cadmium

19990069903 NASA Marshall Space Flight Center, Huntsville, AL USA
Reducing and Inducing Convection in Ge-Si Melts with Static Magnetic Field
Szofran, Frank R., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; Gravitational Effects in Physico-Chemical Systems, 27 Jun. - 2 Jul. 1999, Henniker, NH, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Results of a study of the effectiveness of using static magnetic fields to reduce convection in Ge-Si melts will be presented. Lenz's law causes a retardation of convection when a static magnetic field is applied to an electrically conducting liquid. However,

during the solidification of a solid-solution system such as Ge-Si, the interface is neither isothermal nor isoconcentrational. The variation of temperature and chemical composition along the interface causes thermoelectric currents to be generated within the solidifying material (and the container if it is electrically conductive). These currents, in the presence of a magnetic field, can cause movement (stirring, convection) in the melt which can exceed convection induced by normal thermosolutal mechanisms. Crystals have been grown by both the Bridgman and floating-zone methods. Clear evidence for the existence of this thermoelectromagnetic convection, especially in the case of Si floating-zone growth, will be presented.
Author
Convection; Germanium Compounds; Silicon Compounds; Magnetostatic Fields; Melts (Crystal Growth)

19990069929 Lockheed Martin Michoud Space Systems, New Orleans, LA USA
Filler Wire Development for 2195 Aluminum-Lithium, Pt. 2 ***Final Report***
Bjorkman, Gerald W., Lockheed Martin Michoud Space Systems, USA; Cho, Alex, Lockheed Martin Michoud Space Systems, USA; November 1998; 390p; In English
Contract(s)/Grant(s): NAS8-39929
Report No.(s): FW-DOC-051; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

The objective of the research was to determine the susceptibility of submitted welded 2195 plate in an AI (Alternate Immersion) environment. Forty-day AI exposure was completed on 8 welded 2195 stress corrosion samples. No stress corrosion cracking (SCC) was found on any of the samples tested. All 8 samples experienced exfoliation corrosion attack in the heat-affected zone (HAZ) adjacent to the weld. All samples were examined metallographically and showed varying degrees of intergranular corrosion (IG). The filler metal on all samples showed moderate to heavy pitting.
Derived from text
Fillers; Wire; Aluminum-Lithium Alloys; Heat Affected Zone; Intergranular Corrosion; Weld Tests; Stress Corrosion Cracking; Corrosion Tests

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.

19990064361 NASA Marshall Space Flight Center, Huntsville, AL USA
MSFC Investigations of Beta Cloth Darkening Due to Ultraviolet Radiation Interactions
Kamenetzky, Rachel R., NASA Marshall Space Flight Center, USA; Finckenor, Miria M., NASA Marshall Space Flight Center, USA; 1999; 3p; In English; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics
Contract(s)/Grant(s): RTOP 478-88-50; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A common component of multi-layer insulation blankets is beta cloth, a woven fiberglass cloth impregnated with Teflon. It is planned for extensive use on the International Space Station (ISS). The Environmental Effects Group of the Marshall Space Flight Center Materials, Processing and Manufacturing Department has investigated the impact of atomic oxygen (AO) and ultraviolet (UV) radiation on the optical properties of plain and aluminized beta cloth, both in the laboratory and as part of long-duration flight experiments. These investigations indicate that beta cloth was susceptible to darkening in the presence of UV radiation, dependent on the additives used. The presence of AO countered some, if not all, of the UV degradation.
Author
Multilayer Insulation; Composite Materials; Glass Fibers; Teflon (Trademark); Aluminum

19990064391 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Toxicity Testing of Combustion Products of Polyurethane and Polyvinylchloride ***Final Report***
Busker, R. W., Prins Maurits Lab. TNO, Netherlands; Hammer, A. H., Prins Maurits Lab. TNO, Netherlands; Kuijpers, W. C., Prins Maurits Lab. TNO, Netherlands; Poot, C. A. J., Prins Maurits Lab. TNO, Netherlands; Bergers, W. W. A., Prins Maurits Lab. TNO, Netherlands; Bruijnzeel, P. L. B., Prins Maurits Lab. TNO, Netherlands; January 1999; In English; Original contains color illustrations; Sponsored in part by DMGB, The Hague
Contract(s)/Grant(s): A96M523; TNO Proj. 215495163
Report No.(s): TD98-0338; PML-1998-A97; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., P.O. Box 45, 2280 AA Rijswiijk, The Netherlands), Hardcopy

Inhalation of toxic combustion products is the major cause of death during fires. This problem is also prominent in military equipment, because of the widespread use of plastics, especially PUR and PVC. Increased knowledge of the combustion products formed and their toxicity could decrease the risks. This report describes the development and validation of a test that can be used to estimate the toxicity of the combustion products of plastics. In this test, 2 - 100 g of plastics are combusted, and rats are exposed to the complete smoke mixture. In addition to survival, also sublethal effects, such as respiratory depression and lung damage are investigated. For the validation process, a number of combustion experiments was performed, aimed at demonstrating that the test is useful to compare the toxicity of several plastics. The toxicity risk of polyurethane (PUR) could be estimated, both with PUR foam and with PUR rigid plates. The test allows the combustion to be performed under conditions with varying oxygen concentrations and temperatures. This was demonstrated using PUR and polyvinylchloride (PVC) samples. The toxic effects of PUR were mainly attributed to carbon monoxide and by hydrogen cyanide. The toxicity of PVC was partly due to the formation of carbon monoxide and by hydrogen chloride. Quantitatively, the results were in reasonably good agreement with literature data.
Author
Combustion Products; Damage; Polyurethane Resins; Toxicity; Carbon Monoxide

19990064429 California Inst. of Tech., Pasadena, CA USA
Experimental and Analytical Studies for a Computational Materials Program ***Final Report***
Knauss, W. G., California Inst. of Tech., USA; August 1999; 65p; In English
Contract(s)/Grant(s): NAG1-1780; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The studies supported by Grant NAG1-1780 were directed at providing physical data on polymer behavior that would form the basis for computationally modeling these types of materials. Because of ongoing work in polymer characterization this grant supported part of a larger picture in this regard. Efforts went into two combined areas of their time dependent mechanical response characteristics: Creep properties on the one hand, subject to different volumetric changes (nonlinearly viscoelastic behavior) and time or frequency dependence of dilatational material behavior. The details of these endeavors are outlined sufficiently in the two appended publications, so that no further description of the effort is necessary.
Derived from text
Viscoelasticity; Polymers; Time Dependence; Images

19990064514 Department of the Navy, Washington, DC USA
Carbon-Based Composites Derived from Phthalonitrile Resins
Sastri, Satya B., Inventor; Armistead, James P., Inventor; Keller, Teddy M., Inventor; Jun. 26, 1998; 18p; In English
Patent Info.: Filed 26 Jun. 1998; US-Patent-Appl-SN-08,105,087
Report No.(s): AD-D019354; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A carbon-based composite is made by the steps of: (1) impregnating a fibrous material with a phthalonitrile thermoset polymer precursor, (2) curing the product of step (1) to form a fiber-reinforced thermoset polymer, and (3) pyrolyzing the product of step (2) to form the carbon-based composite. The carbon-based composite may be made with only one cycle of the steps (1), (2), and (3).
DTIC
Carbon-Carbon Composites; Thermosetting Resins; Phthalates; Fiber Composites

19990064575 NASA Langley Research Center, Hampton,VA USA
Design Requirements for Amorphous Piezoelectric Polymers
Ounaies, Z., Institute for Computer Applications in Science and Engineering, USA; Young, J. A., Virginia Univ., USA; Harrison, J. S., NASA Langley Research Center, USA; August 1999; 22p; In English
Contract(s)/Grant(s): RTOP 522-32-00-02
Report No.(s): NASA/TM-1999-209359; L-17883; NAS 1.15:209359; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An overview of the piezoelectric activity in amorphous piezoelectric polymers is presented. The criteria required to render a polymer piezoelectric are discussed. Although piezoelectricity is a coupling between mechanical and electrical properties, most research has concentrated on the electrical properties of potentially piezoelectric polymers. In this work, we present comparative mechanical data as a function of temperature and offer a summary of polarization and electromechanical properties for each of the polymers considered.
Author
Amorphous Materials; Piezoelectricity; Polymers

19990064634 Lehigh Univ., Dept. of Materials Science and Engineering, Bethlehem, PA USA
Microstructural Design of Tough Ceramics for Contact Damage Resistance ***Final Report, Feb. 1995 - Aug. 1998***
Chan, Helen M.; Lawn, Brian R.; May 1999; 86p; In English
Contract(s)/Grant(s): F49620-95-1-0187
Report No.(s): AD-A365160; AFRL-SR-BL-TR-99-0160; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The results of research investigating contact damage and fatigue of ceramics is described, with particular attention to microstructural design. The aims were as follows: (1) to develop experimental testing methodologies, using Hertzian contacts, for studying the fundamental short-crack damage properties of tough ceramics, notably in silicon carbide and silicon nitride; (2) to examine the role of critical microstructural variables (grain size and shape, grain boundary phase, interface energy, internal stress) on the nature of the ensuing contact damage; (3) to investigate the effect of the damage on associated mechanical properties, e.g., strength degradation, fatigue resistance, wear resistance; (4) to process and modify ceramic materials in order to improve the above properties; (5) to develop theoretical models of the damage micromechanics; and (6) to establish design engineering criteria for materials selection and optimization. The proposed program has led to new insights into the role of micromechanical phenomena in mechanical behavior of tough ceramics, insights that will ultimately bear on practical areas such as bearing mechanics, cyclic fatigue, ceramic design, and coating-substrate technology.
DTIC
Ceramics; Toughness; Composite Materials; Contact Resistance; Damage; Degradation; Fracture Strength; Micromechanics; Microstructure; Wear Resistance

19990066624 NASA Ames Research Center, Moffett Field, CA USA
Biological and Organic Chemical Decomposition of Silicates, Chapter 7.2
Silverman, M. P., NASA Ames Research Center, USA; Studies in Environmental Science; 1979; Volume 3, pp. 445-465; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The weathering of silicate rocks and minerals, an important concern of geologists and geochemists for many years, traditionally has been approached from strictly physical and chemical points of view. Biological effects were either unrecognized, ignored, or were mentioned in passing to account for such phenomena as the accumulation of organic matter in sediments or the generation of reducing environments. A major exception occurred in soil science where agricultural scientists, studying the factors important in the development of soils and their ability to nourish and sustain various crops, laid the foundation for much of what is known of the biological breakdown of silicate rocks and minerals. The advent of the space age accelerated the realization that many environmental problems and geo- chemical processes on Earth can only be understood in terms of ecosystems. This in turn, spurred renewed interest and activity among modem biologists, geologists and soil scientists attempting to unravel the intimate relations between biology and the weathering of silicate rocks and minerals of the earth surface.
Author
Silicates; Biological Effects; Organic Materials; Decomposition; Weathering; Soil Science; Minerals; Chemical Reactions

19990066692 Mississippi Univ. Medical Center, Dept. of Biochemistry, Jackson, MS USA
Interacting Sites in Novel Polymeric Proteins ***Final Report, 1 Mar. 1995 - 31 Dec. 1998***
Case, Steven T., Mississippi Univ. Medical Center, USA; Feb. 23, 1999; 8p; In English
Contract(s)/Grant(s): DAAH04-95-1-0129
Report No.(s): AD-A365318; ARO-33106.5-LS; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The object of this project was the folding and association of Cys-rich recombinant and native silk proteins from aquatic larvae of the midge, Chironomus tentans. Specific aims include. (A) Learn which Cys residues are critical to the pathway for intramolecular disulfide bond formation in rCAS, a recombinant repeat from silk protein, spIa. (B) Determine if intramolecular disulfide bonds stabilize the higher-order structure of rCAS. (C) Determine the conditions and which Cys participate in formation of intermolecular disulfide bonds. (D) Learn how and where other native silk proteins interact with spIs. In addition, we also chose to do the following. (E) Determine if N-linked glycosylation sites in ssp160 are evolutionarily conserved. (F) Acquire consensus repeat sequences for Cys-containing motifs in sp185/sp220 homologs and sp195. The final results of this project indicate: (1) Aquatic silk proteins can be expressed and purified from bacteria in large quantities. (2) However, fibrous proteins may prove difficult to analyze: CD and FTTR basis spectra lack fibrous protein standards and proteins with Cys may refold into multiple conformers. (3) The abundance and conservation of glycosylation sites on some aquatic silk proteins suggest such post-translational modification merits study before biotechnological applications are considered. (4) Aquatic silk proteins contain more Cys motifs than previously thought.
DTIC
Polymers; Proteins; Larvae

19990067233 NASA Marshall Space Flight Center, Huntsville, AL USA

Morphology and Structure of ZnO Films Synthesized by Off-Axis Sputtering Deposition

Zhu, Shen, Universities Space Research Association, USA; Su, C.–H., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; 1999; In English, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Optical Society for Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

ZnO is a wide-band-gap oxide material that has many applications. A new potential application of ZnO material is for light emitting devices since its structure and electrical properties are similar to that of the GaN material (a blue laser candidate). It also is a good substrate for fabricating GaN-based devices. Off-axis sputtering technique has revealed great potential in synthesizing excellent oxide materials because the negative ion bombardment is greatly reduced when adatoms condense on substrates. The surface of films grown by off-axis sputtering will be much smoother than that produced in a regular sputtering configuration. A growth mechanism is studied by investigating the morphology and structure of ZnO films under different growth conditions and orientations. ZnO films are deposited on (0001) sapphire and quartz substrates by off- axis sputtering deposition at various oxygen/argon mixture ratios and pressures and at different temperatures. All films reveal highly textured structures on quartz substrates and epitaxial growth on sapphire substrates. Two off-axis configurations, vertical and horizontal orientations are conducted to study the process of film growth, surface morphology, and film structure. X-ray diffraction, scanning probe microscopy, and electrical measurements are used to characterize these films. Detailed results will be discussed in the presentation. Keywords: ZnO, Photonic material, Off-axis sputtering, Growth mechanism

Author

Morphology; Zinc Oxides; Deposition; Electrical Measurement; Electrical Properties; Fabrication; Substrates; Metal Films

19990067271 NASA Marshall Space Flight Center, Huntsville, AL USA

Orientation Effects in ZnO Films Using Off-Axis Sputtering Deposition

Zhu, Shen, Universities Space Research Association, USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Lehoczky, S., NASA Marshall Space Flight Center, USA; George, M. A., Alabama Univ., USA; 1999; 1p; In English; 5th; IUMRS, 13-18 Jun. 1999, Beijing, China; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

ZnO is a wide-band-gap oxide material and has been used in numerous applications. It is also a good substrate for fabricating GaN-based (a blue laser candidate) devices. Off-axis sputtering technique is one of the best techniques in synthesizing oxide materials because negative ion bombardment and particle kinetic energy is greatly reduced when adatoms condense on substrates. Since the sputtered material from the target arrive on the substrate surface at a 90 deg. configuration, which differs from the normal sputtering geometry, it is expected that the film uniformity and composition distributions will be affected. However, the details of these properties and mechanisms have not been well studied. ZnO films are synthesized on (0001) sapphire and quartz substrates by off-axis sputtering deposition in various oxygen/argon mixture ratios and pressures at different temperatures. Substrates and sputtering sources are placed at three different orientations that are orthogonal to each other. The normal direction of a substrate is parallel to the gravity vector and the other is perpendicular to it. Film thickness profiles at different growth orientations are determined using a profimeter. All films grown at high temperatures have highly textured structures on quartz substrates and epitaxially grow on sapphire substrates. Because of this process, the film surface is very smooth. X-ray diffraction, scanning probe microscopy, and Fourier transfer infrared spectroscopy, and electrical measurements will be used to characterize these films. Detailed results will be discussed in the presentation.

Author

Zinc Oxides; Metal Films; Film Thickness; Deposition; Fabrication; Gravitation; Substrates

19990068028 Centre Technique des Industries Mecaniques, Saint Etienne, France

Evaluation of Lubricants for Loaded Slideways ***Evaluation des Huiles Pour Glissieres Chargees sur Staticinemetre Cinergol***

Ridard, A., Centre Technique des Industries Mecaniques, France; Materiaux and Techniques; Sep. 1996; ISSN 0032-6895, Nos. 9-10, pp. 45-48; In French; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This document describes the staticinemetre friction test machine and methodology which can be used to evaluate the behaviour of lubricants in machine-tools slideway systems. It is simple, quick and reliable method of investigating the frictional characteristics of a lubricant with particular respect to stick slip phenomenon. This test is going to be standardized in France.

Author

Evaluation; Lubricants; Procedures

19990068029 Conservatoire National des Arts et Metiers, Dept. Genie Mecanique, Paris, France

Viscoelastic Behaviour of Injection Molded Polypropylene/Sort Glass Fibers Composites ***Comportement Viscoelastique Lors Du Moulage Par Injection de Composites Polypropylene-Fibres de Verre Courtes***

Haddout, A., Conservatoire National des Arts et Metiers, France; Elghorba, M., Conservatoire National des Arts et Metiers, France; Villoutreix, G., Conservatoire National des Arts et Metiers, France; Materiaux and Techniques; Sep. 1996; ISSN 0032-6895, Nos. 9-10, pp. 39-44; In French; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our work deals with the viscoelastic behavior and the evaluation of the morphology of polypropylene samples reinforced with short glass fibers and molded with an injection machine. The influences on polymer properties of the mold temperature, of the rate of the fiber and of the embedding are studied. We determine the existence of typical relations between the microstructure, the thermomechanical parameters of the injection and the viscoelastic properties of the composite. All these results contribute to optimize the mechanical resistance of molded objects thanks to a better knowledge of the action of injection molding parameters. Author

Viscoelasticity; Polypropylene; Injection Molding; Embedding

19990068030 Ecole Nationale Superieure des Mines, Paris, France

Mechanical Characterization of Thin Films, Pt. 1, Literature Review ***Caracterisation Mecanique des Films Minces, Premiere Partie, Revue Bibliographique***

Angelelis, Celine, Ecole Nationale Superieure des Mines, France; Felder, Eric, Ecole Nationale Superieure des Mines, France; Materials and Techniques; 1996; ISSN 0032-6895, Nos. 9-10, pp. 33-37; In French; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The extensive use of thin films in the manufacture of microelectronic devices and for protection against wear and corrosion has simulated considerable interest in their mechanical properties . This kind of study requires the development and use non-traditional mechanical testing techniques. The most widely used testing methods of free standing films and of films adherent to their substrates are reviewed with an emphasis on their strengths and liabilities. Results obtained by these method are discussed. Author

Mechanical Properties; Thin Films; Liabilities; Corrosion Prevention

19990068992 Osaka Univ., Dept. of Electrical Engineering, Osaka, Japan

Electron Emission from Sulfur-Doped BN Films Grown by Plasma-Assisted Chemical Vapor Deposition

Tagawa, Shigeru, Osaka Univ., Japan; Sugino, Takashi, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2324, pp. 201-208; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Sulfur-doped boron nitride (BN) films have been grown by plasma-assisted chemical vapor deposition (PACVD) method. Fourier transform infrared absorption (FTTR) spectra with absorption band at 800/cm and 1380/cm suggest deposition of hexagonal BN (h-BN). The electrical resistivity is estimated to be 4.9 x 10(exp 2) (omega)cm and optical energy bandgap is evaluated to be 5.9eV from the absorption spectrum measured in the ultraviolet-visible region. The electron emission occurs at an electric field as low as 1OV/micrometer for the S-doped BN film. It is found that no degradation of this value occurs for the BN film treated with O2 plasma for 15 min.

Author

Electron Emission; Doped Crystals; Boron Nitrides; Vapor Deposition; Plasmas (Physics); Infrared Spectra; Absorption Spectra

19990068993 Osaka Univ., Dept. of Electrical Engineering, Osaka, Japan

Temperature-Dependent Field Emission Characteristics of Phosphorus-Doped Diamond Films

Kuriyama, Kenji, Osaka Univ., Japan; Kawasaki, Seiji, Osaka Univ., Japan; Sugino, Takashi, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2323, pp. 191-199; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Temperature dependence of field emission characteristics is investigated for phosphorus(P)-doped polycrystalline diamond films in comparison with that of undoped ones. The turn-on voltage decreases with increasing temperature for the P-doped diamond film. On the other hand, there is no variation in the turn-on voltage for the undoped diamond film. It is considered that ionized donor concentration related to P atoms enhances with increasing temperature, leading to a reduction of the tunnel barrier width at the interface between diamond and cathode. As a result, an emission current increases. This reveals that the internal electron

emisson determines the field emission characteristics. Field emission characteristics in the higher voltage region feature the space charge limited current.
Author
Temperature Dependence; Field Emission; Phosphorus; Diamond Films; Doped Crystals; Electron Emission

19990069003 NASA Langley Research Center, Hampton, VA USA
Imide Oligomers Containing Pendent and Terminal Phenylethynyl Groups-2
Connell, J. W., NASA Langley Research Center, USA; Smith, J. G., Jr., NASA Langley Research Center, USA; Hergenrother, P. M., NASA Langley Research Center, USA; High Performance Polymers; 1998; ISSN 0954-0083; Volume 10, pp. 273-283; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

As part of a program to develop high-performance/high-temperature structural resins for aeronautical applications, imide oligomers containing pendent and terminal phenylethynyl groups were prepared, characterized and the cured resins evaluated as composite matrices. The oligomers were prepared at a calculated number-average molecular weight of 5000 g/mol and contained 15-20 mol% pendent phenylethynyl groups. In previous work, an oligomer containing pendent and terminal phenylethynyl groups exhibited a high glass transition temperature (approximately 313 C), and laminates therefrom exhibited high compressive properties, but processability, fracture toughness, microcrack resistance and damage tolerance were less than desired. In an attempt to improve these deficiencies, modifications in the oligomeric backbone involving the incorporation of 1,3-bis(3-aminophenoxy)benzene were investigated as a means of improving processability and toughness without detracting from the high glass transition temperature and high compressive properties. The amide acid oligomeric solutions were prepared in N-methyl-2-pyrrolidinone and were subsequently processed into imide powder, thin films, adhesive tape and carbon fiber prepreg. Neat resin plaques were fabricated from imide powder by compression moulding. The maximum processing pressure was 1.4 MPa and the cure temperature ranged from 350 to 371 C for 1 h for the mouldings, adhesives, films and composites. The properties of the 1,3-bis(3-aniinophenoxy)benzene modified cured imide oligomers containing pendent and terminal phenylethynyl groups are compared with those of previously prepared oligomers containing pendent and terminal phenylethynyl groups of similar composition and molecular weight.
Author
Oligomers; Imides; Resins; Matrix Materials; Methyl Compounds; Ethylene Compounds; Laminates; Phenyls

19990069600 Colorado State Univ., Dept. of Chemistry, Fort Collins, CO USA
Using Template-Synthesized Micro- and Nanowires as Building Blocks for Self-Assembly of Supramolecular Architectures
Sapp, Shawn A.; Mitchell, David T.; Martin, Charles R.; Jun. 01, 1999; 14p; In English
Contract(s)/Grant(s): N00014-91-J-1201
Report No.(s): AD-A365191; TR-27; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Template-synthesized conductive polymer microwires and Au nanowires have been used as building blocks to self-assemble supramolecular architectures. In the conductive polymer case, biotin/streptavidin chemistry was used to self-assembly latex spheres onto the ends of the conductive polymer microwires. In the Au case, thiol chemistry was used to self-assemble colloidal Au nanoparticles onto the ends of the Au nanowires.
DTIC
Biosynthesis; Biotin; Thiols

19990069928 Colorado State Univ., Dept. of Chemistry, Fort Collins, CO USA
Preparation of Polymeric Micro-and Nanostructures Using a Template-Based Deposition Method ***Interim Report***
Cepak, Veronica M.; Martin, Charles R.; Jun. 01, 1999; 19p; In English
Contract(s)/Grant(s): N00014-91-J-1201
Report No.(s): AD-A365312; TR-26; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Polymeric microtubules and nanofibrils have been prepared by depositing a solution of the desired polymer within the pores of microporous template membranes. Both microporous alumina and track-etched polyester membranes were used as the templates. Tubules and fibrils composed of polystyrene, poly(2,6-dimethyl-1,4-phenylene oxide), poly(vinylidene fluoride), poly(methyl methacrylate), poly(bisphenol A carbonate), and poly(lactic acid) have been prepared. Nanofibrils with diameters as small as 30 nm have been achieved. A concentric tubular composite microstructure consisting of an outer microtubule of polystyrene surrounding an inner microwire of polypyrrole has also been fabricated.
DTIC
Nanostructures (Devices); Templates; Deposition; Polymers; Synthesis (Chemistry)

19990070298 Fukuoka Univ., Central Research Inst., Japan

Extended Studies on Superconductivity and Structural Properties in Oxygen Deficient YBa2Cu3O(7-delta) Ceramics

Nishida, Akihiko, Fukuoka Univ., Japan; Fuketa, Nobuhiro, Fukuoka Univ., Japan; Furuya, Kouki, Fukuoka Univ., Japan; Horai, Kazumi, Fukuoka Univ., Japan; Fukuoka University Science Reports; September 1993; ISSN 0386-118X; Volume 23, No. 2, pp. 155-176; In English

Contract(s)/Grant(s): MOE-03650024; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A series of high-Tc YBa2Cu3O(7-delta) superconductors has been investigated by expanding preparation and estimation methods from our initial study to more sophisticated analyses with fair emphasis on material characterizations, on the basis of electrical resistivity measurements and X-ray powder diffractometry. The performance of the previous resistivity cryostat has been drastically improved by use of the computer averaging technique. Crystallographic characterizations have been carried out by least square analyses, resulting in the precision being independent of the superconducting transition width and temperature. We have also confirmed a simple method for estimating oxygen contents in the specimen through determination of unit cell parameters by X-ray diffraction peaks. Structural and stoichiometric examinations have been further performed through the Rietveld refinement with atomic coordinates and occupancy factors. by finding good agreement of our X-ray Rietveld analyses with the neutron diffraction results, we have confirmed the reliability of our X-ray studies. Finally, we have discussed importance of careful examinations on sample homogeneity and superconducting transition width as well as importance of local structure for the high Tc superconductivity.

Author

Superconductivity; YBCO Superconductors; Research; Technology Utilization; Dynamic Structural Analysis

19990070309 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Evaluation of Damage Induced by Low-Energy Ion Irradiation in Silicon

Baba, Akiyoshi, Kyushu Univ., Japan; Sadoh, Taizoh, Kyushu Univ., Japan; Kenjo, Atsushi, Kyushu Univ., Japan; Nakashima, Hiroshi, Osaka Univ., Japan; Mori, Hiroshi, Kyushu Univ., Japan; Tsurushima, Toshio, Kyushu Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 127-138; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The damage induced by various ions in the low-energy (500 eV - 50 keV) region in Si substrates has been investigated using the displacement efficiency as a function of the energy of the incident ions and the binding energy of the substrate Si atoms. In the calculation, the nuclear energy loss process has been divided into two parts, the displacement collision process and the lattice site atom vibration process. The damage function has been calculated on the basis of the energy conservation in the collision process. The displacement efficiency for proton and He(+) ion irradiation decreases with decreasing the incident ion energy, while that for various heavier ion irradiation is almost independent of the incident ion energy and the species. The displacement efficiency increases with decreasing the binding energy U(d). The displacement efficiency for U(d) = 0.0 eV is about 10-30% larger than that for U(d) = 15.8 eV, which is assumed to be the displacement energy of the lattice site atoms in Si substrates. The calculation results for the Si-Si collision show a good agreement with the experimental results of the pulse-height defect.

Author

Binding Energy; Ion Irradiation; Silicon; Substrates; Damage; Defects; Displacement

19990070342 Monash Univ., Chemistry Dept., Clayton, Australia

New Multifunctional Polar Silanes for Polyner Modification

Hewitt, David G., Monash Univ., Australia; Jing, Lin, Monash Univ., Australia; Australian Journal of Chemistry; 1998; ISSN 0004-9425; Volume 51, No. 4, pp. 267-272; In English; Copyright; Avail: Issuing Activity (CSIRO Publishing, P.O. Box 1139, 150 Oxford St., Collingwood, Vic. 3066, Australia); US Sales Only, Hardcopy, Microfiche

New trifunctional carbosilanes containing hydroxy, alkenyl, chloro and cyano groups have been synthesized in good yields. A useful synthesis of these polymer precursors from dichlorosilanes was developed after it was found that hydrosilation of functionalized alkenes by a dihydrosilane, 2-cyanoethylmethyldihydrosilane, failed to give the expected dialkylsilanes.

Author

Procedures; Technology Assessment; Silanes

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.

19990064484 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang and Energetik, Jakarta, Indonesia
Effects of Solid Content on the Mechanical Characteristics of Butadiene Propellant with IPDI Amplifier ***Pengaruh Kandungan Padatan Pada Sifat Mekanik Propelan Dasar Butadien Dengan Pengeras IPDI***
Prangili, Siti, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Syarkawi, Atwirman, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Setianingsih, Henny, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April 1998; ISSN 0126-9754, No. 55, pp. 22-27; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Solid content in propellant ingredient has a role on the propellant combustion cause of the particles influence in adhesive and cohesive among component's molecule to from propellant's mechanical strength. Mechanical properties of propellant has to be known for determining that composition has available against shock or friction either assembling or on transportation from warehouse to the launching pad. 2 With IPDI as a hardener the mechanical properties is tensile strength 7,3 kg/sq cm , elongation 3,5 % and modulus of elasticity 2,1 k g/sq cm at the solid content 80 %. This composition considered as the best because the tensile strength is growing stable.
Author
Propellant Combustion; Solid Propellants; Propellants; Mechanical Properties

19990067259 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Parametric Erosion Investigation (Propellant Adiabatic Flame Temperature) ***Final Report, Jul. 1997 - Dec. 1997***
Conroy, Paul J.; Weinacht, Paul; Nusca, Michael J.; Jun. 1999; 39p; In English
Contract(s)/Grant(s): DA Proj. 1L1-622105-AH-84
Report No.(s): AD-A364761; ARL-TR-1954; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In this report, we investigate the influence of quasi-independent parameters and their potential influence on erosion in guns. Specifically, we examine the effects of flame temperature and the effect of assuming that the Lewis Number (ratio of mass to heat transport to the surface), Le, is one. The adiabatic flame temperature was reduced for a propellant through the addition of a diluent from a high of 3,843 K similar to that of M9 down to 3,004 K, which is near the value for M30A1 propellant. Also shown are mass fractions of critical species at the surface with and without the assumption of Le = 1, demonstrating that certain species preferentially reach the surface providing varied conditions for the surface reactions. The results for gun tube bore surface regression qualitatively agree with previous studies and with current experimental data. The propellant composition influence upon erosion must still be inferred at this time from the presence of specific product species at the surface because the finite-rate gas surface reactions are not well known under ballistic conditions.
DTIC
Erosion; Flame Temperature; Propellants; Adiabatic Conditions

29
MATERIALS PROCESSING

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

19990064345 NASA Marshall Space Flight Center, Huntsville, AL USA
Microgravity Materials and Biotechnology Experiments
Vlasse, Marcus, NASA Marshall Space Flight Center, USA; 1998; In English, 19 Mar. 1998, Los Angeles, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Presentation will deal with an overview of the Materials Science and Biotechnology/Crystal Growth flight experiments and their requirements for a successful execution. It will also deal with the hardware necessary to perform these experiments as well as the hardware requirements. This information will serve as a basis for the Abstract: workshop participants to review the poss7ibilifies for a low cost unmanned carrier and the simple automation to carry-out experiments in a microgravity environment with

little intervention from the ground. The discussion will include what we have now and what will be needed to automate totally the hardware and experiment protocol at relatively low cost.
Author
Microgravity; Biotechnology; Experimentation; Crystal Growth

19990064346 NASA Marshall Space Flight Center, Huntsville, AL USA
Real-Time X-Ray Microscopy of Al-Cu Eutectic Solidification
Kaukler, William F., Alabama Univ., USA; Curreri, Peter A., NASA Marshall Space Flight Center, USA; Sen, Subhayu, Universities Space Research Association, USA; 1998; 1p; In English; 10th; Experimental Methods for Microgravity Science, 16-19 Feb. 1998, San Antonio, TX, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent improvements in the resolution of the X-ray Transmission Microscope (XTM) for Solidification Studies provide microstructure feature detectability down to 5 micrometers during solidification. This presentation will show the recent results from observations made in real-time of the solid-liquid interfacial morphologies of the Al-CuAI2 eutectic alloy. Lamellar dimensions and spacings, transitions of morphology caused by growth rate changes, and eutectic grain structures are open to measurements. A unique vantage point viewing the face of the interface isotherm is possible for the first time with the XTM due to its infinite depth of field. A video of the solid-liquid interfaces seen in-situ and in real-time will be shown.
Author
Real Time Operation; X Ray Analysis; Microscopy; Eutectics; Solidification; Aluminum Alloys; Copper Alloys

19990064432 Northrop Grumman Corp., Bethpage, NY USA
Shuttle Mission STS-50: Orbital Processing of High-Quality CdTe Compound Semiconductors Experiment: Final Flight Sample Characterization Report
Larson, David J., Northrop Grumman Corp., USA; Casagrande, Luis G., Northrop Grumman Corp., USA; DiMarzio, Don, Northrop Grumman Corp., USA; Alexander, J. Iwan D., Alabama Univ., USA; Carlson, Fred, Clarkson Univ., USA; Lee, Taipo, Clarkson Univ., USA; Dudley, Michael, State Univ. of New York, USA; Raghathamachar, Balaji, State Univ. of New York, USA; September 1998; 178p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS8-38147
Report No.(s): NASA/CR-1999-209567; NAS 1.26:209567; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The Orbital Processing of High-Quality Doped and Alloyed CdTe Compound Semiconductors program was initiated to investigate, quantitatively, the influences of gravitationally dependent phenomena on the growth and quality of bulk compound semiconductors. The objective was to improve crystal quality (both structural and compositional) and to better understand and control the variables within the crystal growth production process. The empirical effort entailed the development of a terrestrial (one-g) experiment baseline for quantitative comparison with microgravity (mu-g) results. This effort was supported by the development of high-fidelity process models of heat transfer, fluid flow and solute redistribution, and thermo-mechanical stress occurring in the furnace, safety cartridge, ampoule, and crystal throughout the melting, seeding, crystal growth, and post-solidification processing. In addition, the sensitivity of the orbital experiments was analyzed with respect to the residual microgravity (mu-g) environment, both steady state and g-jitter. CdZnTe crystals were grown in one-g and in mu-g. Crystals processed terrestrially were grown at the NASA Ground Control Experiments Laboratory (GCEL) and at Grumman Aerospace Corporation (now Northrop Grumman Corporation). Two mu-g crystals were grown in the Crystal Growth Furnace (CGF) during the First USA Microgravity Laboratory Mission (USML-1), STS-50, June 24 - July 9, 1992.
Author
Cadmium Tellurides; Crystal Growth; Doped Crystals; Microgravity; Semiconductors (Materials); Zinc Tellurides; Space Processing; Gravitational Effects; Spaceborne Experiments

19990064643 Alabama Univ., Dept. of Civil and Environmental Engineering, Huntsville, AL USA
Constitutive and Stability Behavior of Soils in Microgravity Environment
Alshibli, Khalid A., Alabama Univ., USA; Sture, Stein, Colorado Univ., USA; Costes, Nicholas, Colorado Univ., USA; [2000]; 1p; In English; Space Technology Applications, 28 Jan. 2000, Albuquerque, NM, USA
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

All aspects of soil stability, bearing capacity, slope stability, the supporting capacity of deep foundations, and penetration resistance depend on soil strength. The stress-deformation and stress-deformation-time behavior of soils are of importance in any problem where ground movements are of interest. In most engineering materials, the strength is derived from internal chemical and physico-chemical forces of interaction, which bond the atoms, molecules, and particles together. In soils, the constitutive relations are mainly derived from interparticle friction between particles and particle groups and dilatancy, and to a lesser extent from

particle bonding by weak electrostatic, physico-chemical, and coulomb forces. For engineering purposes, soils are classified as cohesive (clays and silts; typical particle sizes range from 10 nm to 10 micrometers) and cohesionless (sand and gravel; typical particle sizes range from 10 micrometers to 75 mm). The mechanical or constitutive properties of cohesionless soils or granular materials are highly fabric-dependent, highly non-linear, and non-conservative with engineering properties primarily depending on the effects of gravity through self-weight and on the tractions or forces applied to the soil mass. Under moderate-to-high stress levels, the influence of gravity on the behavior of laboratory test specimens may not be pronounced and, therefore, the test results in terrestrial (1-g) environment may be sufficiently conclusive. However at low interparticle stresses, which can result either from low applied (confining) stresses or from excess pore fluid pressures developed within the soil mass without corresponding changes in the applied stresses, the presence of gravitational body forces acting on solid particles and interstitial fluids exerts a pronounced influence on movement of individual particles or particle groups. Such motions, in turn, cause changes in soil fabric which results in significant changes in the interparticle friction forces contributing to the soil's strength and deformation characteristics.
Author
Soils; Granular Materials; Microgravity; Interstitials

19990064646 NASA Marshall Space Flight Center, Huntsville, AL USA
Measurement of Temperature Fluctuations and Microscopic Growth Rates in a Silicon Floating Zone Under Microgravity
Croell, Arne, NASA Marshall Space Flight Center, USA; Schweizer, Markus, NASA Marshall Space Flight Center, USA; Dold, P., NASA Marshall Space Flight Center, USA; Kaiser, T., NASA Marshall Space Flight Center, USA; Lichtensteiger, M., NASA Marshall Space Flight Center, USA; Benz, K. W., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 2 Aug. 1999, Tucson, AZ, USA; Sponsored by American Association for Crystal Growth, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

USA Several microgravity experiments on sounding rockets and the Space Shuttle have shown that time-dependent thermo-capillary (Marangoni) convection is the major cause for the formation of dopant striations in floating-zone grown semiconductor crystals, at least in small-scale systems not employing RF heating. to quantify this correlation, a silicon floating-zone experiment was performed during the TEXUS36 flight (February 7, 1998) in the monoellipsoid mirror furnace TEM02-ELLI. During the experiment, temperature fluctuations in the silicon melt zone and the microscopic growth rate were simultaneously measured. Temperature fluctuations of 0.5 C - 0.7 C with main frequencies between 0.1 Hz and 0.3 Hz were detectable. The microscopic growth rate fluctuated considerably around the average growth rate of 1 mm/min: rates from 4 mm/min to negative values (back-melting) were observed. Dopant striations are clearly visible in the Sb-doped crystal. They were characterized by Spreading Resistance measurements and Differential Interference Contrast microscopy. The frequencies associated with the dopant inhomo-geneities correspond quite well with those of the temperature fluctuations and microscopic growth rates. 3D numerical simulations were performed to predict the optimum position of the temperature sensor, to evaluate characteristic temperature amplitudes and frequencies, and to give insight into the instability mechanisms of Marangoni convection in this configuration. The simulations were in good agreement with the experimental values, showing temperature fluctuations with frequencies ? 0.25 Hz and ampli-tudes up to 1.8 C at a position equivalent to that of the sensor tip in the experiment.
Author
Marangoni Convection; Melts (Crystal Growth); Crystal Growth; Doped Crystals; Microgravity; Float Zones; Semiconductors (Materials)

19990068007 NASA Marshall Space Flight Center, Huntsville, AL USA
Processing of Bulk YBa2Cu3O(7-x) High Temperature Superconductor Materials for Gravity Modification Experiments and Performance Under AC Levitation
Koczor, Ronald, NASA Marshall Space Flight Center, USA; Noever, David, NASA Marshall Space Flight Center, USA; Hiser, Robert, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Joint Propulsion, June 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have previously reported results using a high precision gravimeter to probe local gravity changes in the neighborhood of bulk-processed high temperature superconductor disks. Others have indicated that large annular disks (on the order of 25cm diameter) and AC levitation fields play an essential role in their observed experiments. We report experiments in processing such large bulk superconductors. Successful results depend on material mechanical characteristics, and pressure and heat treat proto-cols. Annular disks having rough dimensions of 30cm O.D., 7cm I.D. and 1 cm thickness have been routinely fabricated and tested under AC levitation fields ranging from 45 to 300OHz. Implications for space transportation initiatives and power storage fly-wheel technology will be discussed.
Author
High Temperature Superconductors; Levitation; Mechanical Properties; Superconductivity; Gravitation

19990069533 NASA Marshall Space Flight Center, Huntsville, AL USA
Modified Truncated Cone Target Hyperthermal Atomic Oxygen Test Results
Vaughn, Jason A., NASA Marshall Space Flight Center, USA; Kamenetzky, Rachel R., NASA Marshall Space Flight Center, USA; Finckenor, Miria M., NASA Marshall Space Flight Center, USA; May 1999; 1p; In English
Contract(s)/Grant(s): RTOP 546-88-50
Report No.(s): NASA/TM-1999-209266; M-927; NAS 1.15:209266; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The modified truncated cone target is a docking target planned for use on the International Space Station. The current design consists of aluminum treated with a black dye anodize, then crosshairs are laser etched for a silvery color. Samples of the treated aluminum were exposed to laboratory simulation of atomic oxygen and ultraviolet radiation to determine if significant degradation might occur. Durability was evaluated based on the contrast ratio between the black and silvery white areas of the tar-et. Degradation of optical properties appeared to level off after an initial period of exposure to atomic oxygen. The sample that was not alodined according to MIL-C-5541, type 1A, performed better than alodined samples.
Author
Environment Effects; Spacecraft Docking; Oxygen Atoms; Degradation

19990069902 NASA Marshall Space Flight Center, Huntsville, AL USA
Flight- and Ground-Based Materials Science Programs at NASA
Gillies, Donald C., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 25-29 Jan. 1999, Cocoa Beach, FL, USA; Sponsored by American Ceramic Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Microgravity Research Division of NASA funds research programs in all branches of materials science including ceramics and glasses. A NASA Research Announcement (NRA)is currently planned with proposals due in March 1999. Proposals are accepted for both flight- definition and ground- based research projects with a main criterion being a strong justification for microgravity. A review of the program in its entirety will be given, with special emphasis on microgravity related ceramics research. The topics of current interest in the NRA will be discussed in terms of International Space Station research and NASA's Human Exploration and Development of Space (HEDS) initiative.
Author
NASA Programs; Microgravity

31
ENGINEERING (GENERAL)

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

19990064516 Department of the Navy, Washington, DC USA
Tow Cable with Conducting Polymer Jacket for Measuring the Temperature of a Water Column
Ruffa, Anthony A., Inventor; Jul. 06, 1998; 12p; In English
Patent Info.: Filed 6 Jul. 1998; US-Patent-Appl-SN-09,115,073
Report No.(s): AD-D019357; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A tow cable is discussed for measuring temperature in a water column comprising an optical fiber core, an electrically conducting polymer jacket concentrically superimposed over the cable core and a temperature sensor embedded in the electrically conducting polymer jacket. The superior heat transfer characteristics of the electrically conducting polymers allow the heat sensors to be embedded directly into the insulating polymer jacket.
DTIC
Fiber Optics; Cables (Ropes); Temperature Measuring Instruments; Conducting Polymers; Optical Fibers

19990064540 Helsinki Univ. of Technology, Lab. of Heating, Ventilation and Air Conditioning, Espoo, Finland
Calculation Methods for Air Supply Design in Industrial Facilities. Literature Review
Hagstroem, K.; Siren, K.; Zhivov, A. M.; 1999; ISSN 1455-2043; 220p; In English
Report No.(s): PB99-147480; Rept-B60; ISBN 951-22-4418-7; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

The objectives of air distribution systems for warm air heating, ventilating, and air-conditioning are to create the proper thermal environment conditions in the occupied zone (combination of temperature, humidity, and air movement), and to control vapor and air born particle concentration within the target levels set by the process requirements and/or threshold limit values based on health effects, fire and explosion prevention, or other considerations. Air supplied into the room through the various types of out-

lets(grills, ceiling mounted air diffusers, perforated panels, etc.), is distributed by turbulent air jets. In mixing type air distribution systems, these air jets are the primary factor affecting room air motion. Design methods based on air jet theory allows for the prediction of extreme values of air velocities and air temperatures in the occupied zone of empty spaces. Current air jet theory techniques account for the effects of buoyancy, confinement, jets interaction.
NTIS
Air Conditioning; Air Conditioning Equipment; Heating; Ventilation; Industrial Plants

19990066649 Lockheed Martin Corp., Huntsville, AL USA
Product Structure, the Heart of Product Definition
DeHoog, C., Jr., Lockheed Martin Corp., USA; 1999; In English; Mission Critical Enterprise Systems, 24-26 May 1999, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-36200; Copyright; Avail: Issuing Activity, Hardcopy

This paper describes the LMMSS Product Definition System (PDS) philosophy and approach were the use of each item parts document or software can be traced to a specific end item (EI) serial/tail number of the product. It explains why a part-oriented approach to data organization and configuration management is required. The definition of part-oriented is that all appropriate product definition data products will be collected. Referenced and managed by their linkage/relationship to parts/items, The paper will touch upon how LMMSS store/controls product definition information under each project's top product designator in a two tiered approach. One tier for each product end item and another tier which contain/controls listings of drawings, documents. Specifications and standards that are required for hardware item definition.
Author
Hardware; Equipment Specifications; Data Management

19990067272 Alabama Univ., Huntsville, AL USA
Constitutive and Stability Behavior of Granular Materials Under Very Low Effective Stresses
Alshibli, Khalid A., Alabama Univ., USA; Sture, Stein, Colorado Univ., USA; Costes, Nicholas C., Colorado Univ., USA; Batiste, Susan N., Colorado Univ., USA; Swanson, Roy A., Colorado Univ., USA; Lankton, Mark R., Colorado Univ., USA; 1999; 1p; In English; ASCE Alabama Section, 5 Aug. 1999, Gulf Shores, AL, USA
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The study of the behavior of granular materials such as sand is of great importance to the understanding of the response of foundations resting on surface and near-surface soil deposits. A clear understanding of the behavior of such materials can also provide insights into other related issues where low effective stresses are encountered such as liquefaction. The main sources of the constitutive and stability properties of cohesionless granular materials is interparticle friction, which in turn under low confinement stress levels is strongly affected by gravitational body forces under terrestrial (1 gravity) conditions. Under moderate-to-high stress levels, the influence of gravity on the behavior of experiments may not be pronounced and therefore the test results in a terrestrial environment may be acceptable for engineering purposes. However, the conduct of experiments on granular materials under very low stress levels and under quasi-static conditions can only be performed in a microgravity environment. A series of displacement-controlled cyclic triaxial compression experiments were performed in a SPACEHAB module on the Space Shuttle during the STS-79 mission to Mir in September, 1996, and the STS-89 mission in January, 1998. The experiments were conducted on six right cylindrical specimens 75 mm in diameter and 150 mm long at effective confining pressures of 0.05, 0.52 and 1.30 kPa. The results show very high peak strength friction angles in the range of 47.6 to 70.0 degrees, which are mainly due to overconsolidation and grain interlocking effects. It was observed that the residual strength levels were in the same range as that observed at higher confining stress levels. The dilatancy angles were unusually high in the range of 30 to 31 degrees. All specimens display substantial initial stiffnesses and elastic moduli during unloading and reloading events, which are nearly an order of magnitude higher than conventional theories predict. A periodic instability phenomenon which appears to result from buckling of multiple internal arches and columnar systems, augmented by stick-slips was observed in the experiments. Computed Tomography (CT) measurements revealed valuable data about the internal fabric and the specimens deformation patterns. Uniform diffuse bifurcation with multiple radial shear bands was observed in the specimens tested in a microgravity environment. In the axial direction, two major conical surfaces were developed. Spatial nonsymmetrical deformations were observed in specimens tested in terrestrial laboratory.
Derived from text
Stability; Granular Materials; Stress Analysis; Research; Computer Aided Tomography; Residual Strength

19990067832 NASA Goddard Space Flight Center, Greenbelt, MD USA

Flight Testing of a Cryogenic Capillary Pumped Loop

Ku, Jentung, NASA Goddard Space Flight Center, USA; Kobel, Mark, NASA Goddard Space Flight Center, USA; Bugby, David, Swales Aerospace, USA; Kroliczek, Edward, Swales Aerospace, USA; Baumann, Jane, C and R Technologies, Inc., USA; Cullimore, Brent, C and R Technologies, Inc., USA; 1999; 1p; In English; Two-Phase Technology, 17-19 May 1999, College Park, MD, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Future space-based cryogenic systems will require enhanced integration flexibility, lower weight reduced parasitic penalties, better vibration isolation, and a variety of other improvements to meet performance goals. Additionally, there is an increasing need to locate cooling sources remotely from cooled components. In the past flexible conductive links were used and worked well in most cases. However, as the transport lengths increase, conductive couplings become heavier and less effective, and must be replaced by higher performance systems. One available option, which can meet many of these future requirements, is the cryogenic capillary pumped loop (CCPL). The development of the CCPL technology started in 1992, following the success of the room temperature CPLS. The extrapolation of CCPL technology to cryogenic temperatures offers many performance benefits, which are not currently within the reach of traditional heat pipes or conductive links. Specific advantages of the CCPL technology pertaining to cryocooler integration include: (1) greater capillary pumping pressure for improved ground testability; (2) improved mechanical isolation; (3) faster diode shutdown and lower reverse heat leaks; (4) tighter control of detector temperature; (5) variable or fixed conductance operation; and (6) ease of integration due to their flexibility. The applications of CCPL technology are numerous. Military and commercial applications include surveillance satellites, earth observing satellites, deep space observation systems, medical devices, and many other cryogenic systems. Over the past few years, several breadboard and prototype CCPLs have been built and ground tested. A prototype CCPL has demonstrated successful operation between 80K and 110K with heat loads between O.5W and 12W using nitrogen as the working fluid, and 35K and 40K with head loads of 0.25W to 3.5W using neon. In order to verify CCPL performance in a microgravity environment, a flight unit, CCPL-5, was tested onboard the Space Shuttle STS-95 in October of 1998 as part of the CRYOTSU Flight Experiment. This flight was the first in-space demonstration of the CCPL. The CCPL-5 utilized nitrogen as the working fluid and operated between 75K and 110K. Flight results indicated excellent performance of the CCPL-5 under zero-G environment The CCPL could start from a supercritical condition in all tests, and the loop operating temperature could be tightly controlled regardless of changes in the heat load and/or the sink temperature. In addition, the loop demonstrated successful operation with a heat load of 0.5W as well as with parasitic heat loads alone. There were no noticeable differences between zero-G and one-G operation.

Author

Cooling; Cryogenic Temperature; Cryogenics; Microgravity; Capillary Flow

19990068441 Defence Evaluation Research Agency, Technical Development Group, Boscombe Down, UK

Integrated Test and Evaluation in Support of Defence Capability

Brain, Colin, Defence Evaluation Research Agency, UK; Smart Procurement for Weapon Systems: Proceedings; 1999, pp. 7.1 - 7.9; In English; See also 19990068434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Following the Strategic Defense Review (SDR), the principle of a layered ”systemsengineering” approach to managing military capability in the UK has become widely accepted. These layers range from defence capability at the top, to components at the bottom. Underlying this is the familiar ’V’ model; requirements are divided and distribute to an increasingly large number of sub-items on the way down and the developed sub-items meeting these requirements are integrated on the way back up. Each level requires Test and Evaluation (T&E) to support requirement capture and ensure that requirements have been met within known risk margins and sub-items have been correctly integrated. This presents a complex picture, but managing cost-effective T&E, through layers and through life, becomes a major challenge in the SDR context of: reduced project durations, concurrent development, cost as an independent variable, increasing system complexity, use of COTS systems, risk management, technology insertion and increased reliance on software. Unlike our allies, the UK currently does not have any central Defense T&E foci and lacks co-ordinated T&E policies and strategies. Thus the military T&E community is ill prepared to handle this challenge. The paper looks at the requirements for through-life and through-level T&E and considers how these might be implemented into capability management and the integrated project teams that are emerging as a result of the Smart Procurement Implementation initiative. In this analysis, customers for different forms of T&E are identified, since they vary with level and with time. However, an underlying issue is that of maintaining and developing the capabilities necessary to deliver T&E, particularly the people. The paper ends by reviewing the major steps necessary if we are to confront the challenge of integrating T&E in support of building cost-effective future Defense capability.

Author (revised)

Government Procurement; Weapon Systems; Weapons Development; Defense Program

19990068988 Osaka Univ., Dept. of Civil Engineering, Osaka, Japan

Strengthening of Rectangular RC Piers with Partial Concrete Lining and Carbon Fiber Sheet

Lee, Youngho, Osaka Univ., Japan; Matsui, Shigeyuki, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2328, pp. 247-254; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

From the experience of the serious damages of concrete piers due to the Great Hanshin Earthquake, the strengthening for the existing concrete piers against such a large earthquake has become a more important maintenance work. By strengthening, both the ductility and the flexural strength of the strengthened pier must be well increased. In this paper, a strengthening method for concrete piers using partial concrete lining jacket covered by carbon fiber sheets is investigated. ne test specimens are loaded statically with alternating horizontal loads. A total of 11 specimens are loaded until failure. The results show that the combination of the partial concrete lining and the carbon fiber sheet covering in the hoop direction improves both of the load carrying capacity and the ductility of RC piers.

Author

Concretes; Carbon Fibers; Flexural Strength; Bridges; Load Carrying Capacity

19990069948 NASA Kennedy Space Center, Cocoa Beach, FL USA

Design and Use of a Large-Scale Liquid Helium Conversion System

Knudsen, P. N., NASA Kennedy Space Center, USA; 1999; 4p; In English; Cryogenic Engineering and International Cryogenic Materials, 12-16 Jul. 1999, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A large-scale liquid helium (LHe) to high-pressure (HP) gas conversion system has been implemented at the John F. Kennedy Space Center (KSC). Helium is used by the Space Shuttle, Titan, Atlas, and Delta programs for prelaunch processing, during launch count-down, and for postlaunch securing. The first phase of modifications to the Compressor Converter Facility (CCF), operational in April 1998, allowed the facility to accept bulk liquid helium from tanker containers and to off-load the helium at super-critical pressures. The second phase of modifications, planned to be operational by January 2001, will implement a 227-cubic-meter (m(sup 3)) on-site liquid helium storage system. This paper describes the design and operation of the current system and discusses the design and implementation for the second phase system.

Author

Liquid Helium; Compressed Gas; Prelaunch Tests; Countdown; Flight Operations

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COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. For related information see also 04 Aircraft Communications and Navigation and 17 Space Communications, Spacecraft Communications, Command and Tracking. For search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation.

19990064390 Institute for Human Factors TNO, Soesterberg, Netherlands

The Effects of Two Types of Information Exchange on Team Self-Correction ***Interim Report Het Effect van Twee Soorten Informatie-Uitwisseling op Team Zelf-Correctie***

Rasker, P. C., Institute for Human Factors TNO, Netherlands; Schraagen, J. M. C., Institute for Human Factors TNO, Netherlands; Koster, E. R., Institute for Human Factors TNO, Netherlands; Jan. 12, 1999; In English

Contract(s)/Grant(s): B98-061; TNO Proj. 731.1

Report No.(s): TD99-0002; TNO-TM-99-B001; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy

In this study, we investigated the role of information exchange in Command & Control teams. For the sake of efficiency, it is often thought that information exchange in teams should be restricted to 'what is needed'. Team members are expected to exchange relevant data only. We hypothesized, however, that additional information exchange in teams would contribute to the performance. Furthermore, we expected that teams use the time during breaks between task execution to evaluate their task performance, which may improve their performance for the next time. This phenomenon is called 'team self-correction'. Two types of information exchange that play a role in Command & Control teams were distinguished. First, during task execution teams engaged in 'activity-based' information exchange: information exchange with concrete content concerning the ongoing flow of events. Second, between task execution (or in low workload periods) teams engaged in 'task-related' information exchange: information exchange with a conceptual and abstract content concerning the task performance in general. In an experiment, we investigated the effects of these two types of information exchange on team self-correction and the overall team performance. Four

conclusions can be drawn from the experimental results. First, in order to improve team performance, team members need to exchange additional information, besides the necessary data. Second, team performance improves, when team members engage in 'task-related' information exchange. This strongly supports the notion of team self- correction. Third, so called 'activity-based' information exchange during the task contributes more to the team performance than so called 'task-related' communication outside the task. This may be explained by better opportunities for coordination, more possibilities to cross check and to correct errors, a better shared understanding of the situation, and more possibilities to learn. Finally, 'activity-based' based information exchange is required to deal successfully with novel situations.
Author
Command and Control; Human Performance; Data Transmission

19990064417 California Inst. of Tech., Pasadena, CA USA
Finline Ortho-Mode Transducer for Millimeter Waves, ***1999-2006***
Chattopadhyay, Goutam, California Inst. of Tech., USA; Carlstrom, John E., Chicago Univ., USA; [1999]; 11p; In English; Copyright; Avail: Issuing Activity, Hardcopy

We evaluate the possibility of using a finline ortho-mode transducer (OMT) at millimeter wavelengths. A finline OMT has low loss, low cross-polarization and good return loss over a full waveguide band. We propose a novel finline OMT structure for millimeter wavelengths and present results at X-band.
Author
Transducers; Millimeter Waves; Evaluation

19990064471 Massachusetts Univ., Multimedia Indexing and Retrieval Group, Amherst, MA USA
Polarimetric Measurements of Natural Surfaces at Millimeter Wavelengths ***Final Report***
Baker, Jeffrey M.; McIntosh, Robert E.; Mar. 01, 1999; 9p; In English
Contract(s)/Grant(s): DAAH04-96-1-0043
Report No.(s): AD-A365268; ARO-34080.1-EL; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

In support of the goals the Army Research Office (ARO) and to further scientific understanding, the Microwave Remote Sensing Laboratory at the University of Massachusetts has developed millimeter wave radars capable of measuring polarimetric scattering from natural surfaces including snow cover. These radars, operating at 35, 95, and 225 GHz, have been employed with two goals in mind. The first has been to develop a database of millimeter wave scattering measurements. The second goal was to increase the depth of scientific knowledge pertaining to electromagnetic scattering from terrain at millimeter wavelengths.
DTIC
Polarimetry; Millimeter Waves

19990064474 Auburn Univ., Dept. of Electrical Engineering, AL USA
Cyclostationary Signal Processing in Digital Communication Systems ***Final Report, 1 Jan. - 31 Dec. 1998***
Ding, Zhi; May 07, 1999; 6p; In English
Contract(s)/Grant(s): DAAH04-94-G-0252
Report No.(s): AD-A365285; ARO-33151.19-EL-DPS; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Our focus in this ARO research project is to investigate and study the application of cyclostationary signal processing in digital communication systems. We consider several important areas of application including channel equalization, co-channel interference rejection, and antenna beamforming. During this report period, we developed a number of new algorithm for the blind identification and equalization of multiple input multiple output systems. These methods are more robust and accurate than many existing methods. Blind separation of signals using both the higher order and second order (cyclostationary) statistics are studied. Several simple methods are proposed. We also developed a finite window decorrelator receiver for asynchronous CDMA systems. This new algorithm is near far resistant even when the processing window is rather short, overcoming the weakness of the conventional decorrelator that relies on large (almost infinite) window size. In another important study, we investigate the applicability of blind equalization algorithms in practical wireless cellular systems such as the GSM. Since the GSM transmission is nonlinear and is in burst mode, blind equalization algorithms must be adopted for this nonlinear modulation and must converge within each frame of data burst. Using a linearization method, we implied the nonlinear GMSK signal into an equivalent linear QAM signal. A de-rotation scheme further allowed channel diversity be extracted without the need of additional downlink antennae. Successful blind equalization and semi-blind equalization results for GSM are established.
DTIC
Signal Processing; Telecommunication; Pulse Communication; Digital Systems

19990064500 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Teknologi Transmisi Komunikasi Dirgantara, Jakarta, Indonesia

Analysis of Data Communication: Communications Between the Rancabungur Lapan and the Jakarta Lapan ***Analisis Hubungan Komunikasi Data Antara LAPAN Rancabungur Dan LAPAN Jakarta***

Yuba, Rakhim, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Hardhienata, Soewarto, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April 1998; ISSN 0126-9754, No. 55, pp. 1-9; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Voice or data communication through radio using VHF (Very High Frequency) or UHF (Ultra High Frequency) frequency spectrum, often receives disturbance which is caused by several factors. Factors which often emerge those disturbances are; geographic position of the transmitting and receiving station, distance as well as abstract which exists between the transmitting station and the receiving station ,height of the antenna positioning and direction, signal strength which is being used, etc. This paper discusses the analyst of data communication between LAPAN Rancabungur and LAPAN Jakarta office. The result are stipulations which should be followed so that data communication between those two stations be done smoothly, relied and efficiently.
Author (revised)

Data Processing; Frequency Distribution; Voice Communication

19990064505 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Radio Plasma Imager Investigation on the IMAGE Spacecraft

Reinisch, Bodo W., Massachusetts Univ., USA; Haines, D. M., Massachusetts Univ., USA; Bibl, K., Massachusetts Univ., USA; Cheney, G., Massachusetts Univ., USA; Galkin, I. A., Massachusetts Univ., USA; Huang, X., Massachusetts Univ., USA; Myers, S. H., Massachusetts Univ., USA; Sales, G. S., Massachusetts Univ., USA; Benson, R. F., NASA Goddard Space Flight Center, USA; Fung, S. F., NASA Goddard Space Flight Center, USA; May 01, 1999; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Radio plasma imaging uses total reflection of electromagnetic waves from plasmas whose plasma frequencies equal the radio sounding frequency and whose electron density gradients are parallel to the wave normals. The Radio Plasma Imager (RPI) has two orthogonal 500-m long dipole antennas in the spin plane for near omni-directional transmission. The third antenna is a 20-m dipole. Echoes from the magnetopause, plasmasphere and cusp will be received with three orthogonal antennas, allowing the determination of their angle-of-arrival. Thus it will be possible to create image fragments of the reflecting density structures. The instrument can execute a large variety of programmable measuring programs operating at frequencies between 3 kHz and 3 MHz. Tuning of the transmit antennas provides optimum power transfer from the 10 W transmitter to the antennas. The instrument can operate in three active sounding modes: (1) remote sounding to probe magnetospheric boundaries, (2) local (relaxation) sounding to probe the local plasma, and (3) whistler stimulation sounding. In addition, there is a passive mode to record natural emissions, and to determine the local electron density and temperature by using a thermal noise spectroscopy technique.
Author

Imaging Techniques; Plasmas (Physics); Transmitters; Thermal Noise; Plasma Frequencies

19990064549 Physics and Electronics Lab. TNO, The Hague, Netherlands

JWID 1998: An Impression ***Final Report JWID 1998: Een Impressie***

Zwaard, P. H., Physics and Electronics Lab. TNO, Netherlands; December 1998; In Dutch
Contract(s)/Grant(s): A98/D/755; TNO Proj. 28323
Report No.(s): FEL-98-A248; TD98-0194; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., P.O. Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy

The objective of JWID'98 is to demonstrate technologies which contribute to the interoperability of C2 systems. JWID'98 has shown that the functionality of the World Wide Web and Internet technology allows to combine commercial systems and military systems into a C4I network which provides access to the digital battlefield information of various NATO partners. The exchange of information between C2 systems is however still cumbersome. Although message standards are used (e.g. AdatP-3 or OTH-G) there remain differences in implementation of these standards and differences in the data models used by these C2 systems. Question marks remain about the security aspects and survivability aspects of the demonstrated technologies when applied in a military environment. Also it is questioned whether military communications networks can provide sufficient bandwidth to support C4I networks.
Author

Bandwidth; Communication Networks; Digital Data; Security; Over-The-Horizon Radar

19990064598 NASA Goddard Space Flight Center, Greenbelt, MD USA

Cramer-Rao Bounds for M-PSK Packets with Random Phase

Drake, Jeffrey, NASA Goddard Space Flight Center, USA; 1999; 4p; In English; 5th; Signal Processing and its Applications, 22 Aug. 1999, Brisbane, Australia; Copyright; Avail: Issuing Activity, Hardcopy

In this paper, we derive new Cramer-Rao bounds (CRBs) for the estimation of phase from a block of random M-PSK (M=8) symbols for the case where the phase to be estimated is a random variable(r.v.). Existing bounds for 2 and 4-PSK which model the phase as non-random are extended to obtain a new 8-PSK CRB. The new bound which models the phase as a r.v. is compared to the new 8-PSK bound which models the phase as non-random. With 8-PSK we see clearly that use of the random phase CRB more accurately models the behavior if the phase, as normally happens, is supposed to be constrained to the interval [-pi/M,pi/M).
Author

Cramer-Rao Bounds; Estimating; Packets (Communication); Phase Shift Keying; Maximum Likelihood Estimates; Data Transmission; Packet Switching; Synchronism

19990064599 NASA Goddard Space Flight Center, Greenbelt, MD USA

Lower Bounds for Phase Estimation of PSK Packets with Random Phase

Drake, Jeffrey, NASA Goddard Space Flight Center, USA; May 09, 1999; 3p; In English; 33rd; Signals, Systems and Computers, 24 Oct. 1999, Pacific Grove, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy

In this paper, we derive new Cramer-Rao bounds (CRBs) for the estimation of phase from a block of random M-PSK (M=2,4,8) symbols where the phase to be estimated is a random variable. Existing bounds for 2 and 4-PSK which model the phase as non-random are extended to obtain a new 8-PSK CRB. The new random phase bounds are compared to the new 8-PSK and existing 2,4-PSK bounds which model the phase as non-random. We see that the random phase CRBs more accurately model the behavior if the phase, as normally happens, is suppose to be constrained to the interval [-pi/M,pi/M).
Author

Cramer-Rao Bounds; Packets (Communication); Phase Shift Keying; Data Transmission; Packet Switching; Packet Transmission; Maximum Likelihood Estimates; Random Processes

19990066683 Naval Research Lab., Washington, DC USA

Wave Equation Solution for Electromagnetic Field Incident on Planar Conducting Arrays

Loschialpo, Peter; Jun. 10, 1999; 35p; In English

Report No.(s): AD-A364920; NRL/MR/5050--99-8381; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new wave equation solution is presented for analyzing planar periodic patch or aperture arrays having complex conductivity with an arbitrary distribution. The approach extends prior developments in photonic band-gap theory by including the conductivity mechanism. The wave equation is written in the form Schroedinger's equation. Solutions are obtained in the spectral domain for the radiated field in terms of a summation of plane waves. The method provides valuable physical insights not readily obtainable using conventional solutions for periodic arrays. Incident and radiated fields are related in a single mathematical expression. This expression shows how each radiated field mode is coupled to the others via mutual capacitive and inductive terms. The theory may be readily extended to multiple layers.
DTIC

Schroedinger Equation; Plane Waves; Wave Equations; Electromagnetic Fields

19990066689 Illinois Univ., Coordinated Science Lab., Urbana, IL USA

One-Success Access Without Feedback for a Bounded Number of Active Stations

Bruneteau, Philippe P., Illinois Univ., USA; Jun. 1998; 483p; In English

Contract(s)/Grant(s): DAAH04-95-1-0246

Report No.(s): AD-A365033; UILU-ENG-98-2214; ARO-33988-EL-FRI; No Copyright; Avail: CASI; A04, Microfiche; A21, Hardcopy

We consider a random multi-access system, where T active stations among M stations contend for transmission over a common medium in L minislots. Each active station transmits in a subset of these minislots, the subsets chosen by the stations being mutually independent. A success is said to occur if during at least one minislot there is a single transmission; otherwise, a failure occurs. We seek transmission policies which minimize the probability of failure. We investigate a transmission strategy which is suitable if the number of active stations T is unknown but bounded by some number T sub 0. We derive performance bounds for the strategy and suggest particular choices of parameters for the strategy for given values of L and T sub 0.
DTIC

Pulse Communication; Packet Switching; Spread Spectrum Transmission; Multiple Access; Multipath Transmission

19990067239 Space and Naval Warfare Systems Center, San Diego, CA USA

Measures of Effectiveness for Multiple ROTHR Track Data Fusion (MRTDF)

Yssel, W. J., Space and Naval Warfare Systems Center, USA; Torrez, W. C., Space and Naval Warfare Systems Center, USA; Lematta, R. A., Space and Naval Warfare Systems Center, USA; Jun. 1998; 6p; In English; Published in Proceedings of the First Australian Data Fusion Symposium, IEEE 96th8216, p106-109, Nov 96.

Report No.(s): AD-A365091; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Relocatable Over-the-Horizon Radar (ROTHR) is a long range, bi-static, high frequency radar surveillance system tasked with tracking air targets over large land and ocean areas. The long ranges, together with the relatively low altitudes of the targets, require that the radar look beyond the line-of-sight, in other words, over-the-horizon (OTH). This is accomplished by refracting the signal off the ionosphere to points beyond the horizon. In order to quantify the performance of the data fusion of multiple OTH radar tracks, several Measures of Effectiveness (MOEs) have been developed that correspond to the unique technical challenges facing a single OTH radar tracking system. This paper describes appropriate MOEs arising from OTH technical issues relating to ionospheric mode identification, crossing targets, and low Doppler targets. These MOEs were chosen to be sensitive to the performance that would be expected by fusing data from two OTH radar systems having overlapping coverage.

DTIC

Over-The-Horizon Radar; Radar Tracking; Multisensor Fusion

19990067250 Research Associates for Defense Conversion, Inc., Marcy, NY USA

MCARM/STAP Data Analysis, Volume 2 ***Final Report, Apr. 1996 - Feb. 1998***

Himed, Braham, Research Associates for Defense Conversion, Inc., USA; May 1999; 96p; In English

Contract(s)/Grant(s): F30602-96-C-0053; AF Proj. 4506

Report No.(s): AD-A364942; AFRL-SN-RS-TR-1999-48-VOL-2; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The purpose of this report is to assess the quality of the Multi-Channel Airborne Radar Measurements (MCARM) airborne data collected, evaluate several reduced rank Space-Time Adaptive Processing (STAP) algorithms, and provide guidance to researchers. The goal of MCARM is the development of STAP algorithms for enhanced target detection in severe environments through the use of real world multi-channel airborne data. The Rome Laboratory's MCARM program provides real data, monostatic and bistatic, for performance evaluation of existing and future STAP approaches. This report evaluates the performance of several state of the art STAP algorithms using monostatic MCARM data. The algorithm list includes Factored Time Space (FTS), Extended FTS Approach (EFA), Cross Spectral Metric (CSM), Joint Domain Localized (JDL), Principal Components, Parametric Adaptive Matched Filter (PAMP), and others. As expected, adaptive processing results in significant detection performance improvements over conventional beamforming techniques. N single algorithm can be deemed "best" as several factors affect performance. Two primary factors are the sample support requirement for interference estimation and computational complexity. A significant finding from the work is the non-homogeneous nature of the clutter returns. This nature violates the assumption of independent, identically distributed data for interference estimation illustrating the need for Non-Homogeneity Detectors (NHDs). NHDs offer improved detection and false alarm performance through better selection of secondary data.

DTIC

Signal Processing; Data Management; Radar Data; Distributed Processing; Radar Measurement; Airborne Radar

19990069214 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

InterSpace: Trial Services in Japan and the USA

Sugawara, Shohei, Nippon Telegraph and Telephone Public Corp., Japan; Yamana, Takashi, Nippon Telegraph and Telephone Public Corp., Japan; Sugiyama, Hiroshi, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 84-88; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Two trial services utilizing "InterSpace" system, a communication environment based on the shared virtual space with combination of real-time video, audio and CG (computer graphics), are described. "CyberForum" system consists of InterSpace and a VOD (video on demand) systeM. CyberForum shows future abilities of a VOD system in multi-user virtual space. Users can enjoy multi-media databases with coexistence feeling. "CyberCampus" aims to create virtual community. A system configuration is refined to support large number (approx. 100) of users. An ordinary PC's user can access CyberCampus via Internet. Many communication oriented features are tested through a trial CyberCampus service.

Author

Sensory Feedback; Internets; Data Bases; Computer Graphics; Communication Networks

19990069607 Space and Naval Warfare Systems Center, San Diego, CA USA
Underwater Acoustic Modem Configured for Use in a Local Area Network
Rice, J. A.; Green, Maurice D.; Merriam, S.; Sep. 1998; 7p; In English; Prepared in collaboration with Datasonics Inc., Cataumet, MA and Delphi Communications Systems Inc., Burlington, MA. Pub. in Proceedings of IEEE OCEANS '98 Conference, v2 p634-638, Sep 98.
Contract(s)/Grant(s): Proj-MA15
Report No.(s): AD-A365063; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The U.S. Navy Telesonar RDT&E effort is developing a low cost, non-coherent acoustic modem capable of data transmission under adverse channel conditions at data rates up to 2400 bits per second (bps). This modem was described at Oceans
DTIC
Modems; Underwater Acoustics; Data Transmission; Local Area 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.

19990064451 NASA Goddard Space Flight Center, Greenbelt, MD USA
Behavior of 2 Cell CPV NI-H2 Battery During Pulse Discharge
Gopalakrishna, M. Rao, NASA Goddard Space Flight Center, USA; Vaidyanathan, Hari, Communications Satellite Corp., USA; 1997; In English; Battery, 18-20 Nov. 1997, Huntsville, AL, USA; Sponsored by NASA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
A study was carried out to determine the transient voltage behavior of the 2-cell CPV nickel-hydrogen battery with the objective of using the results as a basis for mathematical modeling. The 2-cell CPV battery which is manufactured by Eagle Picher, Inc. for the GOES program yields 18.5 Ah at C/2 rate of discharge at 10 C with a mid-discharge voltage of 2.514 V. The capacity increased with decrease of temperature and a maximum capacity of 22 Ah was obtained at - 5 C. The pulse test consisted of obtaining the voltage profile in the first 20 milliseconds of the one minute pulse discharge at 37 A and pulse discharge was repeated as a function of state-of-charge. The pulse test at 10 C and 20 C provided voltage profiles with the expected decrease in voltage as the pulse was applied. The end of pulse voltage decreased with the state-of-charge. The battery voltage was above 2V at the end of the one-minute pulse at 12% state-of-charge at 10 C. The voltage profile during the 37 A pulse discharge consists of an initial drop in voltage which was independent of the state of charge. The invariability in the value for the initial drop in voltage with state of charge is a very important observation and indicates that towards the end of discharge the dominant resistance is not ohmic in nature. It could be hypothesized from the nature of the voltage transients that the dominant mechanism towards the end of discharge is proton diffusion. The study also shows that the dominant resistance in the voltage plateau during discharge is activation polarization.
Author
Nickel Hydrogen Batteries; Hydrogen-Based Energy; Energy Storage; Pulsed Radiation; Electric Discharges

19990064513 Department of the Navy, Washington, DC USA
Power Envelope Shaper
Costa, David R., Inventor; Suppappola, Seth B., Inventor; Jan. 14, 1999; 17p; In English
Patent Info.: Filed 14 Jan. 1999; US-Patent-Appl-SN-09/252,243
Report No.(s): AD-D019353; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
A power envelope shaping device for joining to a serial control output is disclosed. Multiple power switcher modules are joined to a plurality of incremental power sources and controlled by the power select circuitry module. In this way, each power switcher module can provide power from at least one of the incremental power sources on command from said power select circuitry module. The power switcher module outputs are joined together in order for providing varying power levels in accordance with a preprogrammed power envelope shape. In a further embodiment, there is provided a sonar system comprising a computer for system control, a power envelope shaper, a transmitter module, and a transducer array. The power envelope shaper receives control signals from the system computer. These control signals, serial data and data clock, are processed by a power level decoder, which enables a selected output channel at the appropriate time. Each power switcher channel controls a single tap of the battery pack by enabling and disabling its output. The output power from the power switcher is fed directly to a sonar transmitter and controls the amplitude of the acoustic sonar signal. The computer provides the serial data control signals to the power switcher,

using fast switching speeds thereby allowing for the production of different sonar envelope shapes. The particular envelope shape may be immediately modified by software to produce Gaussian or other power envelope shapes.
DTIC
Sonar; Electric Power Supplies; Modules; Transducers

19990064636 Michigan Univ., Dept. of Electrical Engineering and Computer Science, Ann Arbor, MI USA
A Quantitative Approach to Nonlinear IC Process Design Rule Scaling
Gold, Spencer Montgomery; Jan. 1999; 153p; In English
Contract(s)/Grant(s): DAAH04-94-G-0327
Report No.(s): AD-A365170; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This thesis introduces a methodology for determining scaled horizontal process design rule values that reach an effective tradeoff between not only cost and area, but performance. This is accomplished with a procedure that interactively finds the design rules that have the greatest impact on minimum layout area, and reduces them to their points of diminishing return from a cost, area, and performance perspective. The primary internment for performing this analysis is a process-independent RAM compiler. This thesis also describes optimization algorithms for exploring the large SRAM transistor size design space, and gives an innovative approach for optimizing an entire synchronous SRAM. Finally, a cost/benefit analysis of CGaAs transistor threshold voltage scaling is described. Through PUMA RAM compiler-based performance evaluations and die cost estimations, it was shown that CGaAs transistor threshold voltage scaling is expensive (with respect to expected benefits), compared to horizontal design rule scaling.
DTIC
Algorithms; Quantitative Analysis; Nonlinear Systems; Costs

19990066480 University of North Texas, Denton, TX USA
Three-Dimensional Ferroelectric Integrated Circuits -- Prototype Fabrication and Interface Studies ***Final Report, 1992-1996***
Pinzzotto, R. F., University of North Texas, USA; May 1999; 18p; In English
Contract(s)/Grant(s): DAAL03-92-G-0401
Report No.(s): AD-A365411; ARO-30872.1-EL-SM; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

1. Stoichiometry and Deposition Temperature Dependence of the Microstructural and Electrical Properties of Barium Strontium Titanate Thin Films; the Group II/Ti ratio should be as close as possible, but should not exceed the stoichiometric value of 1.00 and the grain size should be as large as possible in order to optimize the electrical properties of BST thin films deposited using LS-MOCVD. The Effect of Deposition Temperature. Conclusions: The Group II/Ti ratio should be as close to 1.00 as possible. The effects of grain size and volume fraction on the amorphous phase are of secondary importance when the stoichiometry ratio is close to 1.00. The Group II/Ti ratio plays a far greater role in controlling the electrical properties of BST films than the deposition temperature, grain size, or amorphous phase volume fraction. 2. Microstructural and Electrical Characterization of Barium Strontium Titanate Thin Films; a microstructure consisting of cubic BST plus a second amorphous phase is characteristic of BST thin films and not the deposition process used for their synthesis. When the Group II/Ti ratio is close to one, the grain size is not related to the electrical properties of the thin films.
DTIC
Integrated Circuits; Ferroelectric Materials; Metalorganic Chemical Vapor Deposition; Barium Titanates; Strontium Titanates; Amorphous Materials; Fabrication; Ferroelectricity

19990066643 NASA Goddard Space Flight Center, Greenbelt, MD USA
Electrostatic Discharge (ESD) Failures in Thin Film Resistors
Hull, Scott M., NASA Goddard Space Flight Center, USA; 1999; 12p; In English; 25th; Testing and Failure Analysis, 14-18 Nov. 1999, Santa Clara, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy

Field failures of nichrome thin film resistors have been investigated recently for several pieces of space flight hardware. These failures have involved resistance shifts ranging from a few percent to complete open circuits. Failure analysis and duplication of these failures have revealed that the failures were caused by electrostatic discharge. The failure characteristics and the circuit conditions necessary for failure have been studied for several types of thin film resistors including nichrome and tantalum nitride resistive elements. The effects of latent damage and resistive pattern design will also be discussed.
Author
Failure Analysis; Resistors; Electric Discharges; Electrostatic Charge

19990066675 Farr Research, Albuquerque, NM USA

The Ferratron: A High-Voltage, High Rep-Rate, Low Jitter, Ultrawideband Switch with a Ferroelectric Trigger ***Final Report, May 1998 - Jan. 1999***

Bowen, Leland H.; Feb. 1999; 26p; In English

Contract(s)/Grant(s): F29601-98-C-0150; AF Proj. 3005

Report No.(s): AD-A364808; AFRL-DE-TR-1999-1036; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The system is a novel application of ferroelectric ceramics combined with a gas flow scheme that provides reliable triggering at high repetition rates. The design can be interpreted as an active trigatron-like switch where the ferroelectric ceramic behaves as an electron/corona source and the trigger configuration is that of a simple trigatron with the advantage that the trigger voltages are not as high as the gap voltage. The trigger system is integrated into a fast gas flow switch chamber design capable of sustaining 500 kV at a pressure of 1500 psi. The switch chamber is tailored to reduce field stress and provide a low inductance current path with a very compact geometry. The high gas flow allows the replacement of the gas in the discharge region on a time scale necessary to sustain the required repetition rate (100 Hz to 1 kHz). The switch has been successfully operated during the preliminary tests using N2 at low pressure. The jitter was found to be is less than 70 ps at a repetition rate of 1 Hz. The rise time was on the order of 500 ps. Higher repetition rates, faster rise times, and higher voltages will be attained as testing and development continue.
DTIC

Ferroelectricity; Electric Switches; Ferroelectric Materials; Vibration

19990066679 Technische Univ., Inst. fuer Festkoerperelektronik, Vienna Austria

THz Radiation Source Through Periodically Modulated Structures ***Final Report, Nov. 1996 - Feb. 1999***

Gornik, E., Technische Univ., Austria; Rauch, C., Technische Univ., Austria; Pioner, G., Technische Univ., Austria; May 18, 1999; 83p; In English

Contract(s)/Grant(s): N68171-96-C-9015

Report No.(s): AD-A364882; ARO-34978.5-PH; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The main goal of the project was to investigate various possible mechanism for coherent THz radiation sources based on semiconductor devices. A novel concept considers the occurrence of a current driven plasma instability (CDPI) in a confined plasma. In this case tunnel injection can be used to achieve an inverted electron distribution by injecting carriers selectively into higher quantum well states and maintaining an efficient extraction scheme. In this project we have demonstrated for the first time that these injection-extraction structures can be realized by MBE growth and characterized by transport experiments. Two types of structures have been processes into ridge like mesa structures which have demonstrated for the first time THz emission the energy of the confined plasmon. The observation of electrically excited plasmon emission from parabolic quantum well up to temperatures close to room temperature is milestone for further work. It demonstrates the stability of the plasmon oscillation process and its potential for practical radiation sources. Bunching of electrons has been achieved by the localization of electrons in Bloch oscillations, which is another concept towards the realization of coherent THz emission.
DTIC

Quantum Electronics; Semiconductor Devices; Magnetohydrodynamic Stability; Coherent Radiation

19990067236 Virginia Univ., School of Engineering and Applied Science, Charlottesville, VA USA

Behavioral Fault Modeling in a VHDL Synthesis Environment

Hayne, Ronald J., Virginia Univ., USA; May 1999; 306p; In English

Report No.(s): AD-A365002; No Copyright; Avail: CASI; A03, Microfiche; A14, Hardcopy

Integrated circuit designs continue to increase in both size and complexity, making fault simulation and testing more difficult and costly. Computer aided design tools and hardware description languages are now commonly used to represent designs at higher levels of abstraction. However, fault simulation and testing of digital circuits have been historically done using fault models at the gate level or below. A design methodology is needed for performing fault simulation throughout the design process, incorporating fault models at higher levels of abstraction. Use of these higher level fault models has the promise of reducing complexity, providing earlier identification of potential problems, and improving integration of fault simulation into the overall design process. Previous behavioral fault models lack a well defined link to the hardware which they attempt to describe. Though some relationships to possible hardware faults are proposed, there is no detailed analysis to justify these assertions. Approaches based on perturbing language constructs, such as ADD to SUB, do not accurately reflect underlying hardware faults. In order to compensate for this big micro-operation problem, alternate methods such as heuristics are used to supplement test vector sets to increase the equivalent gate level fault coverage. This dissertation proposes a new set of fault models for VHDL behavioral descriptions of combinational logic circuits. These fault models exploit hardware relationships that exist in a design environment which involves synthesis of behavioral descriptions into gate level circuits. A functional analysis technique is used to evaluate the effects of indus-

try standard single stuck line (SSL) faults on gate level implementations. The generalized functional faults are then abstracted into the behavioral domain by examining their relationship with the higher level language construct.
DTIC
VHSIC (Circuits); Computer Aided Design; Digital Electronics

19990067238 Bogazici Univ., Electrical and Electronic Engineering, Istanbul, Turkey
Recent Advances in Mechatronics.
Kaynak, Okyay, Bogazici Univ., Turkey; Kerestecioglu, Feza, Bogazici Univ., Turkey; Ege, M. Onder, Bogazici Univ., Turkey; Unsaian, Cem, Bogazici Univ., Turkey; May 26, 1999; 505p; In English; 2nd; Recent Advances in Mechatronics: ICRAM'99, 24-26 May 1999, Istanbul, Turkey
Contract(s)/Grant(s): F61775-99-W-F029
Report No.(s): AD-A365064; EOARD-CSR-99-5029; No Copyright; Avail: CASI; A04, Microfiche; A22, Hardcopy
This is an interdisciplinary conference involved with the synergistic integration of mechanical engineering with electronics and intelligent computer control for design and manufacture of products and processes. Topics include: (1) mechatronics design, (2) distributed systems, (3) vision and sensors, (4) robots and mobile machines, (5) vibration and control, (6) computational intelligence in mechatronics, (7) embedded real time systems, (8) micro-mechatronics, (9) motion control, (10) hardware/software co-design, and (11) intelligent manufacturing systems.
DTIC
Robotics; Electromechanical Devices; Mechanical Engineering; Conferences; Computers

19990067242 Air Force Research Lab., Rome, NY USA
Methods of Discrete-Time Phase and Frequency Synchronization, *Apr. 1996 - Apr. 1999*
Noga, Andrew J., Air Force Research Lab., USA; May 1999; 80p; In English
Contract(s)/Grant(s): AF Proj. 4594
Report No.(s): AD-A365462; AFRL-IF-RS-TR-1999-133; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy
Further analysis of the reconstituted numerical FM with feedback (RNFMFB) has been performed, and these results are presented. It is shown that the RNFMFB demodulator is capable of achieving both phase and frequency synchronization in discrete-time applications. In contrast to the digital phase locked loop (DPLL), the RNFMFB is simple to use and can operate at low sampling rates. In addition to providing low SNR threshold enhancement, the RNFMFB demodulator also provides enhancement as the input SNR increases above threshold. This is again, in contrast to currently employed DPLL algorithms which can only provide threshold enhancement. Simulations and analyses are presented which verify this performance enhancement achieved by the RNFMFB demodulator.
DTIC
Frequency Modulation; Frequency Synchronization; Signal Processing; Phase Locked Systems

19990067246 Arizona State Univ., Dept. of Electrical and Computer Engineering, Tempe, AZ USA
Modeling High Frequency Semiconductor Devices Using Maxwells Equations *Final Report*
El–Ghazaly, Samier M., Arizona State Univ., USA; Mar. 1999; 18p; In English
Contract(s)/Grant(s): DAAH04-95-1-0252
Report No.(s): AD-A364832; ARO-32238.13-EL; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
This is the final report on the research performed at Arizona State University and funded by the Army Research Office. The main theme for this research was investigating and developing new approaches to model high-frequency semiconductor devices using physically-based semiconductor device models and Maxwell's equations. In this research, we first replaced the conventional semiconductor device models, which are based on Poisson's Equation as a semiconductor model, with a new one that uses the full-wave electromagnetic model, derived from Maxwell's Equations Solution. We used a complete hydrodynamic model to represent the electron transport physics inside the device. This Model was used to study MM-wave MESFETs and HEMTs. Electromagnetic-wave propagation effects on the transistor performance were analyzed in detail. The newly developed model was used inside a Finite-Difference Time-Domain model to simulate a complete millimeter-wave amplifier. A hybridization technique was used to represent the passive part of the circuit (i.e., the matching network) and reduce the computational load. We also developed a new hybridization technique for simulating large electromagnetic, it is called "Time-Domain Impedance." The developed stud-

ies used for optimizing RF components and novel transmission lines. This research resulted in more than 50 publications and presentations. Four Ph.D. degrees were awarded to students supported by this research, who joined industrial companies in U.S.
DTIC
Semiconductor Devices; Mathematical Models; Maxwell Equation; Poisson Equation; Computerized Simulation; Finite Difference Time Domain Method

19990067249 Defense Group, Inc., Bedford, MA USA
Application Analysis for Electro-Optic Interconnect Coupling ***Final Report, Aug. 1997 - Apr. 1998***
Grover, Morgan; Patel, Pankaj; May 1999; 82p; In English
Contract(s)/Grant(s): F30602-97-C-0295; DARPA ORDER-B667; AF Proj. B667
Report No.(s): AD-A364941; AFRL-SN-RS-TR-1999-96; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy
This report documents an exploratory study of potential impacts of electro-optic (E/O) interconnect and switching technologies for highly demanding defense computing applications. The analysis reported address both future high-resolution wide-area synthetic aperture radar (SAT) image formation processing, and also processing for advanced methods of automatic target recognition (ATR). The results show high-speed interconnects reduce raw computing power requirements by up to 20% for some SAR applications and can save more than 100 GB memory in ATR applications.
DTIC
Electro-Optics; Synthetic Aperture Radar; Image Processing; Switching; Optical Interconnects

19990067261 Michigan Univ., Dept. of Nuclear Engineering and Radiological Sciences, Ann Arbor, MI USA
DURIP 97 Thermionic Cathode and Ceramic Insulator for Ultraclean High Power Microwave Sources ***Final Report, 1 Mar. 1997 - 28 Feb. 1999***
Gilgenbach, Ronald M.; May 1999; 20p; In English
Contract(s)/Grant(s): F49620-97-1-0103; AF Proj. 3484
Report No.(s): AD-A364770; AFRL-SR-BL-TR-99-0154; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
A Nd:YAG laser with a 600 W output power was procured and installed. Thermal defocusing in the laser's Nd:YAG rod suggested that the beam quality and power density were highest at about 400 W, rather than the full 600 W power level. The laser heated cathode system was installed on the MELBA diode. The ceramic insulator stack has been designed, fabricated and vacuum tested. It employs 12 ceramic rings alternating with Kovar rings which are vacuum brazed together.
DTIC
Thermionic Cathodes; Ceramics; Insulators; Radiation Sources; Microwaves

19990067270 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
A Low-Cost Miniaturized Scientific Imager Design with Chip-on-Board Technology for Space Applications
Le, Binh Q., Johns Hopkins Univ., USA; Schwartz, Paul D., Johns Hopkins Univ., USA; Ling, Sharon X., Johns Hopkins Univ., USA; Strohbehn, Kim, Johns Hopkins Univ., USA; Peacock, Keith, Johns Hopkins Univ., USA; Jan. 1999; 12p; In English
Report No.(s): AD-A365495; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The Miniaturized Scientific Imager uses a reflective telescope, a single filter, and a charge coupled device detector. This visible imager has a 1.5 x 20 field of view, a focal length of 720 mm, and a spatial resolution of 4 m at a range of 500 km. Heaters and radiators control the detector temperature. In this design, the user can control exposure mode, duration, and frame buffer selections. Thirty-two internal frame buffers will store the images captured by the imager. Our goal is to demonstrate and qualify a miniaturized, modularized, smart imager for future space missions. In this article, we present the detailed design of the imager, with emphasis on APL's chip on board technology and its significant impact on system weight and volume reduction. The development resulted in an imager design that weighs only 0.5 kg with a low power consumption of 1 W. A similar imager in the Near Earth Asteroid Rendezvous spacecraft weighs 7.7 kg and consumes 6.9 W.
DTIC
Image Processing; Charge Coupled Devices; Miniaturization; Space Missions; Technology Utilization

19990067840 Rutgers - The State Univ., Dept. of Ceramic Engineering, Piscataway, NJ USA
Advanced Characterization of Photonic Materials by Volumetric 3-D Displays ***Final Report, 10 Mar. 1997 - 28 May 1998***
Riman, Richard E.; Jun. 26, 1999; 40p; In English
Contract(s)/Grant(s): N00014-97-1-0359
Report No.(s): AD-A365378; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A spectrometer was built that can measure various types of luminescence at a spectrum of infrared and visible wavelengths. The system is capable of fluorescence, lifetime and quantum efficiency measurements for single and two-step upconversion studies. Samples in the form of powders, liquid and monolithic solids can be examined. In conclusion, current optical spectroscopy hardware can be implemented cost effectively. Furthermore, this equipment is very useful for developing materials for flat panel and volumetric displays.
DTIC
Flat Panel Displays; Volumetric Analysis

19990069215 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
Fiber Physical Contact Optical Connector
Kobayashi, Masaru, Nippon Telegraph and Telephone Public Corp., Japan; Iwano, Shin–ichi, Nippon Telegraph and Telephone Public Corp., Japan; Nagase, Ryo, Nippon Telegraph and Telephone Public Corp., Japan; Mitachi, Seiko, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 72-77; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A fiber physical contact (FPC) optical connector achieves excellent optical performance with average insertion and return losses of 0.17 dB and 60 dB respectively. Moreover, this level of performance is maintained in the -25 to 70 C range for 200 connection cycles. This connector does not require a ferrule or a spring, unlike conventional PC connectors, and is very small, with a diameter of 3mm.
Author
Optical Fibers; Connectors; Optical Communication

19990069216 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
MU-Type Optical Fiber Connector System
Iwano, Shin–Ichi, Nippon Telegraph and Telephone Public Corp., Japan; Nagase, Ryo, Nippon Telegraph and Telephone Public Corp., Japan; Nagase, Ryo, Nippon Telegraph and Telephone Public Corp., Japan; Kanayama, Kazunori, Nippon Telegraph and Telephone Public Corp., Japan; Ando, Yasuhiro, Nippon Telegraph and Telephone Public Corp., Japan; Mitachi, Seiko, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 63-71; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A compact optical fiber connector system called an MU optical fiber connector system has been developed for high-density packaging systems. This system features a newly developed 1.25 mm diameter ferrule and a self-retentive mechanism, and consists of simplex and duplex miniature optical plugs; simplex, duplex, and 8-port adaptors, 2-port and 8-port backplane connectors, and simplex receptacles. A variety of tools and accessories have also been developed to provide ease of operation. The system inherits the superior performance of the SC-type optical fiber connector and DS-type back-plane connectors, and also achieves the compactness and high density packaging of optical connectors.
Author
Optical Fibers; Connectors; Fabrication; Duplexers

19990069217 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
Simplified SC-Type Receptacles for ONU
Nagase, Ryo, Nippon Telegraph and Telephone Public Corp., Japan; Kato, Kuniharu, Nippon Telegraph and Telephone Public Corp., Japan; Iwano, Shin–Ichi, Nippon Telegraph and Telephone Public Corp., Japan; Mitachi, Seiko, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 58-62; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed three types of simplified receptacle; simplex and duplex types for use with an ONU module and an 8-port receptance for a fiber termination module. They have the same optical characteristics as conventional SC connectors, e.g. a connection loss of 0.06 dB and a return loss of 50.6 dB, and exhibit no degradation during or after mechanical and environmental tests.
Author
Fabrication; Duplexers; Connectors

19990069218 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan
Trend in the Technology and Prospects for Reducing the Cost for Fiber Optic Connectors
Mitachi, Seiko, Nippon Telegraph and Telephone Public Corp., Japan; Iwano, Shin–Ichi, Nippon Telegraph and Telephone Public Corp., Japan; Nagase, Ryo, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334;

Volume 9, No. 2, pp. 52-57; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Low cost connectors have been realized by simplifying their structure. Pre-assembled ferrules have been developed for automatic connector assembly and alternative ferrules have been proposed. to achieve high density connection, ferrule diameter have been minimized and, in addition, a new connector without ferrules has been reported.

Author

Cost Reduction; Technological Forecasting; Fiber Optics; Connectors

19990069219 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

LSI Technologies for a Very-High-Speed ATM Switching System

Kawamura, Tomoaki, Nippon Telegraph and Telephone Public Corp., Japan; Suzuki, Masao, Nippon Telegraph and Telephone Public Corp., Japan; Genda, Kouichi, Nippon Telegraph and Telephone Public Corp., Japan; Endo, Ken–ichi, Nippon Telegraph and Telephone Public Corp., Japan; Fukuda, Hideki, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 46-51; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A 20 Gbit/s throughput ATM crosspoint switch LSI was developed using silicon bipolar LSI technology. The LSI consists of 4,000 gates of ECL (Emitter Coupled Logic) circuits and operates at 625 Mbit/s with a power dissipation of 6 W. An ATM cell buffering LSI was developed using BI-CMOS (Bipolar and Complementary Metal-Oxide Semiconductor) technology. This LSI consists of a high-speed ECL interface, a 28 kbit 2- port RAM, and 20,000 gates of CMOS logic circuits.

Author

Procedures; High Speed; Coupling Circuits; Logic Circuits; Gates (Circuits)

19990069220 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

High-Performance Packaging Technology for Very-High-Speed ATM Switching Systems

Kaizu, Katsumi, Nippon Telegraph and Telephone Public Corp., Japan; Kishimoto, Tohru, Nippon Telegraph and Telephone Public Corp., Japan; Sasaki, Shin–ichi, Nippon Telegraph and Telephone Public Corp., Japan; Yamanaka, Naoaki, Nippon Telegraph and Telephone Public Corp., Japan; Genda, Kouichi, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 36-450; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes high-performance, high-density multichip modules (MCMs) using a copper polymide multi-layer substrate and innovative heat-pipe cooling for high-speed ATM switching systems. High-speed ATM link wires are interconnected on the top surface of the MCMs by the newly developed flexible printed circuit cables and connectors to reduce the rear-side I/O count and achieve 620-Mbits 32-bit parallel interconnections. A heat-pipe is attached to the back surface of each MCM to cool the power dissipation, which is 30 W per MCM. With a 2-m/s forced air flow, a prototype ATM switch system operated at 320 Gbit/s (with 8 x 8 MCMs) with a maximum junction temperature of less than 85 C. These results indicate that this technology is suitable for future B-ISDN high-speed switching systems.

Author

Packaging; Chips (Electronics); Switching; Architecture (Computers); Printed Circuits; Heat Pipes; Asynchronous Transfer Mode

19990069221 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

160 Gbit/s High Speed ATM Switching System

Yamanaka, Naoaki, Nippon Telegraph and Telephone Public Corp., Japan; Kaizu, Katsumi, Nippon Telegraph and Telephone Public Corp., Japan; Kishimoto, Tohru, Nippon Telegraph and Telephone Public Corp., Japan; Genda, Kouichi, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 28-35; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes a 160 Gbit/s high speed multi-chip ATM switching system for broadband ISDN. This system uses a Copper/Polyimide MCM with 4-layer copper-polyimide signal transmission layers and 11-layers ceramic power supply layers. It uses 64 MCMs that are interconnected by a 98-high-way flexible printed circuit connector. Si-bipolar VLSIs are mounted on a Multi-Chip Module (MCM) using the 15-microns very thin pitch outer lead TAB technique. The system switches ATM cells at a throughput of up to 320 Gbit/s and it is applicable for future B-ISDN.

Author

Asynchronous Transfer Mode; Switches; Signal Transmission; Bipolarity

19990069222 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

A Very-High-Speed ATM Switch Architecture Using Internal Speed-up Technique

Genda, Kouichi, Nippon Telegraph and Telephone Public Corp., Japan; Doi, Yukihiro, Nippon Telegraph and Telephone Public

Corp., Japan; Endo, Ken–ichi, Nippon Telegraph and Telephone Public Corp., Japan; Yamanaka, Naoaki, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 20-28; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An internal speed-up crossbar-type ATM switch architecture is proposed. This switch accommodates 10 Gbit/s cell streams from AHMs in order to guarantee the QoS of switched cells. A new high-speed arbitration algorithm using three buses on each output line, called the bi-directional arbiter, is used. It handles output contention about twice as fast as the conventional ring-arbiter and has the same fairness function. It increases the switch throughput to 160 Gbit/s efficiently. by combining the high-speed switch and AHMS, it will be able to make a sub-terabit/s ATM switching system for future Broad-band ISDN networks.
Author
High Speed; Switching Circuits; Algorithms; Architecture (Computers)

19990069601 Texas Christian Univ., Dept. of Engineering, Fort Worth, TX USA
Design, Modeling, and Fabrication of a Quasi-Optical Power Combiner Based on the Talbot Effect ***Final Report***
Tayag, Tristan J.; Penninck, Sophie M.; Feb. 1999; 30p; In English
Contract(s)/Grant(s): DAAG55-98-1-0440
Report No.(s): AD-A365178; ARO-39063.1-EL-II; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This document is a final technical report describing the work completed under the Short-Term Research Initiative (STIR) contract (DAAG55-98-1-0440) awarded to Texas Christian University (TCU) by the US Army Research Office on 20 July 1998. The work was carried out in collaboration with Professor Michael Steer's research group at the North Carolina State University (NCSU). The objective of this effort was to investigate the feasibility of quasi-optical power combiners based on the Talbot effect. At TCU, planar waveguide structures were designed in the X-band (8-12.4 GHz). Waveguide structures were constructed in Rexolite 1422 and characterized at NCSU. Although the optimum designs were not fabricated due to waveguide material limitations, the electromagnetic field data indicated the structure and high degree of symmetry associated with multimode interference phenomena. This favorable result is key to the demonstration of a quasi-optical power combiner based on the Talbot effect.
DTIC
Fabrication; Optical Waveguides

19990069613 Naval Research Lab., Washington, DC USA
Optics and MEMS
Walker, Steven J.; Nagel, David J.; May 15, 1999; 133p; In English
Report No.(s): AD-A364799; NRL/MR/6336--99-7975; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

MEMS (MicroElectroMechanical Systems) are a new frontier in miniaturization. Optics and MEMS have a natural synergism. On the one hand, optical techniques are basic to the manufacturing of MEMS. On the other hand, a wide variety of MEMS have already been demonstrated to produce, manipulate or detect optical radiation. The "optical" range of wavelengths is from 0.2 micrometers in the ultraviolet to 12 micrometers in the far infrared region. Entire optical systems with volumes on the order of 1 cu cm have been demonstrated. This review of optics and MEMS begins with the use of optical techniques to make MEMS. Then several techniques to measure the small motion of dynamic MEMS surfaces are described. Optical MEMS sources, optics are detectors are reviewed in turn. Then, a survey of salient optical MEMS applications follows. It is likely that MEMS will be very important commercially in the display and optical fiber communications sectors, among others. Design challenges, and the status of commercially-available software germane to the design of optical MEMS, and a short study of MEMS patents are given in two appendices. It is concluded that there are great opportunities for both new technology and new applications in this arena.
DTIC
Microelectromechanical Systems; Manufacturing; Miniaturization; Optical Fibers

19990069614 Massachusetts Univ., Dept. of Electrical and Computer Engineering, Amherst, MA USA
Proceedings of the 1998 Antenna Applications Symposium ***Final Report, Jan. - Dec. 1998***
Schaubert, Daniel H.; Apr. 1999; 356p; In English
Contract(s)/Grant(s): F30602-98-C-0022; AF Proj. 4600
Report No.(s): AD-A364798; AFRL-SN-RS-TR-1999-86; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

The Proceedings of the 1998 Antenna Applications Symposium is a collection of state-of-the-art papers relating to phased array antennas, multibeam antennas, satellite antennas, microstrip antennas, reflector antennas, HF, VHF, UHF, and various other antennas.
DTIC
Conferences; Satellite Antennas; Phased Arrays; Multibeam Antennas

19990069927 Bogazici Univ., Faculty of Engineering, Istanbul, Turkey
Recent Advances in Mechatronics
Kaynak, Okyay; Tosunoglu, Sabri; Ang, Marcelo, Jr; Jan. 1999; 602p; In English
Contract(s)/Grant(s): F61775-99-WF029
Report No.(s): AD-A365066; EOARD-CSP-99-5029; ISBN 981-4021-34-2; No Copyright; Avail: CASI; A06, Microfiche; A99, Hardcopy

This is an interdisciplinary conference involved with the synergistic integration of mechanical engineering with electronics and intelligent computer control for design and manufacture of products and processes. Topics include: (1) mechatronics design, (2) distributed systems, (3) vision and sensors, (4) robots and mobile machines, (5) vibration and control, (6) computational intelligence in mechatronics, (7) embedded real time systems, (8) micro-mechatronics, (9) motion control, (10) hardware/software co-design, and (11) intelligent manufacturing systems.
DTIC
Mechanical Engineering; Conferences; Artificial Intelligence; Electromechanical Devices; Computer Aided Design

19990070317 NASA Goddard Space Flight Center, Greenbelt, MD USA
Validation of Modified Wine-Rack Thermal Design for Nickel-Hydrogen Batteries in LANDSAT-7 Spacecraft Thermal Vacuum Test and in Flight
Choi, Michael K., NASA Goddard Space Flight Center, USA; 1999; 8p; In English; 34th; Intersociety Energy Conversion Engineering, 1-5 Aug. 1999, Vancouver, British Columbia, Canada; Sponsored by Society of Automotive Engineers, Inc., USA
Report No.(s): SAE-1999-01-2626; Copyright; Avail: Issuing Activity, Hardcopy

A heritage wine-rack thermal/mechanical design for the nickel-hydrogen batteries was the baseline at the LANDSAT-7 Preliminary Design Review. An integrated thermal and power analysis of the batteries performed by the author in 1994 revealed that the maximum cell-to-cell gradient was 6.6 C. The author proposed modifying the heritage wine-rack design by enhancing heat conduction from cells to cells, and from cells to battery frame. At the 1995 Intersociety Energy Conversion Engineering Conference (IECEC), the author presented a paper on methods of modifying the wine-rack design. It showed that the modified wine-rack option, which uses a metallic filler, could reduce the maximum cell-to-cell temperature gradient to 1.30 C, and could also reduce the maximum cell temperature by as much as 80 C. That design concept was adopted by the LANDSAT7 Project Office, and a design change was made at the Critical Design Review. Results of the spacecraft thermal vacuum and thermal balance tests, and temperature data in flight show that the temperatures of the battery cells are very uniform. The maximum cell-to-cell gradient is 1.50 C. They validate the modified wine-rack thermal design.
Author
Design Analysis; Thermal Batteries; Nickel Hydrogen Batteries; Thermal Vacuum Tests

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.

19990064342 Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA USA
Application of CFD to Explain Anomalous Stall Behavior of the SSME Flowmeter
Ascoli, E., Boeing Co., USA; Clever, W., Boeing Co., USA; Hadid, A., Boeing Co., USA; Lynch, E. D., Boeing Co., USA; Stewart, M., Boeing Co., USA; Lee, K., Rockwell International Science Center, USA; [1999]; In English; 35th; Propulsion, Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-45000; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Anomalous behavior manifested in the apparent SSME fuel flowmeter constant which relates the rotor speed to the engine flowrate has been shown to be the result of wakes of the upstream hexagonal web flow straightener periodically stalling the rotor blades, thereby changing the lift on the blades and the rotation speed of the rotor. Moreover, an unsteady, two-dimensional computational fluid dynamics model of the flowmeter has shown this wake-induced stall disappearing as the straightener-rotor distance is doubled, in accord with the existing SSME flowmeter database for the previous ”egg crate” flowmeter. These observations have led to a new flowmeter design which has been shown in three-dimensional CFD computations (consistent with both the previous two-dimensional analyses and with existing correlations for airfoil stall) to be much less susceptible to stalling instabilities.
Author
Space Shuttle Main Engine; Propulsion System Performance; Fuel Flow; Flow Velocity; Flowmeters

19990064375 NASA Langley Research Center, Hampton, VA USA

Supersonic Coaxial Jet Experiment for CFD Code Validation

Cutler, A. D., George Washington Univ., USA; Carty, A. A., George Washington Univ., USA; Doerner, S. E., George Washington Univ., USA; Diskin, G. S., NASA Langley Research Center, USA; Drummond, J. P., NASA Langley Research Center, USA; 1999; 18p; In English; 30th; Fluid Dynamics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA

Contract(s)/Grant(s): NCC1-217

Report No.(s): AIAA Paper 99-3588; Copyright; Avail: Issuing Activity, Hardcopy

A supersonic coaxial jet facility has been designed to provide experimental data suitable for the validation of CFD codes used to analyze high-speed propulsion flows. The center jet is of a light gas and the coflow jet is of air, and the mixing layer between them is compressible. Various methods have been employed in characterizing the jet flow field, including schlieren visualization, pitot, total temperature and gas sampling probe surveying, and RELIEF velocimetry. A Navier-Stokes code has been used to calculate the nozzle flow field and the results compared to the experiment.

Author

Navier-Stokes Equation; Nozzle Flow; Flow Distribution; Computational Fluid Dynamics; Supersonic Jet Flow; High Speed

19990064389 Texas A&M Univ., Aerospace Engineering Dept., College Station, TX USA

Novel, Miniature Multi-Hole Probes and High-Accuracy Calibration Algorithms for their use in Compressible Flowfields

Rediniotis, Othon K., Texas A&M Univ., USA; July 1999; 162p; In English

Contract(s)/Grant(s): NAG1-1753; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Two new calibration algorithms were developed for the calibration of non-nulling multi-hole probes in compressible, subsonic flowfields. The reduction algorithms are robust and able to reduce data from any multi-hole probe inserted into any subsonic flowfield to generate very accurate predictions of the velocity vector, flow direction, total pressure and static pressure. One of the algorithms PROBENET is based on the theory of neural networks, while the other is of a more conventional nature (polynomial approximation technique) and introduces a novel idea of local least-squares fits. Both algorithms have been developed to complete, user-friendly software packages. New technology was developed for the fabrication of miniature multi-hole probes, with probe tip diameters all the way down to 0.035”. Several miniature 5- and 7-hole probes, with different probe tip geometries (hemispherical, conical, faceted) and different overall shapes (straight, cobra, elbow probes) were fabricated, calibrated and tested. Emphasis was placed on the development of four stainless-steel conical 7-hole probes, 1/16” in diameter calibrated at NASA Langley for the entire subsonic regime. The developed calibration algorithms were extensively tested with these probes demonstrating excellent prediction capabilities. The probes were used in the ”trap wing” wind tunnel tests in the 14’x22’ wind tunnel at NASA Langley, providing valuable information on the flowfield over the wing. This report is organized in the following fashion. It consists of a ”Technical Achievements” section that summarizes the major achievements, followed by an assembly of journal articles that were produced from this project and ends with two manuals for the two probe calibration algorithms developed.

Author

Algorithms; Applications Programs (Computers); Calibrating; Flow Distribution; Technology Assessment; Vector Analysis; Velocity Distribution

19990064494 University of South Alabama, Mechanical Engineering Dept., Mobile, AL USA

Inviscid Interactions Between Wake Vortices and Shear Layers

Zheng, Z. C., University of South Alabama, USA; Baek, K., University of South Alabama, USA; Journal of Aircraft; 1998; Volume 36, No. 2, pp. 477-480; In English

Contract(s)/Grant(s): NAG1-1911; Copyright; Avail: Issuing Activity, Hardcopy

Aircraft trailing vortices can be influenced significantly by atmospheric conditions such as crosswind, turbulence, and stratification. According to the NASA 1994 and 1995 field measurement program in Memphis, Tennessee, the descending aircraft wake vortices could stall or be deflected at the top of low-level temperature inversions that usually produce pronounced shear zones. Numerical simulations of vortex/shear interactions with ground effects have been performed by several groups. Burnham used a series of evenly spaced line vortices at a particular altitude to model the ground shear layer of the cross- wind. He found that the wind shear was swept up around the downwind vortex and caused the downwind vortex to move upward, and claimed that the effect was actually produced by the vertical gradient in the wind shear rather than by the wind shear directly, because uniformly distributed wind-shear vortices would have no effect on the trailing vortex vertical motion. Recently, Proctor et al. numerically tested the effects of narrow shear zones on the behavior of the vortex pair, motivated by the observation of the Memphis field data. The shear-layer sensitivity tests indicated that the downwind vortex was more sensitive and deflected to a higher altitude than its

upwind counterpart. The downstream vortex contained vorticity of opposite sign to that of the shear. There was no detectable preference for the downwind vortex (or upwind vortex) to weaken (or strengthen) at a greater rate.
Derived from text
Vortices; Shear Layers; Wind Shear; Inviscid Flow; Aircraft Wakes

19990064529 University of South Alabama, Dept. of Mechanical Engineering, Mobile, AL USA
Initialization and Simulations of Three-Dimensional Aircraft Wake Vortices ***Final Report, 1 Feb. 1997 - 30 Apr. 1999***
Zheng, Zhongquan Charlie, University of South Alabama, USA; 1999; 6p; In English
Contract(s)/Grant(s): NAG1-1911; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research period under the sponsorship of NAG1-1911 is two years: from Feb. 1, 1997 to Jan. 31, 1999 (extended no-cost to April 30, 1999). During the two-year research period, deliverables have included brief monthly progress statements, annual reports and subroutines of computational programs. Several technical papers have been published and are attached to this final report. This Summary of Research contains a brief description of those research results and refers the details to each attached paper.
Author
Aircraft Wakes; Vortices; Velocity

19990064530 NASA Langley Research Center, Hampton, VA USA
Validation and Operation of a Vortex Wake/Shear Interaction Model
Zheng, Z. C., University of South Alabama, USA; Lim, S. H., University of South Alabama, USA; Proctor, F. H., NASA Langley Research Center, USA; [1999]; 9p; In English; 38th; Aerospace Sciences, 10-13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy

A previously developed vortex method model for studying the mechanism in vortex/shear-layer interactions has been validated with Navier-Stokes simulations and field measurement data. Operational issues, such as shear thickness effects and the wind measurement resolution requirement, its sensitivity to the prediction algorithm and the criterion used to incorporate meteorological wind data and possible interfaces with other models in AVOSS, are discussed.
Author
Vortices; Wakes; Simulation; Shear Layers; Mathematical Models

19990064531 University of South Alabama, Mechanical Engineering Dept., Mobile, AL USA
N-S Simulations of Crow-Type Instabilities in Vortex Wake
Zheng, Z. C., University of South Alabama, USA; Baek, K., University of South Alabama, USA; 1999; 17p; 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): NAG1-1911
Report No.(s): AIAA Paper 99-0981; Copyright; Avail: Issuing Activity, Hardcopy

Three-dimensional Navier-Stokes simulations of the Crow instability of wake vortices are conducted using large-eddy simulations without background turbulence. Sinusoidal displacement has been specified as the initial perturbation for the vortex system. The results have shown that the minimum Crow instability wavelength is about one vortex spacing shorter than predicted by Crow's linear stability theory. The planar- standing-wave-angle value and the amplitude indifference behavior agree with Crow's analysis. Simulations with periodicity in the axial direction have indicated minor influence of axial flow on the Crow instability.
Author
Turbulence; Axial Flow; Three Dimensional Models; Navier-Stokes Equation; Large Eddy Simulation; Flow Stability

19990064620 NASA Glenn Research Center, Cleveland, OH USA
Parametric Experimental Study of the Formation of Glaze Ice Shapes on Swept Wings
Vargas, Mario, NASA Glenn Research Center, USA; Reshotko, Eli, Case Western Reserve Univ., USA; 19990601; 22p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Original contains color illustrations
Contract(s)/Grant(s): RTOP 548-20-23
Report No.(s): NASA/TM-1999-108900; NAS 1.15:208900; E-11499; AIAA Paper 99-0094; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experiment was conducted to study the effect of velocity and sweep angle on the critical distance in ice accretion formation on swept wings at glaze ice conditions. The critical distance is defined as the distance from the attachment line to the beginning of the zone where roughness elements develop into glaze ice feathers. Icing runs were performed on a NACA 00 1 2 swept wing

tip at velocities of 75, 100, 150, and 200 miles per hour. At each velocity and tunnel condition, the sweep angle was changed from 0 deg to 45 deg at 5 deg increments. Casting data, ice shape tracings, and close-up photographic data were obtained. The results showed that at given velocity and tunnel conditions, as the sweep angle is increased from 0 deg to 25 deg the critical distance slowly decreases. As the sweep angle is increased past 25 deg, the critical distance starts decreasing more rapidly. For 75 and 100 mph it reaches a value of 0 millimeters at 35 deg. For 150 and 200 mph it reaches a value of 0 millimeters at 40 deg. On the ice accretion, as the sweep angle is increased from 0 deg to 25 deg, the extent of the attachment line zone slowly decreases. In the glaze ice feathers zone, the angle that the preferred direction of growth of the feathers makes with respect to the attachment line direction increases. But overall, the ice accretions remain similar to the 0 deg sweep angle case. As the sweep angle is increased above 25 deg, the extent of the attachment line zone decreases rapidly and complete scallops form at 35 deg sweep angle for 75 and 100 mph, and at 40 deg for 150 and 200 mph.
Author
Glazes; Shapes; Experimentation; Swept Wings; Ice Formation

19990066625 NASA Ames Research Center, Moffett Field, CA USA
Radiative Viscous Shock Layer Analysis of Fire, Apollo, and PAET Flight Data
Balakrishnan, A., Eloret Corp., USA; Park, Chul, NASA Ames Research Center, USA; Green, Michael J., NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermophysical Aspects of Re-Entry Flows; 1986; Volume 103, pp. 514-540; In English; 20th; Thermophysics, 19-21 Jun. 1985, Williamsburg, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 85-1064; ISBN 0-930403-10-X; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Equilibrium, radiating viscous shock layer solutions are obtained for a number of trajectory points of the Fire II, Apollo 4, and PAET experimental flight vehicles. Convective heating rates calculated by a benchmark code agree well with two engineering correlations, except at high altitudes corresponding to low densities. Calculated radiation intensities are compared with the flight radiometer data and with inviscid flow results. Differences as great as 70% are observed between measured data and the viscous calculations. Because of boundary-layer absorption, viscous effects reduce the intensity to the wall by as much as 30% compared with inviscid intensities. Preliminary chemical and thermal nonequilibrium flow calculations along a stagnation streamline for a PAET trajectory predict an enhancement to the radiation owing to the chemical relaxation. Stagnation point solutions are also presented for future aeroassisted orbital transfer vehicle geometries with nose radii of 0.3-15 m.
Author
Viscous Flow; Shock Layers; Research; Apollo Flights; Boundary Layers; Convective Heat Transfer; Fires

19990066659 NASA Goddard Inst. for Space Studies, New York, NY USA
Turbulent Diffusivities for Momentum, Heat, Salt and Passive Scalars
Canuto, V. M., NASA Goddard Inst. for Space Studies, USA; 1999; In English, 19-23 Apr. 1999, Netherlands; Sponsored by European Geophysical Society, Germany; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

A program began ten years ago to build a turbulence model to describe high Reynolds numbers flows. Specifically, the aim was to devise a model that would satisfy two basic conditions: reproduce available turbulence data (laboratory, numerical simulations, etc.) concerning shear driven flows, buoyancy driven flows, 2D turbulence, freely decaying turbulence etc., and yet be manageable so as to be used, for example, in GCM'S. The model was presented in a series of papers that have appeared in Physics of Fluids since 1996. A total of about 80 turbulence statistics were reproduced. The model has no adjustable parameters. The next step was to apply the model to construct the vertical diffusities K for moment K(sub m), temperature K(sub h), salt K(sub s), and passive scalars K(sub c). First, we took K(sub c) = K(sub h) and tested the model using the GFDL ocean model. The results for the profiles of T and S vs. depth are indistinguishable from those derided using the latest model, the KPP model by the NCAR group. Presently, we are running the same GFDL code relaxing the assumptive K(sub c) = K(sub h). Indeed, the turbulence model yelds a salt diffusivity that depends on R(sub i) and R(sub rho) = ((beta)(delta)S/(alpha)(delta)T/(delta)z) in such a way that K(sub s) may be quite different from K(sub h). Salt fingers and double diffusivity laboratory data are reproduced. Results from the ocean model will be available shortly. Finally, we are trying to derive the horizontal diffusivities with the goal of providing a physically acceptable representation of mesoscale eddies. The recently suggested GMW parameterization has improved several O-GCM results and the goal here is to try to derive/justify it from a turbulence model and/or propose improvements/modifications. Theoretical work is in progress.
Author
Mathematical Models; Numerical Analysis; Turbulence Models; High Reynolds Number

19990067237 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA

Cursory and Primitive Comparison of the Signal-to-Noise Ratios of Pressure and Velocity Planar Arrays, *1 May - 30 Jun. 1999*

Maidanik, G., Naval Surface Warfare Center, USA; Becker, K. J., Naval Surface Warfare Center, USA; Jun. 30, 1999; 85p; In English

Report No.(s): AD-A365007; NSWCCD-70-TR--1999/163; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

A cursory and a primitive comparison between the signal-to-noise ratios of pressure and velocity arrays is conducted. The arrays of concern are planar arrays. The noise of special interest is that induced by Turbulent Boundary Layer (TBL). For a given incident pressure, as defined by its spectral density, when comparing an ideal conditioning plate (a rigid boundary) for the pressure array and an ideal conditioning compliance (a pressure release boundary) for the velocity array, the signal-to-noise ratio in the former array is by far superior to that of the latter array. A conditioning compliance that renders the boundary with an inverse fluid loading parameter that is of the order of unity may achieve for a velocity array a signal-to-noise ratio that is on par with that for the pressure array. In this comparison the two corresponding array types are subjected to the same incident spectral density.

DTIC

Signal to Noise Ratios; Turbulent Boundary Layer; Pressure Measurement

19990067829 NASA Goddard Space Flight Center, Greenbelt, MD USA

Overview of Loop Heat Pipe Operation

Ku, Jentung, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Two-Phase Technology, 17-19 May 1999, College Park, MD, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Loop heat pipes (LHP's) are two-phase heat transfer devices that utilize the evaporation and condensation of a working fluid to transfer heat, and the capillary forces developed in the porous wicks to circulate the fluid. The LHP was first developed in the former Soviet Union in the early 1980s, about the same time that the capillary pumped loop (CPL) was developed in the United States. The LHP is known for its high pumping capability and robust operation mainly due to the use of fine-pored metal wicks and an integral evaporator/hydro-accumulator design. The LHP technology is rapidly gaining acceptance in aerospace community. It is the baseline design for thermal control of several spacecraft, including NASA's GLAS and Chemistry, ESA's ATLID, CNES' STENTOR, RKA's OBZOR, and several commercial satellites. Numerous LHP papers have been published since the mid-1980's. Most papers presented test results and discussions on certain specific aspects of the LHP operation. LHP's and CPL's show many similarities in their operating principles and performance characteristics. However, they also display significant differences in many aspects of their operation. Some of the LHP behaviors may seem strange or mysterious, even to experienced CPL practitioners. The main purpose of this paper is to present a systematic description of the operating principles and thermal-hydraulic behaviors of LHP'S. LHP operating principles will be given first, followed by a description of the thermal-hydraulics involved in LHP operation. Operating characteristics and important parameters affecting the LHP operation will then be described in detail. Peculiar behaviors of the LHP, including temperature hysteresis and temperature overshoot during start-up, will be explained. For simplicity, most discussions will focus upon LHP's with a single evaporator and a single condenser, but devices with multiple evaporators and condensers will also be discussed. Similarities and differences between LHP's and CPL's will be addressed throughout the paper whenever appropriate.

Author

Evaporators; Heat Pipes; Temperature Control; Heat Exchangers; Cooling Systems

19990067830 NASA Goddard Space Flight Center, Greenbelt, MD USA

Capillary Pumped Loop 3 Flight Experiment Overview

Ottenstein, Laura, NASA Goddard Space Flight Center, USA; Mar. 30, 1999; 1p; In English; Two-Phase Technology, 17-19 May 1999, College Park, MD, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Capillary Pumped Loop 3 (CAPL 3) Experiment is a follow on to the CAPL 1 and CAPL 2 experiments which flew on STS-60 (2/94) and STS-69 (9/95), respectively. CAPL 3 is tentatively scheduled to fly on the Space Shuttle in late 2000 as part of the Hitchhiker Experiments Advancing Technology (HEAT) payload. The experiment is a joint Naval Research Laboratory (NRL)/Goddard Space Flight Center (GSFC) payload which will meet technology objectives for both the Department of Defense and NASA. The primary objective of CAPL 3 is to demonstrate in space a multiple evaporator capillary pumped loop system, capable of reliable start-up, reliable continuous operation, and at least 50% heat load sharing with hardware for a deployable radiator. CAPL 3 is a full scale CPL system with four parallel capillary evaporators. The loop also contains a capillary starter pump, 8 parallel direct condensation condensers with associated flow regulators, a back pressure regulator, a two-phase reservoir, and various headers and transport tubing. A variable conductance heat pipe is located between one of the evaporators and the experiment radiator to provide a cooling source for the demonstration of heat load sharing. The experiment has an operating power range

of 100 W to approximately 1400 W. The experiment ammonia charge will cause it to transition to a fixed conductance mode of operation if the radiator usage reaches 85%. Ambient functional tests have been performed on the experiment. Tests performed included start-up, low power, power cycles, high power, heat load sharing, variable/fixed conductance transition, saturation temperature changes, and pressure primes while the system was operating. The majority of the testing was performed at an ammonia saturation temperature of 30C, but a few tests were done at temperatures above and below this. The testing was highly successful. Details of the tests performed and a discussion of the results will be given in the presentation.
Author
Conductive Heat Transfer; Cooling; Capillary Tubes; Heat Radiators; Heat Exchangers; Cooling Systems

19990068442 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Annual Research Briefs, 1998
Spinks, Debra, Compiler, Stanford Univ., USA; December 1998; 360p; In English; See also 19990068443 through 19990068468; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

The topics contained in this progress report are direct numerical simulation of turbulent non-premixed combustion with realistic chemistry; LES of non-premixed turbulent reacting flows with conditional source term estimation; measurements of the three-dimensional scalar dissipation rate in gas-phase planar turbulent jets; direct simulation of a jet diffusion flame; on the use of interpolating wavelets in the direct numerical simulation of combustion; on the use of a dynamically adaptive wavelet collocation algorithm in DNS (direct numerical simulation) of non-premixed turbulent combustion; 2D simulations of Hall thrusters; computation of trailing-edge noise at low mach number using LES and acoustic analogy; weakly nonlinear modeling of the early stages of bypass transition; interactions between freestream turbulence and boundary layers; interfaces at the outer boundaries of turbulent motions; largest scales of turbulent wall flows; the instability of streaks in near-wall turbulence; an implementation of the v(sup 2) - f model with application to transonic flows; heat transfer predictions in cavities; a structure-based model with stropholysis effects; modeling a confined swirling coaxial jet; subgrid-scale models based on incremental unknowns for large eddy simulations; subgrid scale modeling taking the numerical error into consideration; towards a near-wall model for LES of a separated diffuser flow; on the feasibility of merging LES with RANS (Reynolds Averaging Numerical simulation) for the near-wall region of attached turbulent flows; large-eddy simulation of a separated boundary layer; numerical study of a channel flow with variable properties; on the construction of high order finite difference schemes on non-uniform meshes with good conservation properties; development of immersed boundary methods for complex geometries; and particle methods for micro and macroscale flow simulations.
CASI
Direct Numerical Simulation; Computational Fluid Dynamics; Large Eddy Simulation; Reynolds Averaging; Turbulent Flow; Turbulence Models; Turbulent Combustion; Separated Flow; Channel Flow; Wall Flow

19990068444 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
LES of Non-Premixed Turbulent Reacting Flows with Conditional Source Term Estimation ***Annual Report***
Steiner, H., Stanford Univ., USA; Bushe, W. K., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 23-34; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the present study the Conditional Source term Estimation (CSE) method (Bushe & Steiner, 1998) has been proposed as an alternative to the aforementioned methods for closing the chemical source terms. CSE is based on the CMC (Conditional Moment Closure) hypothesis. However, unlike in traditional CMC methods, it is not necessary to solve the transport equations in the conditioning space; this makes the method computationally affordable. In its present form the proposed model is devised to provide the filtered means of the chemical source terms needed to close the LES set of equations in reacting flows. CSE has proven its predictive capability in an a priori test using DNS (Direct Numerical Simulation) data of turbulent reacting mixing layer, and it is currently being tested in an LES (large-eddy simulation) of a turbulent jet diffusion flame.
Derived from text
Direct Numerical Simulation; Computational Fluid Dynamics; Turbulent Flow; Reacting Flow; Turbulent Mixing; Mixing Layers (Fluids); Large Eddy Simulation; Reynolds Number

19990068445 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Measurements of the Three-Dimensional Scalar Dissipation Rate in Gas-Phase Planar Turbulent Jets ***Annual Report***
Su, L. K., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 35-46; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This study will address two issues regarding the properties of the scalar dissipation which are of particular significance in the context of combustion. The first concerns the length scales at which dissipation occurs, in particular their magnitude and their

dependence on Reynolds number. The second issue concerns the scaling of the mean dissipation values with downstream distance in jet flows. Defining the thicknesses of the dissipation layers will be of use in determining the resolution requirements of both DNS (Direct Numerical Simulation) and LES (Large Eddy Simulation) computations of turbulent diffusion flames. Meanwhile, experimental assessment of existing models for the downstream decay of mean dissipation will provide a fundamental test of our understanding of the properties of the dissipation rate. The experimental data used in this study are the planar measurements of the complete, three-dimensional scalar dissipation rate by Su & Clemens (1998a,b) in the self-similar region of a gas-phase planar turbulent jet. The data are unique in providing scalar field information simultaneously in two parallel spatial planes, with sufficient resolution to permit differentiation in all three spatial dimensions. Determining the three spatial components explicitly obviates the need to invoke Taylor's hypothesis, while the planar nature of the measurement volume allows direct determination of structural properties of the dissipation field.
Derived from text
Direct Numerical Simulation; Computational Fluid Dynamics; Large Eddy Simulation; Turbulent Diffusion; Diffusion Flames; Boundary Layer Combustion; Combustible Flow; Flame Propagation

19990068451 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Weakly Nonlinear Modeling of the Early Stages of Bypass Transition ***Annual Report***
Maslowe, S. A., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 107-112; In English; See also 19990068442; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The object of the research report here is to formulate nonlinear analyses to be employed in conjunction with numerical simulations of boundary layer transition influenced by free-stream turbulence. Following discussions with Professors Sanjiva Lele and Paul Durbin, it was decided to represent the perturbations at lowest order by modes belonging to the continuous spectrum of the Orr-Sommerfeld equation. Grosch & Salwen (1978) noted that a patch of vorticity in the free stream can be expanded in terms of these eigenfunctions. Their speed of propagation is close to the free-stream value, and their amplitude is largest around the edge of the boundary layer and very small within the boundary layer. These features are exhibited clearly by the computations of some spatially damped eigenfunctions for a Blasius boundary layer reported by Jacobs & Durbin (1998). The weakly nonlinear approach involves a perturbation about a superposition of modes belonging to the continuous spectrum of the Orr-Sommerfeld equation, so the following section consists of an outline and preliminary results for the problem.
Derived from text
Orr-Sommerfeld Equations; Free Flow; Turbulence

19990068452 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Interactions between Freestream Turbulence and Boundary Layers ***Annual Report***
Hunt, J. C. R., Stanford Univ., USA; Durbin, P. A., Stanford Univ., USA; Wu, X., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 113-124; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The interaction between free-stream turbulence and boundary layers is one example out of many that involve different types of fluid motion in overlapping or adjacent regions of flow. We are concerned here with flows at high Reynolds and Peclet numbers, so that the effects on the interactions between these flows of molecular diffusion are small except close to the boundary [B] between them. In these complex configurations the overall flow is not generally dominated by a single mechanism; for example, perturbations do not grow everywhere at the same rate (Hunt & Carruthers, 1990), but in zones of limited extent with characteristic flow pattern such as thin shear layers, and on certain ranges of time and/or length scales, the flow can be dominated by specific mechanisms. These tend to be defined by only a few parameters. Interactions between the flow regions, say [F1] and [F2], are often dominated by such mechanisms in layers lying along the interface [B]. Some effects propagate into the interior of the regions by advection or wave motion, while others act upon the boundary.
Derived from text
Free Flow; Turbulence; Boundary Layers; High Reynolds Number; Peclet Number; Advection; Direct Numerical Simulation; Turbulent Flow

19990068453 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Interfaces at the Outer Boundaries of Turbulent Motions ***Annual Report***
Bisset, D. K., Stanford Univ., USA; Hunt, J. C. R., Stanford Univ., USA; Cai, X., Stanford Univ., USA; Rogers, M. M., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 125-135; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper examines questions such as how non-turbulent fluid become turbulent for an unbounded turbulent shear flow; what are the essential features of the interface and are they distinct enough to define the interface; how can such an interface be defined unambiguously, especially since it may be multiply connected; how can its 3D position and orientation be determined as f(x,y,z,t) in the DNS (Direct Numerical Simulation) data; what are the values of various properties in the vicinity of the interface; what are the characteristics of irrotational fluid that has moved away from its free-stream state, and is there a dependence on Reynolds number, spreading rate, flow type, the nature of the DNS simulation, or other parameters.
CASI
Turbulent Flow; Direct Numerical Simulation; Computational Fluid Dynamics; Large Eddy Simulation; Free Flow; Shear Flow

19990068454 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
The Largest Scales of Turbulent Wall Flows ***Annual Report***
Jimenez, Javier, Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 137-154; In English; See also 19990068442
Contract(s)/Grant(s): F49620-97-1-0210; CICYT-PB95-0159; CEC-E980130118; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The purpose of this paper is to study the flow scales which are of the order of or larger than the channel width or the boundary layer thickness. We will see that their contribution to the integral flow quantities is not negligible. One reason for studying large structures because long wavelengths imply long lifetimes and large volumes, and their integrated coherent effect can be comparable to those of the smaller ones even when their power per unit volume is not. Another reason for studying these largest scales of wall turbulence is because of the substantial fraction of the kinetic energy.
Derived from text
Turbulent Flow; Wall Flow; Boundary Layer Flow; Channel Flow; Flow Distribution; Boundary Layer Thickness

19990068455 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
The Instability of Streaks in Near-Wall Turbulence ***Annual Report***
Kawahara, G., Stanford Univ., USA; Jimenez, J., Stanford Univ., USA; Uhlmann, M., Universidad Politecnica de Madrid, Spain; Pinelli, A., Universidad Politecnica de Madrid, Spain; Annual Research Briefs, 1998; December 1998, pp. 155-170; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The main objectives of our present work are to elucidate the conditions for the streak instability in a turbulent channel flow and to demonstrate the generation mechanism of the streamwise vorticity through the streak instability. We expect that the understanding of the conditions and the streamwise vorticity generation in the streak instability could provide useful information for turbulence control in near- wall flows. In order to accomplish these objectives, we have performed numerically the linear stability analysis of a turbulent-channel-type base flow with a periodic undulation in the spanwise direction.
Derived from text
Turbulent Flow; Wall Flow; Porous Walls; Channel Flow; Flow Stability

19990068456 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
An Implementation of the V(exp 2)-f Model with Application to Transonic Flows ***Annual Report***
Kalitzin, Georgi, Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 171-184; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
This report describes the implementation of the v(sup 2) - f model in CFL3D, a code which solves the time-dependent 3-D compressible Reynolds-averaged Navier-Stokes equations using multi-block structured grids. A two-factored Approximate Factorization scheme, which factorizes the 3-D matrix into a 2-D and a 1-D matrix, improves the robustness and applicability of the model. The factorization errors scale with DELTA.t(sup 2) in this scheme in contrast to DELTA.t(sup 3) in the three-factored scheme for 3-D flows. GMRES is used for the inversion of the 2-D matrix, and a direct solver is used for the inversion of the 1-D matrix. The correctness of the implementation of the v(sup 2) - f model in CFL3D has been tested on several cases: flow over a flat plate, channel flow, and by-pass transition. Results for the channel flow have been included in this report. The performance of each numerical scheme has been tested on the computation of transonic flow around the ONERA M6 wing. This 3-D single block test case presented no major numerical problems with any of these schemes, and it allows a quick evaluation of the CPU time and memory requirements of the different numerical methods. The pressure distributions computed on selected wing cuts

are compared with experimental data. Comparisons to computations with the Spalart-Allmaras model provide an overall view on the relative cost of computation for the v(sup 2) - f model.
Derived from text
Time Dependence; Three Dimensional Models; Compressible Flow; Computational Fluid Dynamics; Reynolds Averaging; Navier-Stokes Equation; Transonic Flow; Channel Flow; Turbulent Flow; Turbulence Models

19990068457 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Heat Transfer Predictions in Cavities ***Annual Report***
Ooi, A., Stanford Univ., USA; Iaccarino, G., Stanford Univ., USA; Behnia, M., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 185-196; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The v(sup 2) - f turbulence model was introduced by Durbin (1991) and has been successfully used to predict heat transfer in attached boundary layers and channel flows (Durbin 1993). This model was later used by Behnia (1997) to predict heat transfer in an axisymmetric impinging jet. The impinging jet is a very challenging test case because the applications of traditional turbulence models to this flow configuration have been shown to result in poor agreement with available experimental data. Computations using the v(sup 2) - f model give better heat transfer predictions in this axisymmetric two-dimensional environment. Here, the v(sup 2) - f turbulence model will be used in a three-dimensional domain to test its ability to predict heat transfer in ribbed passages. We will compare results of the current simulation with the experimental data of Rau (1998). Also of interest is the prediction of heat transfer in a geometry resembling the clearance gap between the tip of an axial turbine blade tip and the adjacent stationary shroud. This problem is of great interest in the engineering community because heat transfer at the blade tip can give rise to large temperature gradients, which in turn causes durability problems. Booth (1982) and Wadia & Booth (1982) have investigated the aerodynamic characteristics of this narrow flow passage between the pressure and suction sides of the blade. Metzger (1989) have provided experimental heat transfer data for this configuration, and we will compare the v(sup 2) - f heat transfer predictions with this data.
Derived from text
Turbulent Heat Transfer; Turbulence Models; Turbulent Boundary Layer; Turbulent Flow; Computational Fluid Dynamics

19990068458 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
A Structure-Based Model with Stropholysis Effects ***Annual Report***
Kassinos, S. C., Stanford Univ., USA; Reynolds, W. C., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 197-209; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The performance of Reynolds Stress Transport (RST) models is limited by the lack of information about two dynamically important effects: the role of energy-containing turbulence structure (dimensionality) and the breaking of reflectional symmetry (stropholysis) due to strong mean or frame rotation. Both effects are fundamentally nonlocal in nature and this explains why it has been difficult to include them in one-point closures such as RST models. Information about the energy-containing structure is necessary if turbulence models are to reflect differences in dynamic behavior associated with structures of different dimensionality (nearly isotropic turbulence vs. turbulence with strongly organized two-dimensional structures). Information about the breaking of reflectional symmetry is important whenever mean rotation is dynamically important (flow through axisymmetric diffuser or nozzle with swirl, flow through turbomachinery, etc.). In the past year, we have formulated a new one-point model, the Q-model, which is based on our understanding of the stropholysis effects and which uses the effective gradients model from the IPRM (Interacting Particle Representation Model) (Kassinos & Reynolds 1996) for the modeling of nonlinear effects. For irrotational deformations the Q-model is equivalent to the previously formulated R-D model (Kassinos & Reynolds 1997) and produces good results for both rapid and slow mean deformations. The Q-model overcomes the restriction to irrotational deformation that applied to the previous model and produces good results even for flows with combinations of strong mean rotation and strain.
Derived from text
Reynolds Stress; Turbulence Models; Turbulent Flow; Direct Numerical Simulation; Computational Fluid Dynamics

19990068459 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Modeling a Confined Swirling Coaxial Jet ***Annual Report***
Lin, C. A., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 211-219; In English; See also 19990068442; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The discrepancy of the predicted results between Pierce and Moin (1998a,b) and Brankovic (1998) has motivated the present study to revisit the experimental study of Roback and Johnson computationally. The present computational frame-work is based

on the Reynolds averaged equation approach, and the eddy-viscosity type turbulence models are adopted. Therefore, the objectives of the present study are to identify the causes pf the discrepancies and to investigate the influences of grid density and turbulence modeling on the predicted results.
Derived from text
Turbulence Models; Turbulent Flow; Reynolds Averaging; Eddy Viscosity; Computational Fluid Dynamics; Large Eddy Simulation

19990068460 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Subgrid-Scale Models Based on Incremental Unknowns for Large Eddy Simulations ***Annual Report***
Dubois, T., Stanford Univ., USA; Bouchon, F., Universite Blaise Pascal, France; Annual Research Briefs, 1998; December 1998, pp. 221-236; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The purpose of this paper is to investigate subgrid-scale (SGS) models for large eddy simulations (LES). Turbulence modeling in the context of large eddy simulation is based on a decomposition of all flow variables into large (energy-containing) eddies and small scales carrying a small percentage of the total kinetic energy. The scale separation is achieved by applying a filter operation in physical space, based on a filter function, to flow fields. The net effect of the filter is to remove or at least to reduce the energy contained in scales of length smaller than the filter width DELTA-f.
CASI
Large Eddy Simulation; Turbulence Models; Navier-Stokes Equation; Turbulent Flow; Computational Fluid Dynamics; Direct Numerical Simulation

19990068461 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Subgrid Scale Modeling taking the Numerical Error into Consideration ***Annual Report***
Morinishi, Youhei, Nagoya Inst. of Tech., Japan; Vasilyev, Oleg V., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 237-253; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

One of the objectives of this study is to develop a dynamic subgrid scale (SGS) model, for which computational results will not depend on the accuracy of the numerical method. The most commonly used SGS model is based on the Smagorinsky eddy viscosity model (Smagorinsky, 1963) with the model coefficient computed dynamically through the tensor level identity by Germano (1991), hereafter denoted by DSM. However, the tensor level identity does not explicitly include the effect of the numerical error, and thus the computational results strongly depend on the numerical method, especially in simulations with poor resolution. In this report we will present a new dynamic procedure with the vector level identity, which takes the numerical error into consideration. We will test the dynamic Smagorinsky SGS model with the vector level identity, hereafter referred as VDSM model. The second objective of this study is to present a modification to the dynamic two-parameter mixed model. It is well known that the correlation between the Smagorinsky model and the SGS stress is low while the model based on the scale similarity assumption by Bardina (1983) has considerably higher correlation. However, the scale similarity model has a defect: it is not dissipative enough. Therefore, the model is usually used together with the Smagorinsky model.
Derived from text
Eddy Viscosity; Large Eddy Simulation; Turbulent Flow; Turbulence Models; Incompressible Flow; Navier-Stokes Equation; Computational Fluid Dynamics; Reynolds Number

19990068462 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Towards a Near-Wall Model for LES of a Separated Diffuser Flow ***Annual Report***
Kaltenbach, Hans–J., Technische Univ., Germany; Annual Research Briefs, 1998; December 1998, pp. 255-265; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The goal of the present study is to investigate the diffuser flow to see if the wall-model based LES method (Cabot 1995, 1996, 1997 and related contributions in this volume) can be applied. The statistics from a well resolved LES of the diffuser flow are used to study the near-wall zone in order to see (i) what are the relevant terms in the mean momentum balance and (ii) whether the turbulent shear stress in the near-wall layer can be predicted by an algebraic eddy-viscosity model. Based on the outcome of these a priori tests, we discuss a model formulation which treats the near wall region primarily in the RANS (Reynolds Averaged Navier-Stokes) spirit with emphasis on accurate specification of the mean turbulent stresses.
Derived from text
Eddy Viscosity; Mathematical Models; Navier-Stokes Equation; Reynolds Averaging; Large Eddy Simulation; Turbulent Flow; Turbulence Models; Computational Fluid Dynamics

19990068463 Stanford Univ., Center for Turbulence Research, Stanford, CA USA

On the Feasibility of Merging LES with RANS for the Near-Wall Region of Attached Turbulent Flows ***Annual Report***

Baggett, Jeffrey S., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 267-277; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this report, we explore the feasibility of using RANS (Reynolds Averaged Navier-Stokes) eddy viscosity models to supplement the SGS (subgrid scale) model in the near-wall region. This exploration is motivated by Durbin's development of the v2f eddy viscosity RANS model which has been shown to give good near-wall predictions in a variety of flows (Durbin 1991, 1995). Unfortunately, as we shall see below, a direct crossover to RANS in the near-wall region is unlikely to be successful in attached turbulent boundary layers. In the next section our numerical experiments in turbulent channel flow are described. In 2.1 two different techniques for adding a RANS eddy viscosity model to a conventional LES (large eddy simulation) eddy viscosity model in the near-wall region are described. In 2.2 we argue that the failure of such models is due to the formation of an artificial near-wall turbulent cycle with streamwise streaks and vortices occurring at scales dictated by the grid resolution and not by near-wall physics. The artificial cycle is worth investigating because it appears to explain the overly large streamwise velocity fluctuations in the near-wall region as well as the overly large additive logarithmic law constants frequently observed in large eddy simulations of turbulent boundary layers and channel flows. Finally, in 2.3 we mention some other wall modeling approaches being explored at CTR and end with some concluding remarks in section 3.

Derived from text

Eddy Viscosity; Large Eddy Simulation; Reynolds Averaging; Navier-Stokes Equation; Turbulent Flow; Turbulence Models; Reynolds Stress; Computational Fluid Dynamics

19990068464 Stanford Univ., Center for Turbulence Research, Stanford, CA USA

Large-Eddy Simulation of a Separated Boundary Layer ***Annual Report***

Cabot, W., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 279-288; In English; See also 19990068442; Sponsored in part by National Partnership for Advanced Computational Infrastructure; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The goal of recent work has been to perform a less expensive LES (large eddy simulation) of this flow with a well resolved wall for use as a test case for evaluating the performance of wall models with coarsely resolved walls (Cabot 1997). Initially, the same low Reynolds number case as the DNS (direct numerical simulation) was to be simulated to validate the LES with well resolved walls and then used to perform tests of LES with coarsely resolved walls using wall models. Further, with the general shift to parallel supercomputing architectures and the diminishing availability of serial time, the separated boundary layer codes needed to be converted to a portable parallel framework (MPI) and validated with results from the extant serial vector code. The status of the separated boundary layer simulations is given in section 2 and the directions for future simulations and wall model tests therein are given in section 3.

Derived from text

Direct Numerical Simulation; Large Eddy Simulation; Low Reynolds Number; Computational Fluid Dynamics; Reynolds Averaging; Navier-Stokes Equation; Turbulent Flow; Turbulence Models

19990068465 Stanford Univ., Center for Turbulence Research, Stanford, CA USA

Numerical Study of a Channel Flow with Variable Properties ***Annual Report***

Nicoud, F. C., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 289-310; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The objective of the present work is to study the case where the thermo-physical properties vary significantly in the absence of compressibility effects (M = M(sub tau) = 0). We perform a DNS (direct numerical simulation) of a low speed flow with a large temperature gradient in order to generate high-fidelity data which is not presently available. The configuration is a plane channel flow between two isothermal walls with temperatures T(sub 1) and T(sub 2). Regarding the turbulence modeling, the objective is to provide more reliable information about the variation of the constant of integration C as a function of B(sub q). Other questions of interest relate to how good the Gaviglio's analogy is in the zero Mach number limit and the exact role of the fluid-property variations. A recent analytical study performed by Eames & Hunt (1997) shows how a lump of fluid experiences a lift force when it moves perpendicularly to a density gradient. A fundamental question that can be addressed using DNS is how this inviscid effect can modify the near wall streaks. Is it related to the intensification of the ejection events observed by Wardana (1992, 1994)? The low Mach number approximation and the numerical method are discussed in Sections 2 and 3. The first DNS results are given in Section 4.

Derived from text

Direct Numerical Simulation; Computational Fluid Dynamics; Turbulence Models; Turbulent Flow; Large Eddy Simulation;

Three Dimensional Models; Compressible Flow; Compressibility Effects; Navier-Stokes Equation; Reynolds Stress; Shear Layers; Shear Flow

19990068466 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
On the Construction of High Order Finite Difference Schemes on Non-Uniform Meshes with Good Conservation Properties ***Annual Report***
Vasilyev, Oleg V., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 311-324; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Numerical simulation of turbulent flows (DNS or LES) requires numerical methods that can accurately represent a wide range of spatial scales. One way to achieve a desired accuracy is to use high order finite difference schemes. However, additional constraints such as discrete conservation of mass, momentum, and kinetic energy should be enforced if one wants to ensure that unsteady flow simulations are both stable and free of numerical dissipation. In addition, both pressure and velocity fields must be physical. These requirements are usually achieved by using a staggered grid and enforcing continuity. Until recently the standard second order accurate staggered grid finite difference scheme of Harlow and Welch (1965) was the only scheme that simultaneously conserved mass, momentum, and kinetic energy. Morinishi (1998) derive the general family of fully conservative higher order accurate finite difference schemes for uniform staggered grids. Both the scheme of Harlow and Welch (1965) and that of Morinishi (1998) conserve mass, momentum, and kinetic energy on a uniform mesh. However, generalizing these schemes to non-uniform meshes and preserving the conservation properties is not straightforward. Morinishi (1998) mistakenly concluded that in order to construct conservative schemes, one should choose between the accuracy and conservation. One of the reasons why the authors came to this conclusion may be the fact that they tried to generalize the scheme by changing the weights in the difference operators as a function of local grid spacings and preserving the order of local truncation error. As a consequence of this generalization, the resulting scheme does not preserve symmetries of the uniform mesh case. Veldman and Versappen (1998), in their analysis of convective-diffusion equation on non-uniform meshes, showed that in order for the scheme to be conservative, it should preserve symmetries of the underlying operator, i.e. the convective derivative should be approximated by skew-symmetric operator.
Derived from text
Convection-Diffusion Equation; Nonuniformity; Computational Grids; Grid Generation (Mathematics); Finite Difference Theory; Direct Numerical Simulation; Large Eddy Simulation; Computational Fluid Dynamics; Turbulent Flow

19990068467 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Development of Immersed Boundary Methods for Complex Geometries ***Annual Report***
Mohd–Yusof, J., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 325-336; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

For fluid dynamics simulations, the primary issues are accuracy, computational efficiency, and the ability to handle complex geometries. Spectral methods offer the highest accuracy but are limited to relatively simple geometries. In order to accommodate more complex geometries, finite-difference or finite-element methods are generally used. However, these methods suffer from relatively low accuracy, requiring fine meshes to obtain good results. Finite element schemes, while able to handle complex geometries, often require significant computational time for grid generation. Spectral element methods can be used for complex geometries, but the grid stretching inherent in these methods leads to time-step limitations and clustering of grid-points in an inefficient manner. In Mohd-Yusof (1997) we demonstrated a discrete-time immersed boundary method which allows implementation of complex geometries in existing pseudo-spectral codes. The method does not incur significant additional cost as compared to the base computational scheme and changes in surface geometry simply require modification of the input files without any further modification of the code itself. Although the method appears to work well in this implementation, the actual convergence properties are not well documented. Also, the earlier code did not properly accommodate moving boundaries. Finally there was a term omitted from the derivation of the forcing presented in that report. While that omission does not affect the results from the earlier work, it would invalidate computations in more complex surface geometries.
Derived from text
Computational Grids; Grid Generation (Mathematics); Direct Numerical Simulation; Finite Difference Theory; Finite Element Method; Computational Fluid Dynamics; Spectral Methods; Turbulent Flow

19990068468 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Particle Methods for Micro and Macroscale Flow Simulations ***Annual Report***
Koumoutsakos, P., Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 337-349; In English; See also 19990068442; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

We have presented some results from our ongoing investigations on particle methods (vortex methods and molecular dynamics). Having resolved in the last decade several issues concerning the accuracy and numerical capabilities of vortex methods, the key issue is the use of efficient computational techniques for the solution of the associated N-body problem. Particle-Mesh techniques and multipole summation algorithms coupled with efficient tree-data structures have being implemented, allowing for large scale simulations using millions of computational elements in two and three dimensions.
Derived from text
High Reynolds Number; Lagrangian Function; Molecular Dynamics; Navier-Stokes Equation; Finite Difference Theory; Computational Fluid Dynamics; Computational Grids; Grid Generation (Mathematics); Vorticity; Vortices; Turbulent Flow

19990068502 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Fluid Mechanics, Goettingen, Germany
Comparison of DSMC Calculations With Experiments in Nozzle Backflows
Rosenhauer, Mathis, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 1-5; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Continuum and DSMC method for rarefied flow have gained much interest to treat flow conditions where strong nonequilibrium situations and large expansion ratios occur in hypersonic flow, e.g. in shocks, blunt body wakes and around nozzle lips. The present paper concerns, as a first step from the effort to build and validate such a program, preliminary DSMC calculations of a nozzle flow. This case gains interest from the opportunity of comparing it to now available corresponding experiments from the new DLR High Vacuum Facility STG. By powerful cryopumps, STG allows reliable measurements in nozzle backflow regions formerly not accessible due to background pressure disturbances, such delivering data urgently needed to check computational models over the whole range of flow conditions. Especially hybrid methods with their sensitive parameters controlling switching and DSMC details relies on such possibility for validation.
Author
Computerized Simulation; Nozzle Flow; Mathematical Models; High Vacuum; Blunt Bodies

19990068516 Kyoto Univ., Dept. of Industrial Arts, Japan
Characteristics of Under-Expanded Jets Issuing from Circular and Non-Circular Orifices
Teshima, Koji, Kyoto Univ., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 101-108; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoyo, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Flow structure of under-expanded jets issuing from circular and non-circular sonic orifices was studied by visualization using laser-induced fluorescence. For a circular orifice, deformation of the jet cross section due to the generation of streamwise vortices was observed. The following non-circular orifices were tested: regular n-polygons (n=3,4,6,8, and 12), a hexagram and a octagram. The geometrical axis rotated for all the polygonal orifices with rotation angle of pi/n. With the concave polygonal orifices (hexagram and octagram) peculiar expansion at the exit of the orifice was observed: the gas expanded along the orifice wall at the location of the concave orifice corners.
Author
Rotation; Orifices; Laser Induced Fluorescence; Deformation; Flow Geometry

19990068519 Astro Research Co., Fujisawa, Japan
Numerical Analysis of the Rarefied Plume Flow Field: The Effect of the Nozzle exit Plane Wall
Okamoto, Hiroyuki, Astro Research Co., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 16-24; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The plume flow field of an hydrazine decomposed gas arcjet thruster has been analyzed numerically with various type of nozzle wall geometry focused on the back flow region. Typical back flow region characteristics is derived from these numerical simulation results.
Author
Numerical Analysis; Flow Characteristics; Flow Distribution; Rarefied Gas Dynamics

19990068520 Kyushu Univ., Dept. of Aeronautics and Astronautics, Fukuoka, Japan
Numerical Simulation of Rarefied Plume Impingement and Comparison with Legge's Experiments
Hyakutake, Toru, Kyushu Univ., Japan; Nishida, Michio, Kyushu Univ., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 25-33; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb.

1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In the present paper, we have simulated normal, parallel and oblique impingements on a flat plate by using the direct simulation Monte Carlo (DSMC) method. The numerical simulation was carried out using variable hard sphere (VHS) model for nitrogen. Simulated results have been compared with the experiments of the jet impingement done by Legge. The present results agreed well with Legge's experimental data and empirical law for the pressure and the shear stress distributions on the flat plate. Moreover, it may be mentioned based on the present results that the Legge's empirical law is applicable in a wide range.
Author

Computerized Simulation; Numerical Analysis; Rarefied Gases; Plumes; Jet Impingement

19990068521 Technische Hochschule, Aachen, Germany

Numerical Approaches to the Boltzmann Equation in the Transition Regime

Beylich, Alfred, Technische Hochschule, Germany; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 34-44; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We are interested in the development of modules for the numerical calculation of elements of the kinetic equation that can help to bridge the gap between small and large cell-Knudsen numbers, and that should become complementary or competitive to the usual Right-path calculations. In this context we have studied the limitations and severe consequences for the Boltzmann kinetic equation (BE) due to the introduction of functions f(sub r, c, t) which are discrete and finite in physical (r) and in velocity (c) space. Since in the kinetic equation the zone of influence is limited to a length of the order of a mean free path, for small cell-Knudsen numbers K(sub n)(sub c), it becomes necessary to subscale in order to avoid distortions of f and artificial dissipation. Thus, we introduce interpolated f. In our scheme, a 2-scale module (2S) becomes active whenever K(sub n)(sub c) less than O(l). Alternatively, a two-point integral (2PI-module) scheme was developed. For the collision term, different modules are used, such as the BGK-model. Furthermore, we have developed a module for the calculation of the collision terms G, upsilon where the lower moments are conserved. The limitations of the BE on a grid with K(sub n)(sub c) much less than 1 makes it attractive to introduce a 2-Level Module (2L). From the equation of transfer we obtain a set of equations for the summational invariants. This set of upper-level equations is interfaced with the BE. For a first study, we used the BGK-model. Some calculations using a 2S-2L-module have shown that it is possible to penetrate the K(sub n)(sub c) less than 1-region to values at least an order of magnitude smaller in K(sub n)(sub c) than if only the 2S-Module had been used. The interlacing has also been extended to the general case where G, upsilon is not simplified. Some sample calculations are presented.
Author

Numerical Analysis; Boltzmann Transport Equation; BGK Model; Transition Probabilities; Regimes

19990068522 Nagoya Univ., Dept. of Aerospace Engineering, Nagoya, Japan

On the Range of Rarefaction Parameter Under Which the Temperature Freezing Takes Place in the Free Jet Expanding into a Vacuum

Soga, Takeo, Nagoya Univ., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 45-53; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Dimensional analysis of two-dimensional and three dimensional source expansion flow was carried out. Rarefaction parameters were introduced and the role of the parameters were discussed. Axisymmetric expansion flow from a circular orifice into a vacuum was studied based upon the DSMC method. The results of numerical simulation were examined applying the results of dimensional analysis. The reason why one of the component of thermal motion does not level off under rarefied environment was discussed and it was revealed that vacuum environment is the primary and inherent cause of this phenomenon.
Author

Three Dimensional Flow; Two Dimensional Flow; Dimensional Analysis; Rarefaction

19990068523 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Fluid Mechanics, Goettingen, Germany

Rarefied Flow Investigation in Gas-Surface Interaction and Supersonic Plumes

Dankert, Carl, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 54-60; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

At the DLR research centre in Gottingen spectroscopic methods like laser induced fluorescence (LEF) and electron beam fluorescence (e(-) -beam) are applied for gas- surface-interaction studies of molecules (N2 and NO) of high kinetic energy (800 m/s to 3000 m/s) colliding with a solid wall of several materials. The interaction takes place under nearly free molecular condi-

tions; there is no shock in front of the obstacle. These experiments are relevant to study the behaviour of diatomic molecules before and after the collision focussing on the rotational temperature (in case of having a Boltzmann distribution). The second topic is plume-plume-interaction of big plumes expanding into vacuum. The new facility STG is now in operation, providing, due to liquid-helium-cryopumping, a pressure less than 10(exp -5) mbar during blowing the flow in a space of 5.25 m length and a diameter of 1.6 m. The gas species N2 and H2 were already tested in flux experiments and the first results of resonance enhanced multi photon ionization (REMPI) were obtained in a supersonic N2-free jet.
Author
Rarefied Gas Dynamics; Flow Characteristics; Research; Gas-Solid Interactions; Supersonic Jet Flow; Surface Reactions

19990068524 Mitsubishi Heavy Industries Ltd., Research and Development Center, Hiroshima, Japan
Fluorescence Intensity Distribution in I2-LIF Flow Visualization Considering I2-Hyperfine Structure
Hirai, E., Mitsubishi Heavy Industries Ltd., Japan; Teshima, K., Kyoto Univ., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 61-65; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; Original contains color illustrations; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Flow fields visualized by laser-induced fluorescence technique using iodine molecules (I2-LIF) sometimes shows strange fluorescence intensity distribution, which does not directly correspond to the molecular density field. In this paper, these phenomena are theoretically analyzed and it is clarified that they are caused by optical resonant mechanisms. The optical interaction between the multimodal laser source for excitation and the rotational spectral shape considering the hyperfine spectral structure of iodine molecules due to nuclear spin takes an important part. The typical phenomena seen in free jet visualization, for example, a radial stripe structure and irregular fluorescence streaks can be interpreted very well by the present theory.
Author
Fluorescence; Flow Distribution; Laser Induced Fluorescence; Flow Visualization; Lithium Fluorides; Iodine

19990068525 Nagoya Univ., Dept. of Electronic-Mechanical Engineering, Nagoya, Japan
Resonantly Enhanced Multiphoton Ionization for Analyses of Rarefied Gas Flows
Niimi, Tomohide, Nagoya Univ., Japan; Dankert, Carl, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 66-74; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

REMPI (Resonantly Enhanced Multiphoton Ionization) technique is one of the most suitable methods to measure thermodynamic variables in the highly rarefied regime with short response time and high sensitivity. In this study, we construct the experimental setups for the 2R+2 and 2R+l N2-REMPT at DLR Gottingen and Nagoya university and examine the fundamental properties of the REMPI spectra. The modeling of the ionization process is derived and the ion current is predicted from the solution. The theoretical REMPI spectra are calculated and compared with the experimental ones.
Author
Gas Ionization; Procedures; Resonance; Thermodynamics; Variable; Rarefied Gas Dynamics; Photoionization

19990068526 Tohoku Univ., Dept. of Aeronautics and Space Engineering, Sendai, Japan
The Status of Measurement of Chemical State in a Nozzle
Park, Chul, Tohoku Univ., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 75-82; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The recent experimental data on the chemical state of the flow produced by an arc-jet wind tunnel are analyzed. The experiments were conducted by Bamford et al and by Fletcher at NASA Ames Research Center using two-photon laser-induced fluorescence technique. Flow velocity, translational temperature, and concentrations of atomic species have been measured. The experimental conditions are calculated in this work using a six-temperature model and the results are compared with the experimental data. It is shown that flow velocity is slightly overestimated, atomic nitrogen density is substantially underestimated, and translational temperature is greatly underestimated. Possible causes are surmised.
Author
Flow Velocity; Gas Density; Research; Data Acquisition

19990068527 Tohoku Univ., Dept. of Aeronautics and Space Engineering, Sendai, Japan
An Analysis of Rotational Rate Processes in Expanding Flows of Nitrogen
Mizobata, Kazuhide, Tohoku Univ., Japan; Park, Chul, National Aeronautical Lab., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 83-92; In English; Nonequilibrium Phenomena of Low-Density Jets in Space,

12-13 Feb. 1998, Kyoto, Japan
Contract(s)/Grant(s): MOE-09751001; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Rotational rate processes of nitrogen in quasi-one dimensional expanding flows are analyzed using state-to-state rate coefficients evaluated from spectroscopic measurements. Master equations for rotational levels in the vibrational ground state are fully coupled with fluid dynamic equations, and solved in a condition of free expansion. Calculated rotational temperature for low rotational levels agrees well with experimental data. Rotational rate processes are solved also in flow conditions corresponding to three kinds of RCS thrusters: a cool gas, a monopropellant, and a bipropellant thruster. It is shown that rotational non-Boltzmann distributions take place in all three cases. Rotational temperatures at different levels deviate from one other, and the number densities of the molecules in rotational levels stop decreasing, at small distances from the throats. Quasiclassical trajectory calculation is also carried out to evaluate theoretically the state-to-state rate coefficients for rotation of N2-N2 system. Evaluated values are substantially larger than the experimental data, quite similarly to the previous results of QCT calculation for vibration-translation. Further refinement of the method and of the potential functions are needed for reliable evaluation.
Author
Research; Rotation; Flow Deflection; Nitrogen; Vibrational States; Cold Gas

19990069589 Mie Univ., Dept. of Mechanical Engineering, Mie Japan
Monte Carlo Direct Simulation on Supersonic Free Jets
Usami, Masaru, Mie Univ., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 6-15; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-12 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Axisymmetric underexpanded jets from an orifice in near continuum, transition and scattering regimes are investigated for several pressure ratios by the DSMC method. The Mach disk and barrel shock are clearly observed as predicted by the continuum analysis. These shock waves broaden as upstream pressure decreases, and they disappear at low stagnation pressure. The DSMC results are compared with the experimental results by a mass-sampling technique and a good qualitative agreement is obtained. The structure of the jet can be characterized using the rarefaction parameter introduced by Muntz et al. The jet structures of gas mixtures for Ar and He are also calculated using the DSMC method and the results are compared with the experimental results by Rothe (UTIAS Report, 1966). The three dimensional interacting flowfield in two parallel axisymmetric underexpanded jets is simulated by the DSMC method.
Author
Gas Jets; Computerized Simulation; Monte Carlo Method; Research; Supersonic Jet Flow; Three Dimensional Flow

19990069943 NASA Marshall Space Flight Center, Huntsville, AL USA
Numerical Prediction of Transient Axial Thrust and Internal Flows in a Rocket Engine Turbopump
VanHooser, Katherine, NASA Marshall Space Flight Center, USA; Bailey, John W., Sverdrup Technology, Inc., USA; Majumdar, Alok, Sverdrup Technology, Inc., USA; [1999]; In English; 35th; Joint Propulsion, 21 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-40386; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents the application of the Generalized Fluid System Simulation Program (GFSSP) to model the time-dependent flow in a complex secondary flow circuit of the turbopump of the Fastrac engine currently under development at Marshall Space Flight Center. GFSSP is a general purpose computer program for analyzing steady-state and time-dependant flowrates, pressures, temperatures, and concentrations in a complex flow network. The program employs a finite volume formulation of mass, momentum and energy conservation equations in conjunction with the thermodynamic equation of state of real fluids. GFSSP was used to calculate the axial thrust and internal flow distribution of the Fastrac engine turbopump during the start and shut down transients. The models discussed in this paper use boundary conditions that were extracted from turbopump test data. The GFSSP predicted turbopump secondary flow passage pressures and temperatures were compared with actual measured values.
Derived from text
X-34 Reusable Launch Vehicle; Turbine Pumps; Computer Programs; Rocket Thrust; Internal Flow; Secondary Flow; Fuel Flow; Mathematical Models; Liquid Propellant Rocket Engines; Fuel Pumps

19990069946 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Implementation of Interaction Algorithm to Non-Matching Discrete Interfaces Between Structure and Fluid Mesh
Chen, Shu–Po, Institute for Computer Applications in Science and Engineering, USA; June 1999; 12p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1999-209340; NAS 1.26:209340; ICASE-IR-36; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents software for solving the non-conforming fluid structure interfaces in aeroelastic simulation. It reviews the algorithm of interpolation and integration, highlights the flexibility and the user-friendly feature that allows the user to select the existing structure and fluid package, like NASTRAN and CLF3D, to perform the simulation. The presented software is validated by computing the High Speed Civil Transport model.

Author

Algorithms; Computer Programs; Software Development Tools; Software Engineering; Computerized Simulation

19990069947 Sandia National Labs., Engineering Sciences Center, Albuquerque, NM USA

Numerical Simulations of a Lobed Fuel Injector

Strickland, J. H., Sandia National Labs., USA; Selerland, T., California Univ., USA; Karagozian, A. R., California Univ., USA; Physics of Fluids; November 1998; ISSN 1070-6631; Volume 10, No. 11, pp. 2950-2964; In English

Contract(s)/Grant(s): NCC2-374; NASA Order H-2357; DE-AC04-94AL-85000; N00014-93-1-1383; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Numerical modeling of the nonreactive mixing processes associated with a lobed fuel injector in a coflowing air stream is presented. The lobed fuel injector is a device which generates strong streamwise vorticity, producing locally high strain rates which can enhance the molecular mixing of reactants while delaying ignition in a controlled manner. Vortex element modeling is used to simulate flow field evolution and fuel element mixing characteristics for this lobed fuel injector. Quantitative predictions for vorticity generation and qualitative results for streamwise rollup compare well qualitatively with recent experimental investigations of this flow field [Smith et al, Phys. Fluids 9, 667 (1997)]. Parametric studies of the effects of lobe amplitude-to-wavelength ratio, lobe angle, and lobe shape for given flow conditions suggest that geometrical features may be optimized to enhance mixing and control reaction processes.

Author

Mathematical Models; Simulation; Air Flow; Streamlining; Fuel Injection

19990070303 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Numerical Studies of Oblique Shock Reflection in Steady Two-Dimensional Flows

Shirozu, Tatsuyuki, Kyushu Univ., Japan; Nishida, Michio, Kyushu Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 193-204; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes the numerical investigations of oblique shock reflection. The oblique shock reflection flowfield considered here is such that an oblique shock starting at the tip of a wedge placed in a steady supersonic flow hits wall and a reflected shock is generated. There exist two types of the oblique shock reflection, namely regular reflection and Mach reflection. These reflection configurations are dependent on the incident flow condition and wedge geometry, so that altering an incident flow Mach number, the reflection configuration has been investigated. Moreover, the transition from the regular to Mach reflection or inverse transition have been investigated. The result shows that the transition from regular to Mach reflection occurs at detachment criterion.

Author

Oblique Shock Waves; Flow Geometry; Mach Reflection; Steady Flow; Supersonic Flow; Wedges

19990070305 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

An Experimental Study of Shock Wave/Turbulent Boundary Layer Interaction Region Induced by Blunt Protuberance

Aso, Shigeru, Kyushu Univ., Japan; Maekawa, Syozo, Kyushu Univ., Japan; Karashima, Keiichi, Tokyo Univ., Japan; Sato, Kiyoshi, Tokyo Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 175-182; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Three-dimensional shock wave/turbulent boundary layer interaction region induced by a blunt protuberance is experimentally investigated. In the experiments, oscillating shock waves in interaction region induced by the blunt protuberance is also experimentally investigated. Experiments are performed at Institute of Space and Astronautical Science (ISAS) supersonic wind tunnel, under the testing condition of freestream Mach number of 2, 3, and 4 with almost adiabatic wall condition. The interaction regions are visualized by the oil flow technique for investigating surface flow pattern and the shadowgraph for observing oscillating shock wave system. Also surface pressure distributions are measured. The primary separation lines locate almost same position irrespective of freestream Mach number, and freestream Mach number independence of the primary separation region is revealed. However, detailed flow structures for each Mach number are different. Pressure begins to rise at slightly ahead of the

primary separation line where stream lines begin to deflect outward. A pressure plateau is formed due to the separated vortex in the interaction region. As free-stream Mach number is increased, the maximum pressure becomes higher but locations of the pressure starting to rise and the maximum pressure exist at almost same locations respectively, regardless of free-stream Mach numbers. The oscillating separated shock waves are observed in the interaction region by instantaneous shadowgraph technique and high speed video system. Also significant unsteady flow structure is captured.
Author
Boundary Layer Flow; Flow Visualization; Free Flow; Unsteady Flow; Turbulent Boundary Layer; Three Dimensional Boundary Layer; Wave Interaction; Wind Tunnel Tests; Protuberances; Shock Waves; Supersonic Speed

19990070306 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
An Experimental Study on Bow Shock Wave/Turbulent Boundary Layer Interaction Region Induced by Blunt Body
Aso. Shigeru, Kyushu Univ., Japan; Maekawa, Syozo, Kyushu Univ., Japan; Shindo, Yoshitaka, Kyushu Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 165-173; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Bow shock wave/turbulent boundary layer interaction regions induced by a blunt body have been experimentally investigated carefully. Experiments have been performed under the testing condition of free-stream Mach number of 3.8, total pressure of 1.2 MPa and Reynolds number of 2.8 x 10(exp 7) with almost adiabatic wall condition. by selecting the displacement h, between a flat plate and a blunt body simulating Solid Rocket Booster (SRB), as the main parameter, the effects of the displacement on the flowfields are examined. First of all, flowfields are visualized by use of the Schlieren method, and surface flows are visualized by oil flow technique, then surface pressure distributions are measured for various h, 5, 10, 15 and 20 mm. For small h, the secondary separation with the primary separation is observed, and there exists a new weak separation downstream of the attachment line. On the contrary for large h, no secondary separation is observed, and the flow structure becomes much simple. The results show that the peak pressure is rapidly decreased as h is increased, also as apart from the centerline. Clearly the displacement affects the interaction region considerably. Those detailed flow structures are revealed.
Author
Blunt Bodies; Boundary Layer Flow; Shock Waves; Turbulent Boundary Layer; Bow Waves; Flow Visualization; Free Flow; Supersonic Flow; Wave Interaction

19990070326 NASA Marshall Space Flight Center, Huntsville, AL USA
Rayleigh Convection in a Rotating Magnetic Field
Volz, M. P., NASA Marshall Space Flight Center, USA; Mazuruk, K., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 21-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The onset of steady and time-dependent flows were measured in a cylinder of liquid gallium subjected to a vertical temperature gradient and a horizontal rotating magnetic field (RMF). by varying the applied vertical temperature gradients and the strength of the applied magnetic field, a stability diagram in Rayleigh number - Hartmann number parameter space was constructed. The application of a RMF increased the critical value of the Rayleigh number by up to a factor of 10. However, there was observed a critical value of the Hartmann number where instability set in, regardless of the value of the Rayleigh number. Significant hysteresis in the value of the critical Rayleigh number was observed depending on whether the applied thermal gradient was increasing or decreasing.
Author
Rayleigh Number; Magnetic Fields; Rotation; Steady Flow; Time Dependence

19990070336 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Stability Analysis of Forced-Flow Cooled Superconductor
Kasao, Daisaku, Kitakyushu Coll. of Technology, Japan; Ito, Takehiro, Kyushu Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 79-96; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Numerical simulations of the thermal stability of a superconductor composite cooled by forced-flow supercritical helium have been performed. The analytical model consists of simultaneous two-dimensional differential equations for coolant, supercritical helium, and an one dimensional differential equation for solid region, superconductor composite. The equations of conservation of mass, momentum, and energy for the coolant and the Fourier heat conduction equation for the solid were solved numerically. Current-sharing mode, temperature-dependent properties of the conductor, and pressure- and temperature-dependent coolant properties were fully taken into account. The transient behaviors of the conductor, coolant flow, effects of transport

current, disturbance-heated length of the conductor, initial-pressure, helium temperature, velocity of coolant, and diameter of coolant passage on the thermal stability of superconductor composite are discussed.
Author
Conductive Heat Transfer; Superconductors (Materials); Cooling; Helium; Differential Equations; Conservation Laws; Coolants

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Aircraft Instrumentation, and 19 Space Instrumentation.

19990064512 Department of the Navy, Washington, DC USA
Infrared Fiber Imager
Sanghera, Jasbinger, Inventor; Aggarwal, Ishwar D., Inventor; Shaw, Brandon, Inventor; Pureza, Paul, Inventor; May 12, 1999; 18p; In English
Patent Info.: Filed 12 May 1999; US-Patent-Appl-SN-310,376
Report No.(s): AD-D019352; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche
An apparatus is discussed for performing spatial and spectral analysis comprising a bundle of a plurality of chalcogenide glass fiber, an optical system for transmitting light received from the bundle, and a detector for receiving the light signal from the optical system for providing spatial and spectral analysis of the bundle image; maximum diameter of the fibers is about the size of the pixels on the detector.
DTIC
Infrared Detectors; Chalcogenides; Images; Infrared Spectra; Glass Fibers; Spectrum Analysis

19990064626 NASA Goddard Space Flight Center, Greenbelt, MD USA
New Generation Lidar Technology and Applications
Spinhirne, James D., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; PIERS 1999, 22-26 Mar. 1999, Taipei, Taiwan, Province of China; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
Lidar has been a tool for atmospheric research for several decades. Until recently routine operational use of lidar was not known. Problems have involved a lack of appropriate technology rather than a lack of applications. Within the last few years, lidar based on a new generation of solid state lasers and detectors have changed the situation. Operational applications for cloud and aerosol research applications are now well established. In these research applications, the direct height profiling capability of lidar is typically an adjunct to other types of sensing, both passive and active. Compact eye safe lidar with the sensitivity for ground based monitoring of all significant cloud and aerosol structure and the reliability to operate full time for several years is now in routine use. The approach is known as micro pulse lidar (MPL). For MPL the laser pulse repetition rate is in the kilohertz range and the pulse energies are in the micro-Joule range. The low pulse energy permits the systems to be eye safe and reliable with solid state lasers. A number of MPL systems have been deployed since 1992 at atmospheric research sites at a variety of global locations. Accurate monitoring of cloud and aerosol vertical distribution is a critical measurement for atmospheric radiation. An airborne application of lidar cloud and aerosol profiling is retrievals of parameters from combined lidar and passive sensing involving visible, infrared and microwave frequencies. A lidar based on a large pulse, solid state diode pumped ND:YAG laser has been deployed on the NASA ER-2 high altitude research aircraft along with multi-spectral visible/IR and microwave imaging radiometers since 1993. The system has shown high reliability in an extensive series of experimental projects for cloud remote sensing. The retrieval of cirrus radiation parameters is an effective application for combined lidar and passive sensing. An approved NASA mission will soon begin long term lidar observation of atmospheric structure from space. The Geoscience Laser Altimeter System (GLAS) of the Earth Observing System is scheduled for deployment in the 2001 time frame. GLAS is both a cloud and aerosol lidar and a surface altimeter, principally for monitoring of polar ice sheets. The GLAS instrument is based on all solid state lasers operating at 40 Hz and high efficiency, solid state detectors. The design lifetime is three to five years. Data from the GLAS mission is expected to revolutionize some aspects of our understanding of the global distribution of cloud and aerosols for global climate prediction.
Author
Optical Radar; Infrared Radiation; Laser Altimeters; Technology Assessment; Detection; Aerosols; Solid State Lasers; Earth Observing System (EOS); Technology Utilization

19990066685 State Univ. of New York, Dept. of Physics and Astronomy, Stony Brook, NY USA
Acquisition of a Scanning Electron Microscope for Electron Beam Lithography ***Final Report, 22 Jan. 1998 - 28 Feb. 1999***
Lukens, James, State Univ. of New York, USA; May 31, 1999; 4p; In English
Contract(s)/Grant(s): F49620-98-1-0323
Report No.(s): AD-A364932; AFRL-SR-BL-TR-99-0161; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

Equipment has been acquired for an Electron Beam Lithography (EBL) system. This system is based on a Leo 1550 SEM with a Raith beam blanker and Raith Elphy Quantum software. The system has been used for the fabrication of SET devices with 30nm dimensions as well as multi-layer superconductor circuits based on the niobium trilayer process.
DTIC
Lithography; Superconductors (Materials); Fabrication

19990067243 Texas Univ., Southwestern Medical Center, Dallas, TX USA
Creation of a TNT Sensor by Directed Evolution of a G-Protein Coupled Receptor ***Final Report, 28 Jun. 1997 - 30 Jun. 1999***
Lerner, Michael R., Texas Univ., USA; Jun. 28, 1999; 3p; In English
Contract(s)/Grant(s): N00014-96-1-1174
Report No.(s): AD-A365475; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

The potential to create hand held or ever smaller biosensors capable of detecting essentially any chemicals of interest remains an exciting opportunity in general and for TNT detection in particular. The basis for developing biosensors uses the concept of rapid directed G-Protein coupled receptor evolution. Mutation is accomplished by the use of the polymerase chain reaction. Selection is accomplished by the use of transfected melanophores in combination with a digital video imaging system. We have successfully integrated the pigment cells with this apparatus and can now identify the presence of a signal arising from clones present at a frequency of well under 1:100,000 in a cDNA library based on plasmid vectors. as a starting point for the mutagenesis of GPCRs in order to obtain new desired specificaties, a collection of cDNAs coding for receptors from many different branches was developed. At the present time the lab has accumulated on the order of 70 such cDNAs, all of which are set up in plasmid vectors capable of being expressed in melanophores.
DTIC
Images; Digital Television; Imaging Techniques; Bioinstrumentation

19990067277 NASA Marshall Space Flight Center, Huntsville, AL USA
A High-Energy Focal-Plane Gas Scintillation Proportional Counter
Ramsey, B. D., NASA Marshall Space Flight Center, USA; Austin, R. A., NASA Marshall Space Flight Center, USA; Apple, J. A., NASA Marshall Space Flight Center, USA; Dietz, K. L., NASA Marshall Space Flight Center, USA; [1999]; In English; 1999 Nuclear Science Symposium, 26-28 Oct. 1999, Seattle, WA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

We have developed a high-pressure Gas Scintillation Proportional Counter (GSPC) for the focus of a hard-x-ray telescope. It features an absorption region 50 mm in diameter and 50 mm deep, filled with Xenon + 4% He at 10(exp 6) Pa total pressure, which gives useful response (greater than 75% efficiency) up to the mirror cut-off of 70 keV. Tests with a prototype unit show an energy resolution of 3.5% at 60 keV and a spatial resolution of 0.35 mm from 30-50 keV. Two flight units are currently under construction for a balloon flight in September 1999. Full details of their design and performance will be presented together with available quick-look background data from the flight.
Author
Compressed Gas; Construction; Scintillation Counters; X Ray Telescopes; Xenon; High Pressure

19990067839 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
A Simple Digital Method for Compensation of Baseline Drift in Low-Frequency Small-Signal Waveform Measurements ***Final Report, Jan. 1997 - May 1998***
Kottke, Thomas; Perry, David M.; Thomsom, George M.; Jun. 1999; 39p; In English
Report No.(s): AD-A365361; ARL-MR-446; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The need to measure relatively small signals mixed with drifting background levels and random noise is a common requirement in the laboratory environment. This report presents a simple device that continuously compensates for drifting baseline levels in systems where the background can be measured independently. The resulting level of automation allows the effects of random

noise to be diminished through extensive signal averaging. For added flexibility, parameters such as the input voltage range and background sampling rate can be set by the user. All required hardware and software are provided and explained in detail.
DTIC
Signal Processing; Background Noise; Random Noise; Waveforms

19990067841 Arizona Univ., Arizona Board of Regents, Tucson, AZ USA
CITIS Demonstration
Dereniak, Eustace L.; Garcia, John P.; Apr. 26, 1999; 7p; In English
Contract(s)/Grant(s): DAAD19-99-1-0177
Report No.(s): AD-A365410; FRS-312170; ARO-40071.1-PH; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This report reviews the demonstration of visible and Mid-Wave Infrared (MWIR) imaging spectrometers at a White sands Missile Range (WSMR) launch. These imaging spectrometers are non-scanning, high speed imaging spectrometer capable of simultaneously recording spatial and spectral data from a rapidly varying target scene. High-speed spectral imaging was demonstrated by collecting spectral and spatial snapshots of a missile launch at WSMR. The instruments are based on computed tomography concepts. The infrared instrument operates in a 3.0 to 4.6 micrometers with resolution of 0.2. Raw images were recorded at a video frame rate of 30% using a 160 x 120 InSb focal plane array. A reconstruction of a simple 819 K blackbody object is presented as proof of concept. A visible spectrometer was also used but only for proof of concept of this technology, operates from 420 to 740 nm with resolution of 10 nm at 15 fps using a 1024 by 1024 focal plane. All data collected was given to the sponsor and not discussed or shown herein.
DTIC
Imaging Spectrometers; Infrared Instruments; Imaging Techniques; Computer Aided Tomography

19990068944 Delft Sensor Systems, Oudenaarde, Belgium
HNV-3D: Multipurpose Head Mounted Display
Jun. 30, 1999; 58p; In English
Report No.(s): AD-A365396; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

HNV-3D stand for Holographic Night Vision goggles with 3 Dimensional vision perception and sensor fusion. They have been especially developed for the advanced future needs of individual soldiers, drivers, special forces, helicopter crew, The lightweight HNV-3D goggles are considered to cover the requirements of the soldier of the 21st century. They offer a unique concept of image mixture with total depth perception and day/night awareness of the battlefield environmental situation. Due to the Holographic Optical Elements (HOEs) total see-through image is guaranteed in a large field of view during unexpected changes in light level conditions. Data information (such as digitized battlefield information) is constantly available in the field of view and can be consulted by the user at any time without disturbing the observation of the outside world.
DTIC
Holographic Optical Elements; Night Vision; Goggles

19990070312 NASA Goddard Space Flight Center, Greenbelt, MD USA
Shared Aperture Multiplexed (SAM) Lidar Telescopes
Schwemmer, Geary K., NASA Goddard Space Flight Center, USA; 1999; 3p; In English; Optical Remote Sensing of Atmosphere, 21-25 Jun. 1999, Santa Barbara, CA, USA; No Copyright; Avail: Issuing Activity, Hardcopy

A concept is introduced in which a single optic containing several holographic optical elements, are employed to effect multiple fields of view as an alternative to mechanically scanned lidar receivers.
Derived from text
Apertures; Multiplexing; Telescopes; Optical Radar; Holographic Optical Elements; Radar Receivers

19990070343 Hokkaido Univ., Faculty of Engineering, Sapporo, Japan
Mott Spin Polarimeter with Spherical Acceleration Electrodes
Sueoka, K., Hokkaido Univ., Japan; Sasaki, M., Hokkaido Univ., Japan; Hamanaka, I., Hokkaido Univ., Japan; Hori, Y., Hokkaido Univ., Japan; Mukasa, K., Hokkaido Univ., Japan; Hayakawa, K., Hokkaido Univ., Japan; Sasaki, Y., Hokkaido Tokai Univ., Japan; Iwata, T., Hokkaido Tokai Univ., Japan; Adachi, H., Muroran Inst. of Tech., Japan; Memoirs of the Faculty of Engineering, Hokkaido University; 1994; ISSN 0368-9379; Volume 19, No. 1 (No. 82), pp. 1-8; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We designed a compact Mott spin polarimeter with spherical acceleration electrodes. The acceleration electrode geometry of the polarimeter has been optimized for 1 KeV to 7 KeV incident electrons and is designed for ease in changing the target Au

films. to evaluate characteristics of the polarimeter, a static electron lens system that consists of three static was constructed and an NEA-GaAs photoemitter was used as a spin polarized electron source, With the present system, the observed spin polarization of photoemitted electrons is about 20%.
Author
Polarimeters; Gallium Arsenides; Electron Sources; Photoelectric Materials; Photoelectric Emission

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LASERS AND MASERS

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

19990064555 Academy of Sciences (USSR), General Physics Inst., Moscow, USSR
Laser With Wavelength 0.589 Micrometers (”Sodium Wavelength Laser”) ***Final Report***
Llichev, Nikolay; Jan. 1999; 17p; In English
Contract(s)/Grant(s): F61775-98-WE057
Report No.(s): AD-A365264; EOARD-SPC-98-4040; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
This report results from a contract tasking General Physics Institute as follows: The contractor will investigate non-thermal lens formation in LiF:F2-lasers and, based on an understanding of that lens formation process, develop a concept for a laser, including the pump source and the resonator, for producing 10 to 40 watts of power at 589 nm.
DTIC
Chemical Lasers; Laser Applications

19990066695 Arizona Univ., Optical Sciences Center, Tucson, AZ USA
High-Powered CO2 Laser Interactions with Surfaces and Related Studies ***Final Report, May 1998 - Apr. 1999***
Crowe, Devon G., Arizona Univ., USA; Apr. 1999; 42p; In English
Contract(s)/Grant(s): DAAH04-95-1-0344
Report No.(s): AD-A365346; ARO-34704.1-EL-SDI; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
Four Institutes in Russia were supported to do researches for the current year. Technical areas include high-temperature electronics with diamond-like carbon materials, laser resonance photoelectron and photoion microscopy, near-field laser microscopy, alteration of the optical properties of materials, atom lithography with laser light, tunable laser diode spectroscopy, remote sensing from space, and UV and X-Ray optics.
DTIC
Carbon Dioxide Lasers; Semiconductor Lasers; Laser Microscopy; Light Beams; Research and Development

19990066697 Laval Univ., Dept. of Physics, Sainte-Foye, Quebec Canada
A Study of the Fundamental Science Underlying the Transport of Intense Femtosecond Laser Pulses in the Atmosphere ***Final Report, 1 Oct. 1997 - 31 Dec. 1998***
Chin, See L., Laval Univ., Canada; Dec. 31, 1998; 103p; In English
Contract(s)/Grant(s): DAAG55-97-1-0404
Report No.(s): AD-A365377; ARO-38069-RT; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy
We have identified and confirmed that ultrafast intense Ti-sapphire laser pulses after propagating through an optical medium self-transform into chirped white light laser pulses as manifested by the generation of supercontinuum. During the propagation of such pulses in air, self-focusing and filamentation take place together with strong field interaction with molecules in its path. Some important physical processes were studied. In particular, we observed a new type of fluorescence from the air molecules characteristic of intense field ionization and fragmentation unexpected from normal wisdom of plasma emission. An analytical tunnel ionization model of air molecules that agree with our experimental results was developed. It could be used in any theoretical modelling of such propagation. New techniques were developed to study the dynamics of filamentation. They allowed us to observed directly for the first time the signature of re-focusing The dependence of filamentation on various laser parameters such as the chirp, the divergence, etc. was also measured. Preliminary results agree with what we expect based on current knowledge of ultrafast nonlinear optics.
DTIC
Pulsed Lasers; Nonlinear Optics; Self Focusing

19990069603 Columbia Univ., Radiation Lab., New York, NY USA
The Interaction of Ultraviolet Laser Radiation with Metal and Semiconductor Surfaces ***Final Report***
Osgood, Richard M., Jr.; Apr. 20, 1999; 21p; In English
Contract(s)/Grant(s): DAAH04-95-1-0535
Report No.(s): AD-A365130; ARO-34446.1-PH; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The work during this contract period focused on phenomena at nanostructured metal and semiconductor surfaces, which are probed using short-pulse photoemission. Specifically, the program was to investigate the low-dimensional quantum confinement of electrons on spatially-patterned surfaces of single-crystal metals. It also aimed to expand the applications, the technique, and the instrumentation for nonlinear optical techniques of surface electrons. Electronic systems of reduced dimensionality are of interest for a variety of applications for electronic devices. In addition, the thin-film metallic structures that are currently under discussion for magnetic-memory applications, also utilize quantum confinement. This investigation has focused on the use of excited-state non-linear spectroscopy as the technique for the probing of electrons on these metal surfaces. In addition, we briefly describe a new technique probing the surfaces of semiconductors at l00A-length scale under ambient conditions.
DTIC
Ultraviolet Lasers; Semiconductors (Materials); Metal Surfaces; Ultraviolet Radiation

19990070310 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Study of Output and Tuning Characteristics of CW Cr(3+):LiSAF Lasers
Vasa, Nilesh, Kyushu Univ., Japan; Sui, Hongye, Kyushu Univ., Japan; Okada, Tatsuo, Kyushu Univ., Japan; Maeda, Mitsuo, Kyushu Univ., Japan; Wu, Xing, Tianjin Univ., China; Uchino, Osamu, Meteorological Research Inst., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 115-125; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We report characteristics of cw Cr(3+):LiSRAlF6 (Cr(3+):LISAF) lasers pumped by a Rhodamine-6G dye laser (616 nm) and a visible diode laser (670 nm). In case of dye laser pumping, the slope efficiency upto (maximum) 30% was achieved with a simple plano-concave cavity. Tuning characteristics were examined using different tuning elements like birefringent filter, a prism, and a grating. The tuning range over broad spectrum of 820 nm to 865 nm and a spectral width of 0.75 nm FWHM is obtained using a diffraction grating in an auxiliary cavity. Severe thermal effects, which lead to decreasing output power and distortion in transverse as well as longitudinal mode structures, were observed. As a compact tunable laser source, an AlGaInP visible diode laser pumped Cr(3+):LiSAF laser is demonstrated with a tuning range from 820 nm to 865 nm with a prism-tuned auxiliary cavity.
Author
Tunable Lasers; Solid State Lasers; Laser Pumping; Diodes; Tuning

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MECHANICAL ENGINEERING

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

19990064355 Sandia National Labs., Albuquerque, NM USA
Batch Wafer Scale LIGA Assembly and Packaging Technique vai Diffusion Bonding
Christenson, T. R.; Schmale, D. T.; Jan. 27, 1999; 41p; In English, 17-21 Jan. 1999, Orlando, FL, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Report No.(s): DE00-003305; SAND99-0229C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

A technique using diffusion bonding (or solid-state welding) has been used to achieve batch fabrication of two- level nickel LIGA structures. Interlayer alignment accuracy of less than 1 micron is achieved using press-fit gauge pins. A mini-scale torsion tester was built to measure the diffusion bond strength of LIGA formed specimens that has shown successful bonding at temperatures of 450 C at 7 ksi pressure with bond strength greater than 100 Mpa. Extensions to this basic process to allow for additional layers and thereby more complex assemblies as well as commensurate packaging are discussed.
NTIS
Batch Processing; Wafers; Packaging; Diffusion Welding; Metal Bonding

19990064381 NASA Glenn Research Center, Cleveland, OH USA
Probabilistic Analysis of Aircraft Gas Turbine Disk Life and Reliability
Melis, Matthew E., NASA Glenn Research Center, USA; Zaretsky, Erwin V., NASA Glenn Research Center, USA; August,

Richard, NYMA, Inc., USA; June 1999; 30p; In English
Contract(s)/Grant(s): NAS3-27186; RTOP 523-22-13
Report No.(s): NASA/TM-1999-107436; NAS 1.15:107436; E-10629-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two series of low cycle fatigue (LCF) test data for two groups of different aircraft gas turbine engine compressor disk geometries were reanalyzed and compared using Weibull statistics. Both groups of disks were manufactured from titanium (Ti-6Al-4V) alloy. A NASA Glenn Research Center developed probabilistic computer code Probable Cause was used to predict disk life and reliability. A material-life factor A was determined for titanium (Ti-6Al-4V) alloy based upon fatigue disk data and successfully applied to predict the life of the disks as a function of speed. A comparison was made with the currently used life prediction method based upon crack growth rate. Applying an endurance limit to the computer code did not significantly affect the predicted lives under engine operating conditions. Failure location prediction correlates with those experimentally observed in the LCF tests. A reasonable correlation was obtained between the predicted disk lives using the Probable Cause code and a modified crack growth method for life prediction. Both methods slightly overpredict life for one disk group and significantly under predict it for the other.
Author
Aircraft Engines; Gas Turbine Engines; Probability Theory; Reliability; Failure Analysis; Life (Durability)

19990064392 Institute for Human Factors TNO, Soesterberg, Netherlands
Analysis of Requirements and Vehicle Concepts of the Multipurpose Armored Vehicle -MPPV ***Analyse Programma van eisen en Voetuigconcepten van het Multipurpose Pantservoetuig -- MPPV***
Essens, P. J. M. D., Institute for Human Factors TNO, Netherlands; Oudenhuijzen, A. J. K., Institute for Human Factors TNO, Netherlands; Walraven, J., Institute for Human Factors TNO, Netherlands; Jan. 05, 1999; In Dutch
Contract(s)/Grant(s): TNO Proj. 731.1; A97/KLu/314
Report No.(s): TD98-0288; TM-98-A073; Copyright; Avail: Issuing Activity (TNO Technische Menskunde, Postbus 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy

In the context of the Active Ground Defence of Air Force installations and the reconnaissance and disposal of explosives, concepts for a new armored vehicle are being studied. The research question is whether the vehicle models developed by industry (CODEMA - project) yield problems because of ergonomic constraints, physical and perceptual demands, and for the task performance in general. In this report interim results of the analysis are reported. It is shown that the models result in such constraints that adjustments of the requirements and the vehicle models are advised. Revised models are evaluated using Virtual Environment techniques. In addition, an analysis was carried out of the acquisition-related factors (including sensors) that affect the deployment of the MPPV for reconnaissance of explosives (Explosive Ordnance Reconnaissance, EOR) and their disposal (Explosive Ordnance Disposal, EOD). it is concluded that more information is required from field experiments, in particular with respect to the viewing conditions under armour. A simple wheeled wooden mock-up, designed for in-field assessment of the realization of EOR and EOD tasks by the vehicle team, is now under construction.
Author
Armor; Explosives; Human Performance; Armed Forces

19990064400 Lockheed Martin Michoud Space Systems, Advanced Processes and Technologies, New Orleans, LA USA
2195 Aluminum-Copper-Lithium Friction Plug Welding Development
Takeshita, Rike P., Lockheed Martin Michoud Space Systems, USA; Hartley, Paula J., Lockheed Martin Michoud Space Systems, USA; Baker, Kent S., Lockheed Martin Michoud Space Systems, USA; 1997; In English; 5th; Welding Trends, Jun. 1998, Pine Mountain, GA, USA; Sponsored by American Welding Society
Contract(s)/Grant(s): NAS8-36200; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Technology developments and applications of friction plug welding is presented. This friction repair welding technology is being studied for implementation on the Space Transportation System's Super Light Weight External Tank. Single plug repairs will be used on a vast majority of weld defects, however, linear defects of up to several inches can be repaired by overlapping plug welds. Methods and results of tensile, bend, simulated service, surface crack tension and other tests at room and cryogenic temperatures is discussed. Attempts to implement Friction Plug Welding has led to both tool and process changes in an attempt to minimize expansive tooling and lengthy implementation times. Process control equipment and data storage methods intended for large scale production will also be addressed. Benefits include increased strength and toughness, decreased weld repair time, automated and highly reliable process, and a lower probability of having to re-repair defect locations.
Author
Control Equipment; Friction Welding; Maintenance; Space Transportation System; Surface Cracks; Technology Utilization; Welded Joints; Technology Assessment

19990064445 Massachusetts Univ., Dept. of Mechanical Engineering, Amherst, MA USA

Experimental Evaluation of a Structure-Based Connectionist Network for Fault Diagnosis of Helicopter Gearboxes

Jammu, V. B., Massachusetts Univ., USA; Danai, K., Massachusetts Univ., USA; Lewicki, D. G., Army Research Lab., USA; Journal of Mechanical Design; March 1998; Volume 120, pp. 106-112; In English

Contract(s)/Grant(s): RTOP 581-30-13; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents the experimental evaluation of the Structure-Based Connectionist Network (SBCN) fault diagnostic system introduced in the preceding article. For this vibration data from two different helicopter gearboxes: OH-58A and S-61, are used. A salient feature of SBCN is its reliance on the knowledge of the gearbox structure and the type of features obtained from processed vibration signals as a substitute to training. to formulate this knowledge, approximate vibration transfer models are developed for the two gearboxes and utilized to derive the connection weights representing the influence of component faults on vibration features. The validity of the structural influences is evaluated by comparing them with those obtained from experimental RMS values. These influences are also evaluated ba comparing them with the weights of a connectionist network trained though supervised learning. The results indicate general agreement between the modeled and experimentally obtained influences. The vibration data from the two gearboxes are also used to evaluate the performance of SBCN in fault diagnosis. The diagnostic results indicate that the SBCN is effective in directing the presence of faults and isolating them within gearbox subsystems based on structural influences, but its performance is not as good in isolating faulty components, mainly due to lack of appropriate vibration features.

Author

Evaluation; Experimentation; Fault Detection; S-61 Helicopter; Transmissions (Machine Elements)

19990064489 Lockheed Martin Michoud Space Systems, New Orleans, LA USA

Mechanical Properties of Friction Stir Welds in A12195-T8

Kinchen, David G., Lockheed Martin Michoud Space Systems, USA; Li, Zhixian, Lockheed Martin Michoud Space Systems, USA; Adams, Glynn P., Lockheed Martin Michoud Space Systems, USA; [1999]; In English; Friction Stir Welding, 15-16 Jun. 1999, Thousand Oaks, CA, USA

Contract(s)/Grant(s): NAS8-36200; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An extensive study of the mechanical properties of friction stir welded Al-Li 2195 has been conducted by Lockheed Martin Michoud Space Systems under contract to NASA. The study was part of a development program in which weld parameters were defined for using FSW to assemble large-scale aluminum cryogenic tanks. In excess of 300 feet of 0.320 in. gage plate material was welded and tested. The tests include room temperature and cryogenic temperature tensile tests and surface crack tension (SCT) tests, nondestructive evaluation, metallurgical studies, and photostress analysis. The results of the testing demonstrated improved mechanical properties with FSW as compared to typical fusion welding processes. Increases in ultimate tensile strength, cryogenic enhancement and elongation were observed with the tensile test results. Increased fracture toughness was observed with the SCT results. Nondestructive evaluations were conducted on all welded Joints. No volumetric defects were indicated. Surface indications on the root side of the welds did not significantly affect weld strength. The results of the nondestructive evaluations were confirmed via metallurgical studies. Photostress analysis revealed strain concentrations in multi-pass and heat-repaired FSW's. Details of the tests and results are presented.

Author

Aluminum; Cryogenic Fluid Storage; Fusion Welding; Weld Strength; Welded Joints; Weld Tests; Nondestructive Tests

19990064490 Lockheed Martin Michoud Space Systems, New Orleans, LA USA

Development and Implementation of a Load-Controlled Friction Stir Welder

Loftus, Z., Lockheed Martin Michoud Space Systems, USA; Venable, R., Lockheed Martin Michoud Space Systems, USA; Adams, Glynn P., Lockheed Martin Michoud Space Systems, USA; [1999]; In English

Contract(s)/Grant(s): NAS8-36200; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Lockheed Martin Michoud Space Systems, under contract to NASA/MSFC, has developed and implemented a friction stir weld tool that uses the magnitude of the spindle axial load to control the weld process. This tool was used during the process development phase and the assembly of a full-scale External Tank barrel section. Both position and load transducers are incorporated into the welder. The control algorithm allows either the position or load transducer to provide the command variable in a closed loop system. Initially, the position transducer was used to actively control the weld process and the axial load on the spindle was monitored and collected via data acquisition hardware. As part of the process development, the axial load was implemented as the command variable in the closed loop. The spindle position is monitored and used to set limits on spindle travel. A zero set point algorithm has also been developed for establishing the spindle position at the start of the weld process. In its current state, the welder operates in a dual mode in which the position control is used to plunge the pin tool to a specified depth at the initiation

of the weld. The load control is then used to control the weld process. This control algorithm has been used to assemble a 27.5-ft diameter, 2195-T8 barrel using hardware designed for NASA's Space Transportation System External Tank.
Author
Axial Loads; Spindles; Transducers; Welding

19990064499 Thiokol Propulsion, RSRM Nozzle Design Engineering, Brigham City, UT USA
Alternatives to Silicon Rubber Thermal Barrier in RSRM Nozzle Joints
Totman, Peter D., Thiokol Propulsion, USA; Prince, Andrew, Thiokol Propulsion, USA; Frost, Doug, Thiokol Propulsion, USA; Himebaugh, Paul, Thiokol Propulsion, USA; 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-2796; Copyright; Avail: Issuing Activity, Hardcopy

Thiokol Propulsion encountered a situation where gas path can form in the Filler material in joints between the phenolic in the Space Shuttle Reusable Solid Rocket Motor nozzle. An investigation determined that the method for injecting the filler material into the joint created a pressurized pocket of air that forced its way to the surface while the filler was curing. The path that the air took remained open some situations leaving a path for hot gas to get deep into the joint. The condition that created the gas path has been corrected by modifications to the manufacturing process, but a design solution that would reduce processing time is being pursued. A strip of open cell installed deep into the joint, can serve as a barrier to the Filler material. Testing indicates that the foam eliminates the pressure pocket, and does not prevent detection of leakage of the o-ring seals during leak test. Open cell foam does not have thermal resistance capability and mechanical structure, which would be required in the event of a gas path. A replacement to open cell foam is now being considered. Braided carbon fiber rope has the permeability characteristics of foam and it has thermal resistance characteristics as well. Braided carbon fiber rope (BCFR) has been tested in simulated joints in sub-scale rocket motor. Results of the testing indicate that braided carbon fiber rope can significantly reduce gas temperature by as much es 3000 F in a nozzle joint configuration. BCFR can be installed as a barrier to stop the joint filler material or it can used as the thermal barrier alone.
Author
Silicon; Rubber; Thermal Insulation; Research; Fillers; Foams; Thermal Resistance; Exhaust Nozzles

19990064518 Department of the Navy, Washington, DC USA
Large Panel Surface Planer
Cassidy, James, Inventor; Jan. 11, 1999; 12p; In English
Patent Info.: Filed 11 Jan. 1999; US-Patent-Appl-SN-246,195
Report No.(s): AD-D019360; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A large panel surface planer is provided. The planer has a flat platform used as a mounting base. A pair of channel rails are clamped to the mounting base using c-clamps at the ends of each channel rail. A workpiece is secured to the flat platform using one or more pairs of back-to-back clamps which clamp both the workpiece and the flat platform. A pair of rectangular guide bars are clamped to and aligned orthogonally with the channel rails using a c-clamp at each end of each guide bar. A tool stop is also clamped at the channel rail-guide bar intersection providing both a tool stop and a spacer for alignment of the spacing between the guide bars. A cutting tool, such as a router, is then manually moved across the surface of the workpiece using the guide bar to hold the tool in position (both height and lateral position). After planing a particular set position, it is necessary to manually reposition the guide bar for the next cut and to continue sequentially until the entire workpiece has been planned.
DTIC
Panels; Flat Surfaces; Mounting

19990064520 Department of the Navy, Washington, DC USA
Roller Grapnel
Waugh, Thomas R., Inventor; Mar. 08, 1999; 16p; In English
Patent Info.: Filed 8 Mar. 1999; US-Patent-Appl-SN-09,267,909
Report No.(s): AD-D019362; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The present invention provides an improved grapnel which permits towed arrays to be retrieved more easily and with less chance of damaging the array. The invention includes a pair of U-shaped members attached to a center stock, the U-shaped members being attached in a perpendicular relationship to each other. A threaded rod connects each vertical portion of the U-shaped members to the center stock, and each row has a roller disposed thereon. The grapnel further includes a hub disposed on the center

stock proximate the rollers and ramps respectively attached to each vertical portion of the U-shaped members, for guiding a towed array into engagement with the rollers.
DTIC
Mechanical Devices; Towed Bodies

19990066656 NASA Marshall Space Flight Center, Huntsville, AL USA
Potential for Fabric Damage by Welding Electron Beam
Fragomeni, James M., Alabama Univ., USA; Nunes, Arthur C., Jr., NASA Marshall Space Flight Center, USA; 1998; In English; 5th; Trends in Welding Research, 1-5 Jun. 1998, Pine Mountain, GA, USA; Sponsored by American Welding Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Welding electron beam effects on Nextel AF-62 ceramic fabric enable a preliminary, tentative interpretation of electron beam fabric damage. Static surface charging does not protect fabric from beam penetration, but penetration occurs only after a delay time. The delay time is thought to be that required for the buildup of outgassing products at the fabric surface to a point where arcing occurs. Extra long delays are noted when the gun is close enough to the surface to be shut off by outgassing emissions. Penetration at long distances is limited by beam attenuation from electronic collisions with the chamber atmosphere.
Author
Damage; Electron Beams; Fabrics; Ceramics; Welding

19990069537 NASA Marshall Space Flight Center, Huntsville, AL USA
A Moving Plug Model for Friction Stir Welding
Nunes, A. C., Jr., NASA Marshall Space Flight Center, USA; Bernstein, E., NASA Marshall Space Flight Center, USA; McClure, J. C., NASA Marshall Space Flight Center, USA; [1999]; 2p; In English; 81st, 26-28 Apr. 2000, Chicago, IL, USA; Sponsored by American Welding Society, USA; No Copyright; Avail: Issuing Activity, Hardcopy

The Friction Stir Welding (FSW) process can produce sound welds in high strength light alloys that would crack in fusion welding. Hence it is a candidate process for welding the fuel/oxidizer tanks for space vehicles. Our first attempts to model the process incorporated a distributed plastic flow field around the weld tool. But the temperature distribution required for steady, quasi-equilibrium plastic flow was not compatible with a plausible heat flow configuration around the tool. This difficulty was overcome by postulating a contracted flow confined to a planar surface about a plug of metal rotating with the tool. The plug moves through the plate by wiping metal from the forward surface of the plug around to the rear surface. Further support for the plug flow model has emerged. An experiment with wire markers embedded in an aluminum plate agreed better with the plug flow model than with a distributed flow field. Computations based upon the plug flow model yield plausible spacings and offsets for the ring or swirl pattern often seen in etched cross sections of an FSW weld.
Derived from text
Models; Fusion Welding; Conductive Heat Transfer; Cracks; Flow Distribution; Friction Welding; Heat Transmission; Metal Surfaces; Temperature Distribution; Welded Joints

19990070315 Queensland Univ., Mechanical Engineering Dept., Saint Lucia, Australia
A Study of Free-Piston Double-Diaphragm Drivers for Expansion Tubes, Report 1
Kendall, M. A., Queensland Univ., Australia; 1997; 202p; In English; 35th; Aerospace Sciences, 6-10 Jan. 1997, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-1846
Report No.(s): AIAA Paper 97-0985; Copyright; Avail: Issuing Activity, Hardcopy

In recent years the free-piston double-diaphragm driver has been used to increase the performance of the XI pilot expansion tube to super-orbital test conditions. However, the actual performance of the double-diaphragm driver was found to be considerably less than ideal. An experimental study of the double-diaphragm driver was carried out on the XI facility over a range of conditions with the objective of determining the effect of. heat losses; and the non-ideal rupture of the 'light' secondary diaphragm on the driver performance. The disparity between the theoretical and measured performance envelope are highlighted. A viscous limit for the experiments vas established. Heat transfer behind the primary shock is shown to be the mechanism behind this limit Incident, reflected and transmitted shock trajectories for the secondary diaphragm were experimentally determined and compared with computed trajectories from a one-dimensional diaphragm inertia model. It was found that the diaphragm did influence the unsteady expansion. A good agreement between experimental and computed shock trajectories was obtained using a diaphragm inertia model assuming that the diaphragm mass became negligible 3 microns after shock impact.
Author
Research; Piston Engines; Viscosity; Mechanical Drives

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QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990064448 NASA Goddard Space Flight Center, Greenbelt, MD USA
Statistical Quality Control of Moisture Data in GEOS DAS
Dee, D. P., NASA Goddard Space Flight Center, USA; Rukhovets, L., NASA Goddard Space Flight Center, USA; Todling, R., NASA Goddard Space Flight Center, USA; 1999; In English; 24th; General Assembly, 19-23 Apr. 1999, The Hague, Netherlands; Sponsored by European Geophysical Society, Germany; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A new statistical quality control algorithm was recently implemented in the Goddard Earth Observing System Data Assimilation System (GEOS DAS). The final step in the algorithm consists of an adaptive buddy check that either accepts or rejects outlier observations based on a local statistical analysis of nearby data. A basic assumption in any such test is that the observed field is spatially coherent, in the sense that nearby data can be expected to confirm each other. However, the buddy check resulted in excessive rejection of moisture data, especially during the Northern Hemisphere summer. The analysis moisture variable in GEOS DAS is water vapor mixing ratio. Observational evidence shows that the distribution of mixing ratio errors is far from normal. Furthermore, spatial correlations among mixing ratio errors are highly anisotropic and difficult to identify. Both factors contribute to the poor performance of the statistical quality control algorithm. to alleviate the problem, we applied the buddy check to relative humidity data instead. This variable explicitly depends on temperature and therefore exhibits a much greater spatial coherence. As a result, reject rates of moisture data are much more reasonable and homogeneous in time and space.
Author
Water Vapor; Mixing Ratios; Moisture; Atmospheric Moisture

19990064526 NASA Glenn Research Center, Cleveland, OH USA
Using High Frequency Focused Water-Coupled Ultrasound for 3-D Surface Depression Profiling
Roth, Don J., NASA Glenn Research Center, USA; Whalen, Mike F., Sonix, Inc., USA; Hendricks, J. Lynne, Sonix, Inc., USA; Bodis, James R., Cleveland State Univ., USA; July 1999; 28p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 523-22-13
Report No.(s): NASA/TM-1999-209268; NAS 1.15:209268; E-11715; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Surface topography is an important variable in the performance of many industrial components and is normally measured with diamond-tip profilometry over a small area or using optical scattering methods for larger area measurement. A prior study was performed demonstrating that focused air-coupled ultrasound at 1 MHz was capable of profiling surfaces with 25 micron depth resolution and 400 micron lateral resolution over a 1.4 mm depth range. In this article, the question of whether higher-frequency focused water-coupled ultrasound can improve on these specifications is addressed. 10 and 25 MHz focused ultrasonic transducers were employed in the water-coupled mode. Time-of-flight images of the sample surface were acquired and converted to depth / surface profile images using the simple relation (d = V*t/2) between distance (d), time-of-flight (t), and the velocity of sound in water (V). Results are compared for the two frequencies used and with those from the 1 MHz air-coupled configuration.
Author
Optical Properties; Physical Optics; Topography; Nondestructive Tests; High Frequencies; Ultrasonics; Surface Properties

19990068469 NASA Langley Research Center, Hampton, VA USA
Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength
Roberts, Mark J., Compiler, Army Research Lab., USA; May 1999; 196p; In English; Nondestructive Evaluation of Bond Strength, 6 Nov. 1998, Hampton, VA, USA; Sponsored by NASA, USA; See also 19990068470 through 19990068479
Contract(s)/Grant(s): RTOP 552-18-11
Report No.(s): NASA/CP-1999-209140; L-17858; NAS 1.55:209140; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Ultrasonics, microwaves, optically stimulated electron emission (OSEE), and computational chemistry approaches have shown relevance to bond strength determination. Nonlinear ultrasonic nondestructive evaluation methods, however, have shown the most effectiveness over other methods on adhesive bond analysis. Correlation to changes in higher order material properties due to microstructural changes using nonlinear ultrasonics has been shown related to bond strength. Nonlinear ultrasonic energy is an order of magnitude more sensitive than linear ultrasound to these material parameter changes and to acoustic velocity changes caused by the acoustoelastic effect when a bond is prestressed. Signal correlations between non-linear ultrasonic measurements and initialization of bond failures have been measured. This paper reviews bond strength research efforts presented by university

and industry experts at the Second Annual Symposium for Nondestructive Evaluation of Bond Strength organized by the NDE Sciences Branch at NASA Langley in November 1998.
Author
Ultrasonics; Adhesives; Computational Chemistry; Microwaves; Microstructure; Acoustic Velocity; Stimulated Emission

19990068470 Army Research Lab., Vehicle Technology Directorate, Hampton, VA USA
Bond Strength Program
Roberts, Mark J., Army Research Lab., USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 1-19; In English; See also 19990068469; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The purpose of this presentation is to discuss the key issues concerning the bond strength program. These issues are customer needs requirements, nondestructive evaluation methods, mechanical tests methods/destructive, adhesive bond strength and bond quality, the various modes of failure: cohesive/adhesive/mixed mode, cohesive properties (bulk), and adhesive properties (surface).
CASI
Nondestructive Tests; Adhesion Tests; Fatigue Tests; Load Tests; Destructive Tests

19990068471 Army Research Lab., Vehicle Technology Directorate, Hampton, VA USA
Microwaves for Bondline NDE
Roberts, Mark J., Army Research Lab., USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 20-30; In English; See also 19990068469; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation discuss the use of microwave images to obtain defect property information. The microwave data may include such information as phase of reflection or transmission coefficient, magnitude of reflection or transmission coefficient, combination of both (i.e. Synthetic Aperture Imaging), and attenuation information.
CASI
Microwave Imagery; Imaging Techniques; Synthetic Apertures; Synthetic Aperture Radar

19990068472 NASA Langley Research Center, Hampton, VA USA
Computational Chemistry of Adhesive Bonds
Phillips, Donald H., NASA Langley Research Center, USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 31-47; In English; See also 19990068469; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This investigation is intended to determine the electrical mechanical, and chemical properties of adhesive bonds at the molecular level. The initial determinations will be followed by investigations of the effects of environmental effects on the chemistry and properties of the bond layer.
Derived from text
Adhesive Bonding; Joints (Junctions); Adhesives

19990068473 Northwestern Univ., Center for Quality Engineering and Failure Prevention, Evanston, IL USA
Assessment of Adhesive Bond Deterioration by Detection of Nonlinear Effects
Achenbach, J. D., Northwestern Univ., USA; Tang, Zhen–Zeng, Northwestern Univ., USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 71-89; In English; See also 19990068469; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The purpose of this presentation is to develop an ultrasonic nondestructive technique to assess deterioration of adhesive bonds by the detection of nonlinear effects. The work on this project is both analytical and experimental in nature.
Derived from text
Adhesive Bonding; Adhesives; Ultrasonics

19990068474 Johns Hopkins Univ., Dept. of Materials Science and Engineering, Baltimore, MD USA
Investigation of Adhesive Bond Cure Conditions using Nonlinear Ultrasonic Methods
Berndt, Tobias P., Johns Hopkins Univ., USA; Green, Robert E., Jr., Johns Hopkins Univ., USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 90-108; In English; See also 19990068469; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The objective of this presentation is to investigate various cure conditions of adhesive bonds using nonlinear ultrasonic methods with water coupling. Several samples were used to obtain normal incidence, oblique incidence, and wave mixing.
CASI
Adhesive Bonding; Nondestructive Tests; Computational Chemistry

19990068475 Adler Consultants, Inc., Columbus, OH USA
ABUS System for Quantitative Inspection of Adhesive Bonds
Adler, Laszlo, Adler Consultants, Inc., USA; Rokhlin, Stanislav I., Adler Consultants, Inc., USA; Mattei, Christophe, Adler Consultants, Inc., USA; Blaho, Gabor, Adler Consultants, Inc., USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 109-137; In English; See also 19990068469
Contract(s)/Grant(s): N68335-97-C-0328; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The Angle Beam Ultrasonic Spectroscopy (ABUS) Scanning System for evaluation of adhesive bond integrity has been developed. The ABUS has the ability to separate the thickness effect from bond quality effect, give a bond line quality factor, and scan bond line quality over the bond area. Correlation between ultrasonic signatures measured with the ABUS method and the strength of the adhesive bond was obtained. The ABUS System is capable of detecting weak bonds which are not detectable by C-Scan.
Derived from text
Ultrasonic Spectroscopy; Software Engineering; Hardware; Algorithms; Nondestructive Tests; Spectrum Analysis

19990068476 Ohio State Univ., Columbus, OH USA
Characterization of Adhesive Bonds Integrity using Angle Beam Ultrasonic Spectroscopy
Rokhlin, S. I., Ohio State Univ., USA; Adler, Laszlo, Adler Consultants, Inc., USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 138-172; In English; See also 19990068469; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The purpose of this presentation is to study the angle beam ultrasonic spectroscopy, assess the environmental degradation of adhesive bonds, manufacture adhesive bonds with weak interfaces, and to characterize adhesive bond integrity after manufacturing.
Derived from text
Angles (Geometry); Beams (Radiation); Ultrasonic Spectroscopy; Nondestructive Tests; Spectrum Analysis; Ultrasonics; Goniometers

19990068477 Commonwealth Scientific and Industrial Research Organization, Telecommunications and Industrial Physics, Linfield, Australia
Nonlinear Propagation of Guides Elastic Waves, 1, Theoretical Aspects
Price, D. C., Commonwealth Scientific and Industrial Research Organization, Australia; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 173-190; In English; See also 19990068469
Report No.(s): Rept-16; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche
The purpose of this presentation is to study the propagation of elastic waves. This is done by analyzing the nonlinear wave equation, approximation approach, and the boundary conditions. Detailed investigation of the incident wave under various boundary conditions at fundamental frequencies and harmonics were studied. A study of both the reflected and transmitted waves were also studied.
CASI
Wave Propagation; Elastic Waves; Wave Incidence Control; Incident Radiation; Reflected Waves; Transmission

19990068478 NASA Langley Research Center, Hampton, VA USA
A Portable Surface Contamination Monitor Based on the Principle of Optically Stimulated Electron Emission (OSEE)
Perey, Daniel F., NASA Langley Research Center, USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 48-51; In English; See also 19990068469; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche
The purpose of this presentation is to discuss how the Optically Stimulated Electron Emission (OSEE), and to also give a detailed cross section of the probe.
CASI
Stimulated Emission; Electron Emission; Light Emission

19990068479 Georgia Inst. of Tech., School of Mechanical Engineering, Atlanta, GA USA
Ultrasonic Nondestructive Characterization of Adhesive Bonds
Qu, Jian–Min, Georgia Inst. of Tech., USA; Jacobs, Larry, Georgia Inst. of Tech., USA; Proceedings of the Second Annual Symposium for Nondestructive Evaluation of Bond Strength; May 1999, pp. 52-69; In English; See also 19990068469; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This project is concerned with the qualification of reliability and integrity of metal/polymer bond joints. The objectives are: to establish the correlation between the microstructural changes and ultrasound propagation characteristics, to develop ultrasonic nondestructive methods to measure the microstructural changes caused by the degradation of bond strength, and to predict remaining bond strength from ultrasonic measurement based on the fundamental structure-property-performance relationships of the constituents and their interfaces.
Derived from text
Adhesive Bonding; Metal Bonding; Joints (Junctions); Metal Joints; Ultrasonics

19990069924 Hernandez Engineering, Inc., Huntsville, AL USA
Beauty and The Beast: Use and Abuse of the Fault Tree as a Tool
Long, R. Allen, Hernandez Engineering, Inc., USA; 1999; 10p; In English; Systems Safety, 16-21 Aug. 1999, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-40364; No Copyright; Avail: Issuing Activity, Hardcopy

Fault Tree Analysis (FTA) has become a popular too[for use in the Space Industry for the System Safety Engineer. The fault tree is used for everything from tracking hazard reports to investigating accidents, as well as presentations to management. Yet, experience in the space industry has shown the fault tree is used most often for purposes other than its original intent, namely for evaluating inappropriate behavior in complex systems This paper describes proper application and common misapplications of the fault tree as a too[when evaluating inappropriate behavior in complex systems. The paper addresses common misconceptions and pitfalls about FrA such as tracking only failures, and the belief that Failure Modes and Effects Analysis (FMEA) can be used in lieu of the fault tree.
Author
Failure Analysis; Trees (Mathematics); Complex Systems

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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.

19990064344 NASA Marshall Space Flight Center, Huntsville, AL USA
Experimentally Determined Crack Location and Mixed Mode Stress Intensity Factors
Zachary, Loren W., Iowa State Univ. of Science and Technology, USA; Swanson, Gregory R., NASA Marshall Space Flight Center, USA; 1999; In English, 7-9 Jun. 1999, Cincinnati, OH, USA; Sponsored by SEM
Contract(s)/Grant(s): RTOP 260-40-03; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This presentation first examines five strain field equations: the two modes of the Westergaard equations, and a mixed mode; the generalized coordinate system, and the significance testing of coefficients. It also discusses the weighted multiple linear least squares method, which shows why it is difficult to find the crack tip. The presentation then discusses the experiments to examine stress intensity. Lastly, comparison of finite element method results and experimental results is reviewed.
CASI
Crack Tips; Finite Element Method; Least Squares Method; Mathematical Models; Strain Distribution; Stress Intensity Factors; Crack Initiation; Cracking (Fracturing)

19990064356 Sandia National Labs., Albuquerque, NM USA
Torsion Testing of Diffusion Bonded LIGA Formed Nickel
Buchheit, T. E.; Christenson, T. R.; Schmale, D. T.; Jan. 27, 1999; 41p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-003304; SAND99-0228C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

A test technique has been devised which is suitable for the testing of the bond strength of batch diffusion bonded LIGA or DXRL defined structures. The method uses a torsion tester constructed with the aid of LIGA fabrication and distributed torsion specimens which also make use of the high aspect ratio nature of DXRL based processing. Measurements reveal achieved bond

strengths of 130MPa between electroplated nickel with a bond temperature of 450 C at 7 ksi pressure which is a sufficiently low temperature to avoid mechanical strength degradation.
NTIS
Torsion; Diffusion Welding; Nickel

19990064431 Southwest Research Inst., San Antonio, TX USA
Guidelines for Proof Test Analysis ***Final Report***
Chell, G. G., Southwest Research Inst., USA; McClung, R. C., Southwest Research Inst., USA; Kuhlman, C. J., Southwest Research Inst., USA; Russell, D. A., Boeing North American, Inc., USA; Garr, K., Boeing North American, Inc., USA; Donnelly, B., Boeing North American, Inc., USA; July 1999; 364p; In English
Contract(s)/Grant(s): NAS8-39380
Report No.(s): NASA/CR-1999-209427; M-932; NAS 1.26:209427; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

These guidelines integrate state-of-the-art elastic-plastic fracture mechanics (EPFM) and proof test implementation issues into a comprehensive proof test analysis procedure in the form of a road map which identifies the types of data, fracture mechanics based parameters, and calculations needed to perform flaw screening and minimum proof load analyses of fracture critical components. Worked examples are presented to illustrate the application of the road map to proof test analysis. The state-of-the art fracture technology employed in these guidelines is based on the EPFM parameter, J, and a pictorial representation of a J fracture analysis, called the failure assessment diagram (FAD) approach. The recommended fracture technology is validated using finite element J results, and laboratory and hardware fracture test results on the nickel-based superalloy Inconel 718, the aluminum alloy 2024-T3511, and ferritic pressure vessel steels. In all cases the laboratory specimens and hardware failed by ductile mechanisms. Advanced proof test analyses involving probability analysis and multiple-cycle proof testing (MCPT) are addressed. Finally, recommendations are provided on how to account for the effects of the proof test overload on subsequent service fatigue and fracture behaviors.
Author
Fracture Mechanics; Finite Element Method; Proving; Fracturing; Heat Resistant Alloys; Aluminum Alloys; Fatigue (Materials); J Integral; Crack Propagation; Structural Analysis; Fracture Strength; Fatigue Tests

19990064433 Southwest Research Inst., San Antonio, TX USA
A Comparison of Single-Cycle Versus Multiple-Cycle Proof Testing Strategies ***Final Report***
McClung, R. C., Southwest Research Inst., USA; Chell, G. G., Southwest Research Inst., USA; Millwater, H. R., Southwest Research Inst., USA; Russell, D. A., Rockwell International Corp., USA; Millwater, H. R., Rockwell International Corp., USA; July 1999; 186p; In English
Contract(s)/Grant(s): NAS8-37451
Report No.(s): NASA/CR-1999-209426; M-931; NAS 1.26:209426; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Single-cycle and multiple-cycle proof testing (SCPT and MCPT) strategies for reusable aerospace propulsion system components are critically evaluated and compared from a rigorous elastic-plastic fracture mechanics perspective. Earlier MCPT studies are briefly reviewed. New J-integral estimation methods for semielliptical surface cracks and cracks at notches are derived and validated. Engineering methods are developed to characterize crack growth rates during elastic-plastic fatigue crack growth (FCG) and the tear-fatigue interaction near instability. Surface crack growth experiments are conducted with Inconel 718 to characterize tearing resistance, FCG under small-scale yielding and elastic-plastic conditions, and crack growth during simulated MCPT. Fractography and acoustic emission studies provide additional insight. The relative merits of SCPT and MCPT are directly compared using a probabilistic analysis linked with an elastic-plastic crack growth computer code. The conditional probability of failure in service is computed for a population of components that have survived a previous proof test, based on an assumed distribution of initial crack depths. Parameter studies investigate the influence of proof factor, tearing resistance, crack shape, initial crack depth distribution, and notches on the MCPT versus SCPT comparison. The parameter studies provide a rational basis to formulate conclusions about the relative advantages and disadvantages of SCPT and MCPT. Practical engineering guidelines are proposed to help select the optimum proof test protocol in a given application.
Author
Fracture Mechanics; Crack Propagation; Surface Cracks; Notch Strength; J Integral; Fatigue Tests; Notch Tests; Structural Analysis

19990064561 NASA Dryden Flight Research Center, Edwards, CA USA

Ground and Flight Test Results of a PZT Health Monitoring System

Voracek, David F., NASA Dryden Flight Research Center, USA; Hurtado, Marco, NASA Dryden Flight Research Center, USA; Hickman, Gail, Innovative Dynamics, USA; Sakk, Eric, Innovative Dynamics, USA; 1997; 16p; In English; 38th; 38th; Structures, Structural Dynamics, and Materials, 7-10 Apr. 1997, Kissimmee, FL, Kissimmee, FL, USA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 97-1345; Copyright; Avail: Issuing Activity, Hardcopy

This paper describes efforts to develop a technique to monitor structural health using response data to characterize the structure. The paper describes the hardware and pattern recognition methodology used in two experiments. The first test used a cantilevered beam to acquire and analyze vibration measurements for assessing the state of the structure. This test demonstrated the use of the health monitoring system as the beam changes its state in a prescribed manner. The second test used the strut of an F-18 vertical tail. Postflight structural signature data were acquired over a 2-month flight period. Qualitative evaluation determined that the system was viable in an operational aircraft environment. No debonding or failures of the transducers occurred. The data indicated frequency shifts below 3000 Hz, which were related to the removal of load-bearing side panels during testing. The cantilevered beam and aircraft experiments showed that, using structural signatures and pattern recognition software, it is possible to detect changes in the structures.

Author

Ground Tests; Flight Tests; Health; Monitors; Active Control; Procedures; Pattern Recognition; Hardware

19990066655 NASA Langley Research Center, Hampton, VA USA

Small Crack Growth and Fatigue Life Predictions for High-Strength Aluminium Alloys, Part 1, Experimental and Fracture Mechanics Analysis

Wu, X. R., Institute of Aeronautical Materials, China; Newman, J. C., NASA Langley Research Center, USA; Zhao, W., Institute of Aeronautical Materials, China; Swain, M. H., NASA Langley Research Center, USA; Ding, C. F., Institute of Aeronautical Materials, China; Phillips, E. P., NASA Langley Research Center, USA; Fatigue and Fracture of Engineering Materials and Structures; 1998; Volume 21, pp. 1289-1306; In English; Copyright; Avail: Issuing Activity, Hardcopy

The small crack effect was investigated in two high-strength aluminium alloys: 7075-T6 bare and LC9cs clad alloy. Both experimental and analytical investigations were conducted to study crack initiation and growth of small cracks. In the experimental program, fatigue tests, small crack and large crack tests A,ere conducted under constant amplitude and Mini-TWIST spectrum loading conditions. A pronounced small crack effect was observed in both materials, especially for the negative stress ratios. For all loading conditions, most of the fatigue life of the SENT specimens was shown to be crack propagation from initial material defects or from the cladding layer. In the analysis program, three-dimensional finite element and A weight function methods were used to determine stress intensity factors and to develop SIF equations for surface and corner cracks at the notch in the SENT specimens. A plastisity-induced crack-closure model was used to correlate small and large crack data, and to make fatigue life predictions, Predicted crack-growth rates and fatigue lives agreed well with experiments. A total fatigue life prediction method for the aluminum alloys was developed and demonstrated using the crack-closure model.

Author

Aluminum Alloys; Crack Propagation; Crack Initiation; Experimentation; Surface Cracks; Prediction Analysis Techniques; Fatigue Tests

19990066696 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Static and Dynamic Analysis of Structural Frameworks Comprised of Inflatable Arches and Beams ***Final Report, 1 May 1995 - 31 Dec. 1998***

Plaut, Raymond H., Virginia Polytechnic Inst. and State Univ., USA; Kapania, Rakesh K., Virginia Polytechnic Inst. and State Univ., USA; Mar. 30, 1998; 6p; In English

Contract(s)/Grant(s): DAAH04-95-1-0175

Report No.(s): AD-A365376; ARO-33421.14-EG; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This project investigated the behavior of large tent-like structures supported by pressurized arch-shaped tubes. These structures are to be used by the U.S. Army as temporary maintenance shelters for helicopters and airplanes. Similar structures exist, but they are much smaller than those required for this purpose. The aim is to develop a structure that can be separated into lightweight modules which would be easy to transport, deploy, and disassemble. One part of the research program involved a study of two pressurized arches that lean against each other. This configuration can be an effective component in supporting a fabric shelter. The behavior of single arch-tubes also was analyzed. Deflections, vibrations, and stability were investigated under various types of snow and wind loading conditions. Critical values of the loads were determined. The effects of changing material proper-

ties, temperature, and moisture were examined. A finite element model of the entire tent structure was developed. A numerical optimization study of the supporting arches was conducted. Finally, two physical models of the entire structure were constructed. They were placed in a wind tunnel and tested under various wind speeds and orientations. Then they were tested under simulated snow loads until failure occurred.
DTIC
Structural Analysis; Finite Element Method; Inflatable Structures; Beams (Supports); Hangars

19990067258 Lehigh Univ., Dept. of Mechanical Engineering and Mechanics, Bethlehem, PA USA
The Collinear Crack Problem in an Inhomogeneous Orthotropic Medium
Ozturk, Murat; Erdogan, Fazil; Jan. 1999; 46p; In English
Contract(s)/Grant(s): DAAH04-95-1-0232
Report No.(s): AD-A364758; ARO-33534.8-EG; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The collinear crack problem in an inhomogeneous orthotropic medium is considered under Mode I plane strain or plane stress loading conditions, It is shown that by introducing certain averaged orthotropy parameters, aside from a scaling parameter the results become only weakly dependent on the orthotropy constants. The main results of the study consist of the stress intensity factors at various crack tips as influenced by the material inhomogeneity parameter and by the relative size and position of the secondary cracks with respect to the dominant crack. Also considered is the crack/contact problem for the graded medium subjected to remote tension and bending through fixed grips. It is shown that the crack surface contact on the compression side of the loading has a magnifying effect on the stress intensity factor on the tension side.
DTIC
Collinearity; Crack Tips; Cracks

19990068989 Osaka Univ., Dept. of Civil Engineering, Osaka, Japan
Bonding Shear Strength at the Interface Between Old and New Concrete
Ali, Maisarah, Osaka Univ., Japan; Kurihara, Shinsuke, Osaka Univ., Japan; Matsui, Shigeyuki, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2327, pp. 237-246; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An important factor for the success of repair works in concrete structures is to realise sufficient bonding of the repair material to the substrate. There are many methods to measure the bonding strength between the two layers but only pull-off tests are carried out in-situ. However, in the concrete structures or elements such as bridge deck overlay, the interface has to resist against shear stresses by shear forces and torsional moments induced by traffic loads. A new testing method was developed by the authors to measure bonding shear strength in-situ by using a torque wrench. This test method was used to find the bonding shear strength at the interface where a new concrete layer was cast on the old concrete and where the precast concrete elements were bonded to existing concrete substrates. Several types of bonding agents were used and several types of surface treatments were prepared and their influences on bonding shear strengths were found. Pull-off tests were carried out simultaneously with these experiments and some relationships between the bonding shear strength and the bonding tensile strength were obtained.
Author
Shear Strength; Bonding; Concretes; Concrete Structures; Surface Treatment; Adhesion Tests

19990068990 Osaka Univ., Dept. of Naval Architecture and Ocean Engineering, Osaka, Japan
Structure Vibration Active Control Theory with Unknown Disturbances Using LQR
Funaki, Toshihiko, Osaka Univ., Japan; Hayashi, Shigehiro, Osaka Univ., Japan; Wang, Keke, Shanghai Jiao Tong Univ., China; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2326, pp. 219-236; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

It is a general situation that in the field of naval architecture and ocean engineering (NAOE) applications, the structure is subject to unmeasurable continuous disturbances with only little priori knowledge being known. In this paper, it is shown that, for a suitable selected quadratic-type performance index and certain changes in state equations, with the consideration of using minimum states observer, a new approach for multi-input multi-output (MIMO) system optimal control can be formulated. As a result, when the unmeasurable disturbances satisfy special relations, the optimal feedback control will never be an explicit function of the disturbances and can be expressed to be linear function of the state variables and their integrals. A numerical simulation of three-degree model is used to verify the feasibility of this approach. Moreover, due to different experimental measuring methods, or sometimes when the accelerations are taken as a criterion in controlling the structural vibration, the output variables would

include acceleration responses. Using the above method accommodating unknown disturbances, in this situation, fundamental study is given on the design of optimal control system and its minimum observer.
Author
Structural Vibration; Optimal Control; Linear Quadratic Regulator; Control Theory; Dynamic Structural Analysis

19990069532 Southwest Research Inst., San Antonio, TX USA
Development of a Practical Methodology for Elastic-Plastic and Fully Plastic Fatigue Crack Growth ***Final Report***
McClung, R. C., Southwest Research Inst., USA; Chell, G. G., Southwest Research Inst., USA; Lee, Y.–D., Southwest Research Inst., USA; Russell, D. A., Boeing North American, Inc., USA; Orient, G. E., Boeing North American, Inc., USA; July 1999; 1p; In English
Contract(s)/Grant(s): NAS8-37828
Report No.(s): NASA/CR-1999-209428; M-933; NAS 1.26:209428; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A practical engineering methodology has been developed to analyze and predict fatigue crack growth rates under elastic-plastic and fully plastic conditions. The methodology employs the closure-corrected effective range of the J-integral, (Delta)J(sub eff), as the governing parameter. The methodology contains original and literature J and (Delta)J solutions for specific geometries, along with general methods for estimating J for other geometries and other loading conditions, including combined mechanical loading and combined primary and secondary loading. The methodology also contains specific practical algorithms that translate a J solution into a prediction of fatigue crack growth rate or life, including methods for determining crack opening levels, crack instability conditions, and material properties. A critical core subset of the J solutions and the practical algorithms has been implemented into independent elastic-plastic NASGRO modules. All components of the entire methodology, including the NASGRO modules, have been verified through analysis and experiment, and limits of applicability have been identified.
Author
Elastoplasticity; Fatigue (Materials); Technology Assessment; Crack Propagation

19990069619 Army Armament Research, Development and Engineering Center, Close Combat Armaments Center, Watervliet, NY USA
Analysis of a Piston Experiencing Environmentally-Assisted Cracking as a Result of Compressive Overloading ***Final Report***
Troiano, E.; Vigilante, G. N.; Underwood, J. H.; Mossey, C.; Jun. 1999; 17p; In English
Report No.(s): AD-A364759; ARCCB-TR-99010; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A piston used in service in a closed-ended pressure vessel, as a component of the seal for the vessel, cracked after as few as two high-pressure loading cycles. As a further complication, the finite element analysis was predicting compression on the cracked piston face during the loading cycle. The cracks in the piston emanated in a radial fashion and were measured at 1.5-mm deep. Upon subsequent loading, the cracks grew in length (in large incremental advances), but did not propagate any deeper than the initial 1.5-mm. In all instances the robust design did not leak. A closer look at the finite element analysis revealed that the piston, made from Maraging 200 steel, was loaded in compression to above the compressive yield point of the material. The initial loading set up a residual tensile stress as a result of the compressive yielding. On the next successive loading, this tensile residual stress field, coupled with the hydrogen-rich products in the pressure vessel and a highly susceptible material, resulted in cracking. The fact that the cracks were only 1.5-mm deep suggests that this was the extent of the compressive yielding, and that the cracks arrested themselves once the neutral axis or zero stress was encountered. The fracture morphology of the cracks revealed that they were intergranular in nature, and likely to be the result of hydrogen-induced cracking. At this point in the program the design of the piston was firmly established, so the only alternatives were to prevent the hydrogen from getting to the susceptible material, or to change to a less susceptible material. Consideration of the second alternative revealed no material that possessed the unique combinations of strength, toughness, hydrogen resistance, or producibility that were required. Therefore, plating of the piston with various nickel and chromium combinations was investigated. Laboratory tests were devised using a modified bolt-loaded compact specimen for conducting plating studies.
DTIC
Pistons; Pressure Vessels; Cracks; Finite Element Method; Compression Loads; Fracturing

19990069625 Kansas State Univ., Dept. of Mechanical and Nuclear Engineering, Manhattan, KS USA
Crack Growth Prediction Methodology for Multi-Site Damage: Layered Analysis and Growth During Plasticity ***Final Report***
James, Mark Anthony, Kansas State Univ., USA; [1999]; 124p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-1503; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

A finite element program has been developed to perform quasi-static, elastic-plastic crack growth simulations. The model provides a general framework for mixed-mode I/II elastic-plastic fracture analysis using small strain assumptions and plane stress, plane strain, and axisymmetric finite elements. Cracks are modeled explicitly in the mesh. As the cracks propagate, automatic remeshing algorithms delete the mesh local to the crack tip, extend the crack, and build a new mesh around the new tip. State variable mapping algorithms transfer stresses and displacements from the old mesh to the new mesh. The von Mises material model is implemented in the context of a non-linear Newton solution scheme. The fracture criterion is the critical crack tip opening displacement, and crack direction is predicted by the maximum tensile stress criterion at the crack tip. The implementation can accommodate multiple curving and interacting cracks. An additional fracture algorithm based on nodal release can be used to simulate fracture along a horizontal plane of symmetry. A core of plane strain elements can be used with the nodal release algorithm to simulate the triaxial state of stress near the crack tip. Verification and validation studies compare analysis results with experimental data and published three-dimensional analysis results. Fracture predictions using nodal release for compact tension, middle-crack tension, and multi-site damage test specimens produced accurate results for residual strength and link-up loads. Curving crack predictions using remeshing/mapping were compared with experimental data for an Arcan mixed-mode specimen. Loading angles from 0 degrees to 90 degrees were analyzed. The maximum tensile stress criterion was able to predict the crack direction and path for all loading angles in which the material failed in tension. Residual strength was also accurately predicted for these cases.

Author

Crack Propagation; Prediction Analysis Techniques; Plastic Properties; Finite Element Method; Algorithms

19990069976 NASA Langley Research Center, Hampton,VA USA

Development of Curved-Plate Elements for the Exact Buckling Analysis of Composite Plate Assemblies Including Transverse-Shear Effects

McGowan, David M., NASA Langley Research Center, USA; August 1999; 112p; In English

Contract(s)/Grant(s): RTOP 522-11-41-01

Report No.(s): NASA/TM-1999-209512; L-17882; NAS 1.15:209512; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The analytical formulation of curved-plate non-linear equilibrium equations including transverse-shear-deformation effects is presented. A unified set of non-linear strains that contains terms from both physical and tensorial strain measures is used. Linearized, perturbed equilibrium equations (stability equations) that describe the response of the plate just after buckling occurs are derived. These equations are then modified to allow the plate reference surface to be located a distance z(sub c) from the centroidal surface. The implementation of the new theory into the VICONOPT exact buckling and vibration analysis and optimum design computer program is described. The terms of the plate stiffness matrix using both classical plate theory (CPT) and first-order shear-deformation plate theory (SDPT) are presented. The effects of in-plane transverse and in-plane shear loads are included in the in-plane stability equations. Numerical results for several example problems with different loading states are presented. Comparisons of analyses using both physical and tensorial strain measures as well as CPT and SDPT are made. The computational effort required by the new analysis is compared to that of the analysis currently in the VICONOPT program. The effects of including terms related to in-plane transverse and in-plane shear loadings in the in-plane stability equations are also examined. Finally, results of a design-optimization study of two different cylindrical shells subject to uniform axial compression are presented.

Author

Plates (Structural Members); Buckling; Design Analysis; Dynamic Structural Analysis; Transverse Loads; Loads (Forces); Curves (Geometry)

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GEOSCIENCES (GENERAL)

19990064460 NASA Goddard Space Flight Center, Greenbelt, MD USA

Check-Up of Planet Earth at the Turn of the Millennium Anticipated New Phase in Earth Sciences

Kaufman, Yoram, NASA Goddard Space Flight Center, USA; 1999; In English, 26 May 1999, Huntsville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Langley's remarkable solar and lunar spectra collected from mt. Whitney inspired Arrhenius to develop the first quantitative climate model in 1896. In 1999, NASA's Earth Observing AM Satellite named recently "Terra" (by Ms. SASha Jones, a 17 year old student in St. Louis, MO) will repeat Langley's experiment, but for the entire planet, thus pioneering calibrated spectral

observations from space. Conceived in response to real environmental problems, EOS-AM, in conjunction with other international satellite efforts, will fill a major gap in current efforts by providing quantitative global data sets with a resolution of few kilometers on the physical, chemical and biological elements of the earth system. Thus, like Langley's data, EOS-AM can revolutionize climate research by inspiring a new generation of climate system models and enable us to assess the human impact on the environment. In this talk I shall a give a historical perspective for the need for this expensive mission, give examples of the science that we anticipate to achieve using Terra measurements and describe this exciting mission.
Author
Spectra; Earth (Planet); Climate Models; Data Acquisition; Earth Resources

19990064538 Geological Survey, Water Resources Div., Austin, TX USA
Water Resources Data Texas, Water Year 1998, Volume 1, Arkansas River Basin, Red River Basin, Sabine River Basin, Neches River Basin, Trinity River Basin, and Intervening Coastal Basins ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Gandara, S. C.; Gibbons, W. J.; Andrews, F. L.; Barbie, D. L.; Apr. 1999; 554p; In English
Report No.(s): PB99-152662; USGS/WDR/TX-98/1; No Copyright; Avail: CASI; A04, Microfiche; A24, Hardcopy

Volume I contains records for water discharge at 112 gaging stations; stage only at 5 gaging stations; stage and contents at 33 lakes and reservoirs; water quality at 65 gaging stations; and data for 12 partial-record stations comprised of 7 flood-hydrograph, 2 low-flow, and 3 crest-stage stations. Also included are lists of discontinued surface-water discharge or stage-only stations and discontinued surface-water-quality stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements.
NTIS
Water Resources; Data Acquisition; River Basins; Hydrology; Surface Water; Water Quality

19990067283 NASA Goddard Space Flight Center, Greenbelt, MD USA
Earth Science Observations, Analysis and Visualization: Roots in the 60's: Vision for the Next Millennium
Hasler, A. F., NASA Goddard Space Flight Center, USA; [1999]; In English; Discovery World, 13-16 May 1999, Milwaukee, WI, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Etheater presents visualizations which span the period from the original Suomi/Hasler animations of the first ATS-1 GEO weather satellite images in 1966 ... to the latest 1999 NASA Earth Science Vision for the next 25 years. Hot off the SGI-Onyx Graphics-Supercomputer are NASA's visualizations of Hurricanes Mitch, Georges, Fran and Linda. These storms have been recently featured on the covers of National Geographic, Time, Newsweek and Popular Science. Highlights will be shown from the NASA hurricane visualization resource video tape that has been used repeatedly this season on National and International network TV. Results will be presented from a new paper on automatic wind measurements in Hurricane Luis from 1-min GOES images that appeared in the November BAMS.
Author
Meteorological Satellites; Satellite Imagery; Wind Measurement; Display Devices

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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.

19990064347 NASA Marshall Space Flight Center, Huntsville, AL USA
Remotely-Sensed Regional-Scale Evapotranspiration of a Semi-Arid Great Basin Desert and its Relationship to Geomorphology, Soils, and Vegetation
Laymon, C., Institute for Global Change Research and Education, USA; Quattrochi, D., NASA Marshall Space Flight Center, USA; Malek, E., Utah State Univ., USA; Hipps, L., Utah State Univ., USA; Boettinger, J., Utah State Univ., USA; McCurdy, G., Desert Research Inst., USA; Geomorphology; December 1997; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

LANDSAT Thematic Mapper data is used to estimate instantaneous regional-scale surface water and energy fluxes in a semi-arid Great Basin desert of the western USA. Results suggest that it is possible to scale from point measurements of environmental state variables to regional estimates of water and energy exchange. This research characterizes the unifying thread in the classical climate-topography-soil-vegetation relation-the surface water and energy balance-through maps of the partitioning of energy throughout the landscape. The study was conducted in Goshute Valley of northeastern Nevada, which is characteristic of most

faulted graben valleys of the Basin and Range Province of the western USA. The valley comprises a central playa and lake plain bordered by alluvial fans emanating from the surrounding mountains. The distribution of evapotranspiration (ET) is lowest in the middle reaches of the fans where the water table is deep and plants are small, resulting in low evaporation and transpiration. Highest ET occurs in the center of the valley, particularly in the playa, where limited to no vegetation occurs, but evaporation is relatively high because of a shallow water table and silty clay soil capable of large capillary movement. Intermediate values of ET are associated with large shrubs and is dominated by transpiration.
Author
Remote Sensing; Evapotranspiration; Geomorphology; Soils; Vegetation; Energy Transfer; Estimates; Evaporation; Surface Water; Thematic Mappers (LANDSAT)

19990064373 NASA Goddard Space Flight Center, Greenbelt, MD USA
Satellite Data Validation Using Trajectory Mapping Techniques, Pt. 2, Precision Assessments
Morris, Gary A, Valparaiso Univ., USA; Gleason, James, NASA Goddard Space Flight Center, USA; Schoeberl, Mark R., NASA Goddard Space Flight Center, USA; [1999]; 32p; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy

The estimation of the precision of data from satellite instruments after launch has proved a difficult endeavor. Previous efforts to validate limb sounder data have relied upon nearby measurements from successive orbits that are separated in space by less than 100 km and in time by less than two hours. Such coincidences are rare for the typical satellite instrument and in the case of the Upper Atmosphere Research Satellite (UARS), only occur in two distinct latitude bands each month. An assessment of the overall, global precision of these data sets must rely upon an extrapolation of the results from these limited latitude bands in which coincidences occur and upon an analysis of the retrieval routines. This paper demonstrates the effectiveness of trajectory mapping in establishing instrument precision. Through application to water vapor data retrieved from approximately 22 - 40 km altitude by the microwave limb sounder (MLS) on UARS, we demonstrate that trajectory mapping provides a superior approach to post-launch evaluation of data precision. Unlike the traditional approach, trajectory mapping yields an estimate of precision for nearly every MLS water vapor measurement at all latitudes. In addition, in the limited latitude bands in which the traditional approach works, trajectory mapping estimates of precision are consistent with or slightly smaller than those found using the traditional approach in almost all cases. Sensitivity studies of the dependence of the trajectory mapping results on the direction and duration of the model integration, the correlation distance, the geographic location, and the season of the calculations help establish the uncertainties inherent in the technique as well as the conditions under which application of trajectory mapping is most appropriate.
Author
Satellite Observation; Satellite Instruments; Measuring Instruments; Upper Atmosphere Research Satellite (UARS); Water Vapor; Data Acquisition; Precision

19990064379 NASA Goddard Space Flight Center, Greenbelt, MD USA
Pre-Launch Noise Characterization of the LANDSAT-7 Enhanced Thematic Mapper Plus (ETM Plus)
Pedelty, J. A., NASA Goddard Space Flight Center, USA; Markham, B. L., NASA Goddard Space Flight Center, USA; Barker, J. L., NASA Goddard Space Flight Center, USA; Seiferth, J. C., Raytheon STX Corp., USA; 1999; 12p; In English; 44th, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity, Hardcopy

A noise characterization of the LANDSAT-7 Enhanced Thematic Mapper Plus (ETM+) instrument was performed as part of a near-real time performance assessment and health monitoring program. Perl'ormance data for the integrated LANDSAT-7 spacecraft and ETM+ were collected before, during, and after the spacecraft thermal vacuum testing program at the Lockheed Martin Missiles and Space (LMMS) facilities in Valley Forge, PA. The LANDSAT-7 spacecraft and ETM+ instrument were successfully launched on April 15, 1999. The spacecraft and ETM+ are now nearing the end of the on orbit engineering checkout phase, and LANDSAT-7 is expected to be declared operational on or about July 15, 1999. A preliminary post-launch noise characterization was performed and compared with the pre-launch characterization. In general the overall noise levels in the ETM+ are at or below the specification levels. Coherent noise is seen in most bands, but is only operationally significant when imaging in (he panchromatic band (band 8). This coherent noise has an amplitude as high as approximately 3 DN (peak-to-peak, high gain) at the Nyquist rate of 104 kHz, and causes the noise levels in panchromatic band images at times to exceed the total noise specification by up to approximately 10%. However, this 104 kHz noise is now much weaker than it was prior to the successful repair of the ETM+ power supplies that was completed in May 1998. Weak and stable coherent noise at approximately 5 kHz is seen in all bands in the prime focal plane (bands 1-4 and 8) with the prime (side A) electronics. Very strong coherent noise at approximately 20 kHz is seen in a few detectors of bands 1 and 8, but this noise is almost entirely in the turn-around region between scans when the ETM+ is not imaging the Earth. Strong coherent noise was seen in 2 detectors of band 5 during some of the pre-launch

testing; however, this noise seems to be temperature dependent, and has not been seen in the current on orbit environment. Strong 91 kHz coherent noise was observed in the redundant (side B) panchromatic band data after the completion of spacecraft thermal vacuum testing. The cause of this coherent noise was identified as a failed capacitor that was replaced prior to launch, and this noise has not been seen on orbit.
Author
LANDSAT 7; Thematic Mappers (LANDSAT); Noise Intensity; Spacecraft Instruments; Noise Temperature; Launching; Imaging Techniques

19990064396 NASA Marshall Space Flight Center, Huntsville, AL USA
Remote Sensing Measurements of Vertical and Horizontal Moisture Variations from Aircraft Instruments
Atkinson, R. J., NASA Marshall Space Flight Center, USA; Guillory, Anthony R., NASA Marshall Space Flight Center, USA; Jedlovec, Gary J., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 10th; Meteorological Observations and Instrumentation, 11-16 Jan. 1998, Phoenix, AZ, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The research in this paper focuses on describing vertical and horizontal of water vapor variability using two remote sensing aircraft instruments. To achieve this goal we will compare precipitable water and upper level humidity estimates derived from the each of the instruments. The Multispectral Atmospheric Mapping Sensor (MAMS) is a visible and infrared radiometer with similar channels to that of the GOES imager. MAMS has flown aboard the NASA ER-2 numerous times. It has been used to validate features observed with the previous series of GOES satellites. MAMS data has been used to study precipitable water and upper level water vapor as well as other geophysical parameters. MAMS provides the opportunity to obtain water vapor Imagery at 6.7 mm. Upper tropospheric humidity can be computed using this channel in a similar fashion to that of Soden and Bretherton. In addition to the water vapor channel, MAMS records data In 3 other Infrared channels and 8 visible and near Infrared bands at high spatial resolution (I 00 Abstract: m). The 1 1 and 12 mm infrared channels allow for the application of a split technique to derive total precipitable water. The Udar Atmospheric Sensing Experiment (LASE) which uses the Differential Absorption Udar (DIAL) technique for obtaining simultaneous water vapor and aerosol profiles through the entire troposphere. LASE operates In the 81 5 nm wavelength region and uses a double pulsed Ti:sapphire laser that is locked onto a water vapor line. LASE has good horizontal (IO km) and excellent vertical (300 m) resolution. MAMS and LASE collected data simultaneously on several ER-2 flights in September 1995. LASE mixing ratio profiles will be Integrated for comparison with MAMS precipitable water estimates and the upper tropospheric humidity will be computed for the layer observed by the MAMS 6.7 mm channel for comparison for this time period. Results show a significant correlation between the measurements of the two Instruments. Regions of high/low upper tropospheric humidity are apparent In measurements from both instruments. Also changes in boundary layer moisture depicted by LASE are reflected in the total precipitable water measured by MAMS.
Author
Remote Sensing; Research; Water Vapor; Humidity; Atmospheric Moisture; Infrared Radiometers

19990064449 NASA Goddard Space Flight Center, Greenbelt, MD USA
Remote Sensing of Forest Fires from Space
Kaufman, Y., NASA Goddard Space Flight Center, USA; 1999; In English; Environmental Physics, 22-26 Mar. 1999, Brasilia, Brazil; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Forest fires, and fires used for deforestation and agriculture are sporadic. Some may last an hour others several days. It is difficult to find the fires or to estimate their effect on atmospheric pollution without an ”eye in the sky” a satellite or an array of satellites that monitors them routinely from space. Since fires have a significant effect on the quality of air that we breath, on the surface vegetation, on clouds and precipitation and even on climate, NASA and other space agencies try to develop fire monitoring capability from space. Presently satellites were not designed to monitor fires. But the AVHRR and GOES satellites were used for fire monitoring. AVHRR is an orbiter that passes over the same area twice a day with detailed observations of fires from a distance of 800 km, GOES is a stationary satellite located above the equator, and observes the larger fires from a distance of 20,000 km. Field experiments, such as the ”SCAR-B” experiment in Brazil conducted in 1995 by INPE, NASA and Universities of Sao Paulo, Washington and Wisconsin, were used to determine the ability of satellites to observe fires and the emitted pollution. They are the basis of a new system of satellites designed by NASA to observe fires and pollution, the Earth Observing System AM1 and PM1. NASA plans to use the information for four observations a day of the fires and the emitted smoke. The information can be used to determine the location of the fires, to distinguish between small and large fires and monitor their development. The satellites will measure the emitted smoke and with trajectory models can be used to predict the density and spread of the smoke.
Author
Forest Fires; Deforestation; Agriculture; Smoke; Remote Sensing; Earth Observing System (EOS)

19990064453 NASA Goddard Space Flight Center, Greenbelt, MD USA

Wide-Field High-Performance Geosynchronous Imaging

Wood, H. John, NASA Goddard Space Flight Center, USA; Jenstrom, Del, NASA Goddard Space Flight Center, USA; Wilson, Mark, NASA Goddard Space Flight Center, USA; Hinkal, Sanford, NASA Goddard Space Flight Center, USA; Kirchman, Frank, NASA Goddard Space Flight Center, USA; 1997; In English; Space Technology and Applications, 25-29 Jan. 1998, Albuquerque, NM, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The NASA Mission to Planet Earth (MTPE) Program and the National Oceanographic and Atmospheric Administration (NOAA) are sponsoring the Advanced Geosynchronous Studies (AGS) to develop technologies and system concepts for Earth observation from geosynchronous orbit. This series of studies is intended to benefit both MTPE science and the NOAA GOES Program. Within the AGS program, advanced imager trade studies have investigated two candidate concepts for near-term advanced geosynchronous imagers. One concept uses a scan mirror to direct the line of sight from a 3-axis stabilized platform. Another eliminates the need for a scan mirror by using an agile spacecraft bus to scan the entire instrument. The purpose of this paper is to discuss the optical design trades and system issues encountered in evaluating the two scanning approaches.

Derived from text

Design Analysis; Optical Equipment; Earth Observations (From Space); Geosynchronous Orbits; Mission to Planet Earth; Earth Observing System (EOS); Remote Sensing

19990064459 NASA Goddard Space Flight Center, Greenbelt, MD USA

Geoscience Applications of Airborne and Spaceborne Lidar Altimetry

Harding David J., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 27 Apr. 1999, Ithaca, NY, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent advances in lidar altimetry technology have enabled new methods to describe the vertical structure of the Earth's surface with great accuracy. Application of these methods in several geoscience disciplines will be described. Airborne characterization of vegetation canopy structure will be illustrated, including a validation of lidar-derived Canopy Height Profiles for closed-canopy, broadleaf forests. Airborne detection of tectonic landforms beneath dense canopy will also be illustrated, with an application mapping active fault traces in the Puget Lowland of Washington state for earthquake hazard assessment purposes. Application of data from the first and second flights of the Shuttle Laser Altimeter will also be discussed in an assessment of global digital elevation model accuracy and error characteristics. Two upcoming space flight missions will be described, the Vegetation Canopy Lidar (VCL) and the Ice, Cloud and Land Elevation Mission (ICESat), which will provide comprehensive lidar altimeter observations of the Earth's topography and vegetation cover.

Author

Vertical Distribution; Airborne Equipment; Altimeters; Elevation; Geophysics; Laser Altimeters; Optical Radar

19990064468 NASA Goddard Space Flight Center, Greenbelt, MD USA

Earth Observing System: Science Objectives and Challenges

King, Michael D., NASA Goddard Space Flight Center, USA; 1998; 1p; In English; Remote Sensing, 14-17 Sep. 1998, Beijing, China; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Earth Observing System (EOS) is a space-based observing system comprised of a series of satellite sensors by which scientists can monitor the Earth, a Data and Information System (EOSDIS) enabling researchers worldwide to access the satellite data, and an interdisciplinary science research program to interpret the satellite data. In this presentation I will describe the key areas of scientific uncertainty in understanding climate and global change, and follow that with a description of the EOS goals, objectives, and scientific research elements that comprise the program (instrument science teams and interdisciplinary investigations). Finally, I will describe how scientists and policy makers intend to use EOS data to improve our understanding of key global change uncertainties, such as: (i) clouds and radiation, including fossil fuel and natural emissions of sulfate aerosol and its potential impact on cloud feedback, (ii) man's impact on ozone depletion, with examples of ClO and O3 obtained from the UARS satellite during the Austral Spring, and (iii) volcanic eruptions and their impact on climate, with examples from the eruption of Mt. Pinatubo.

Author

Earth Observing System (EOS); EOS Data and Information System; Fossil Fuels; Climate Change; Aerosols; Ozone

19990064469 NASA Goddard Space Flight Center, Greenbelt, MD USA

Earth Remote Sensing: What is it Really? What to do with it?

Meeson, Blanche W., NASA Goddard Space Flight Center, USA; 1998; 1p; In English, 20-23 oCT. 1998, Albuquerque, NM,

USA; Sponsored by MU-SPIN; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

NASA!s Earth Sciences Program supports a wide range of endeavors in basic Earth system scientific research, technology development to support that research, development of materials and training for educators and students based on that research and information, and increasingly practical applications. A brief overview of the scope of this scientific research and the key features of the necessary remote sensing instrumentation will be given. I will also describe available educational materials and training courses for a wide range of grade levels. Information will be provided on how to obtain educational materials or to participate in a training course. Finally, a few examples will be given to illustrate how Earth remote sensing effects our daily life.
Author
NASA Programs; Earth Sciences; Remote Sensing; Education

19990064472 Clarkson Univ., Dept. of Civil and Environmental Engineering, Potsdam, NY USA
Nonlinear Interaction of Surge Waves with Ice Cover in River Channels ***Final Report***
Shen, Hung T.; Xia, Xun; Mar. 1999; 114p; In English
Contract(s)/Grant(s): DAAG55-98-1-0520
Report No.(s): AD-A365280; 375-661; ARO-39244.1-EV-II; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The interaction of water waves with an ice cover in river channels is studied using one-dimensional governing equations which describe fluid continuity, momentum, and the ice cover response. The ice cover is assumed to be a continuous, thin elastic plate. Both linearized and nonlinear forms of the above three equations are analyzed in this study. The effects of a constant compressive axial force along an ice cover on the propagation characteristics of linear water waves, i.e., celerity, attenuation, and group velocity, are first investigated over the entire spectrum of wavelengths on the basis of linear stability theory. It is found that only when an axial force approaches a critical value and the wavelength is around 2-pi-l, where l is the characteristic length of the cover, the effect of the axial force is significant. The nonlinear terms in the water equation, which are ignored in the linear theory, become significant in highly unsteady flows such as surges caused by ice jam releases. An analytical solution for the nonlinear shallow wave equations is obtained. The effects of ice inertia and an axial force on the nonlinear waves are examined. The stresses induced in ice cover by both linear and nonlinear waves obtained from the above mentioned analysis are used to investigate the possible formation of closedly-spaced transverse cracks often observed during ice cover breakups. The formation of closedly-spaced transverse cracks is the key mechanism for river ice breakup and the initiation of breakup ice runs. The validity of the linear theory is found to be very limited. The nonlinear analysis provides results in close agreement with field observations. These results provide basic explanation of the formation mechanism of transverse cracks which initiate the breakup ice runs.
DTIC
Surges; Water Waves; Ice; Rivers

19990064542 NASA Goddard Space Flight Center, Greenbelt, MD USA
Estimating Soil Moisture from Satellite Microwave Observations
Owe, M., NASA Goddard Space Flight Center, USA; VandeGriend, A. A., Vrije Univ., Netherlands; deJeu, R., Vrije Univ., Netherlands; deVries, J., Vrije Univ., Netherlands; Seyhan, E., Vrije Univ., Netherlands; 1998; 1p; In English; Applications of Remote Sensing, in Hydrology, 4-6 Nov. 1998, Santa Fe, NM, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Cooperative research in microwave remote sensing between the Hydrological Sciences Branch of the NASA Goddard Space Flight Center and the Earth Sciences Faculty of the Vrije Universiteit Amsterdam began with the Botswana Water and Energy Balance Experiment and has continued through a series of highly successful International Research Programs. The collaboration between these two research institutions has resulted in significant scientific achievements, most notably in the area of satellite-based microwave remote sensing of soil moisture. The Botswana Program was the first joint research initiative between these two institutions, and provided a unique data base which included historical data sets of Scanning Multifrequency Microwave Radiometer (SN4NM) data, climate information, and extensive soil moisture measurements over several large experimental sites in southeast Botswana. These data were the basis for the development of new approaches in physically-based inverse modelling of soil moisture from satellite microwave observations. Among the results from this study were quantitative estimates of vegetation transmission properties at microwave frequencies. A single polarization modelling approach which used horizontally polarized microwave observations combined with monthly composites of Normalized Difference Vegetation Index was developed, and yielded good results. After more precise field experimentation with a ground-based radiometer system, a dual-polarization approach was subsequently developed. This new approach realized significant improvements in soil moisture estimation by satellite. Results from the Botswana study were subsequently applied to a desertification monitoring study for the country of Spain within the framework of the European Community science research programs EFEDA and RESMEDES. A dual frequency approach with only microwave data was used for this application. The Microwave Polarization Difference Index (MPDI) was calculated from 37 GHz data and used to derive the one-way canopy transmissivity. Using a simple radiative transfer model, this

information was combined with horizontally polarized 6.6 GHz SMMR observations to derive a 9-year time series of soil moisture for all of Spain at a one quarter degree spatial scale. Both day and night SMMR observations were used independently, in order to check the consistency of the results. A first order Fourier Transform was performed on the mean monthly soil moisture values to identify major characteristics of time series such as trend, amplitude, and phase shift.
Author
Soil Moisture; Microwave Frequencies; Microwave Imagery; Remote Sensing; Fourier Transformation; Time Series Analysis

19990064609 NASA Goddard Space Flight Center, Greenbelt, MD USA
The CEOS International Directory Network Progress and Plans: Spring, 1999
Olsen, Lola M., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Information Systems and Services, 9-12 Mar. 1999, Osaka, Japan; Sponsored by Committee on Earth Observation Satellites; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Global Change Master Directory (GCMD) serves as the software development hub for the Committee on Earth Observation Satellites' (CEOS) International Directory Network (IDN). The GCMD has upgraded the software for the IDN nodes as Version 7 of the GCMD: MD7-Oracle and MD7-Isite, as well as three other MD7 experimental interfaces. The contribution by DLR representatives (Germany) of the DLR Thesaurus will be demonstrated as an educational tool for use with MD7-Isite. The software will be installed at twelve nodes around the world: Brazil, Argentina, the Netherlands, Canada, France, Germany, Italy, Japan, Australia, New Zealand, Switzerland, and several sites in the United States. Representing NASA for the International Directory Network and the CEOS Data Access Subgroup, NASA's contribution to this international interoperability effort will be updated. Discussion will include interoperability with the CEOS Interoperability Protocol (CIP), features of the latest version of the software, including upgraded capabilities for distributed input by the IDN nodes, installation logistics, "mirroring', population objectives, and future plans.
Author
Computer Programs; Education; Earth Observations (From Space); Protocol (Computers); Software Engineering

19990064627 NASA Goddard Space Flight Center, Greenbelt, MD USA
NASA's Earth Science Enterprise: Future Science Missions, Objectives and Challenges
Habib, Shahid, NASA Goddard Space Flight Center, USA; 1998; In English; Remote Sensing, 14-17 Sep. 1998, Beijing, China; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

NASA has been actively involved in studying the planet Earth and its changing environment for well over thirty years. Within the last decade, NASA's Earth Science Enterprise has become a major observational and scientific element of the U.S. Global Change Research Program. NASA's Earth Science Enterprise management has developed a comprehensive observation-based research program addressing all the critical science questions that will take us into the next century. Furthermore, the entire program is being mapped to answer five Science Themes (1) land-cover and land-use change research (2) seasonal-to-interannual climate variability and prediction (3) natural hazards research and applications (4) long-term climate-natural variability and change research and (5) atmospheric ozone research. Now the emergence of newer technologies on the horizon and at the same time continuously declining budget environment has lead to an effort to refocus the Earth Science Enterprise activities. The intent is not to compromise the overall scientific goals, but rather strengthen them by enabling challenging detection, computational and space flight technologies those have not been practically feasible to date. NASA is planning faster, cost effective and relatively smaller missions to continue the science observations from space for the next decade. At the same time, there is a growing interest in the world in the remote sensing area which will allow NASA to take advantage of this by building strong coalitions with a number of international partners. The focus of this presentation is to provide a comprehensive look at the NASA's Earth Science Enterprise in terms of its brief history, scientific objectives, organization, activities and future direction.
Author
Earth (Planet); Earth Sciences; NASA Programs; Exploration

19990067281 NASA Goddard Space Flight Center, Greenbelt, MD USA
Hyperspectral Imagery Data for Remote Sensing
Garegnani, Jerry, NASA Goddard Space Flight Center, USA; Gualtney, Lawrence, Du Pont de Nemours (E. I.) and Co., USA; [1999]; In English, 18-21 May 1999, Portland, OR, USA; Sponsored by American Society for Photogrammetry and Remote Sensing, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

In order for remotely sensed data to be useful in a practical application for agriculture, an information product must be made available to the land management decision maker within 24 to 48 hours of data acquisition. Hyperspectral imagery data is proving useful in differentiation of plant species potentially allowing identification of non-healthy areas and pest infestations within crop

fields that may require the farm managers attention. Currently however, extracting the needed site-specific feature information from the vast spectral content of large hyperspectral image files is a labor intensive and time consuming task prohibiting the necessary fast turnaround from raw data to final product. We illustrate the methods, techniques and technologies necessary to produce field-level information products from imagery and other related spatial data that are useful to the farm manager for specific decisions that must be made throughout the growing season. We also propose to demonstrate the cost effectiveness of an integrated system, from acquisition to final product distribution, to utilize imagery for decisions on a working farm in conjunction with a commercial agricultural services company and their crop scouts. The demonstration farm is Chesapeake Farms, a 3000 acre research farm in Chestertown, Maryland on the Eastern Shore and is owned by the DuPont Corporation.
Author
Remote Sensing; Data Acquisition; Imagery; Technology Assessment; Agriculture

19990067637 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Development of Kolmogoroff-Like Power Spectra in the Expanding Solar Wind
Goldstein, M. L., NASA Goddard Space Flight Center, USA; Roberts, D. A., NASA Goddard Space Flight Center, USA; Ghosh, S., Space Applications Corp., USA; Deane, A. E., Maryland Univ., USA; 1998; In English; Solar Wind 9, 5-9 Oct. 1998, Nantucket, RI, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Power spectra of the solar wind fluctuations consistently exhibit a -5/3 power-law slope consistent with the idea that the medium is undergoing a turbulent cascade as seen in ordinary fluids. This is surprising both because the radial streams and the magnetic field threading the plasma will induce anisotropies and because the expansion of the wind will tend to lead to the suppression of nonlinear cascades. These conditions violate the assumptions used by Kolmogoroff to derive the -5/3 law. We have studied this issue using a compressible IMHD code in spherical coordinates and have shown that a -5/3 spectrum results from a broad-band flat-spectrum input condition that is sheared and distorted by a current sheet as the wind expands. We determine spectra from time series taken at selected points in the domain as is done with observational spacecraft data. The spectra are very like those we have seen in nonexpanding runs and exhibit evolution and compressive characteristics very similar to those seen in observations. We will report on these results in addition to a new set of runs intended to constrain the necessary and sufficient conditions for the spectra to have this form. The simulation also allows us to examine the anisotropy for the spectra to attempt to determine why the result of an isotropic magnetofluid is obtained in a highly anisotropic situation.
Author
Anisotropy; Power Spectra; Solar Wind; Turbulent Flow; Isotropic Turbulence; Cascade Flow

19990068004 NASA Goddard Space Flight Center, Greenbelt, MD USA
Comparison of Surface Ground Temperature from Satellite Observations and the Off-Line Land Surface GEOS Assimilation System
Yang, R., NASA Goddard Space Flight Center, USA; Houser, P., NASA Goddard Space Flight Center, USA; Joiner, J., NASA Goddard Space Flight Center, USA; 1998; 1p; In English; 79th, 10-15 Jan. 1998, Dallas, TX, USA; Sponsored by American Meteorological Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The surface ground temperature (Tg) is an important meteorological variable, because it represents an integrated thermal state of the land surface determined by a complex surface energy budget. Furthermore, Tg affects both the surface sensible and latent heat fluxes. Through these fluxes. the surface budget is coupled with the atmosphere above. Accurate Tg data are useful for estimating the surface radiation budget and fluxes, as well as soil moisture. Tg is not included in conventional synoptical weather station reports. Currently, satellites provide Tg estimates globally. It is necessary to carefully consider appropriate methods of using these satellite data in a data assimilation system. Recently, an Off-line Land surface GEOS Assimilation (OLGA) system was implemented at the Data Assimilation Office at NASA-GSFC. One of the goals of OLGA is to assimilate satellite-derived Tg data. Prior to the Tg assimilation, a thorough investigation of satellite- and model-derived Tg, including error estimates, is required. In this study we examine the Tg from the n Project (ISCCP DI) data and the OLGA simulations. The ISCCP data used here are 3-hourly DI data (2.5x2.5 degree resolution) for 1992 summer months (June, July, and August) and winter months (January and February). The model Tg for the same periods were generated by OLGA. The forcing data for this OLGA 1992 simulation were generated from the GEOS-1 Data Assimilation System (DAS) at Data Assimilation Office NASA-GSFC. We examine the discrepancies between ISCCP and OLGA Tg with a focus on its spatial and temporal characteristics, particularly on the diurnal cycle. The error statistics in both data sets, including bias, will be estimated. The impact of surface properties, including vegetation cover and type, topography, etc, on the discrepancies will be addressed.
Author
Atmospheric Radiation; Climatology; Diurnal Variations; Satellite Observation; Surface Temperature

19990068044 NASA Marshall Space Flight Center, Huntsville, AL USA

Environmental Assessment and Monitoring with ICAMS (Image Characterization and Modeling System) Using Multi-scale Remote-Sensing Data

Lam, N., NASA Marshall Space Flight Center, USA; Qiu, H.–I., NASA Marshall Space Flight Center, USA; Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; Zhao, Wei, NASA Marshall Space Flight Center, USA; Aug. 26, 1997; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

With the rapid increase in spatial data, especially in the NASA-EOS (Earth Observing System) era, it is necessary to develop efficient and innovative tools to handle and analyze these data so that environmental conditions can be assessed and monitored. A main difficulty facing geographers and environmental scientists in environmental assessment and measurement is that spatial analytical tools are not easily accessible. We have recently developed a remote sensing/GIS software module called Image Characterization and Modeling System (ICAMS) to provide specialized spatial analytical tools for the measurement and characterization of satellite and other forms of spatial data. ICAMS runs on both the Intergraph-MGE and Arc/info UNIX and Windows-NT platforms. The main techniques in ICAMS include fractal measurement methods, variogram analysis, spatial autocorrelation statistics, textural measures, aggregation techniques, normalized difference vegetation index (NDVI), and delineation of land/water and vegetated/non-vegetated boundaries. In this paper, we demonstrate the main applications of ICAMS on the Intergraph-MGE platform using LANDSAT Thematic Mapper images from the city of Lake Charles, Louisiana. While the utilities of ICAMS' spatial measurement methods (e.g., fractal indices) in assessing environmental conditions remain to be researched, making the software available to a wider scientific community can permit the techniques in ICAMS to be evaluated and used for a diversity of applications. The findings from these various studies should lead to improved algorithms and more reliable models for environmental assessment and monitoring.

Author

Environmental Monitoring; Remote Sensing; Thematic Mappers (LANDSAT); Image Classification; Image Analysis; Environment Models

19990068996 Osaka Univ., Dept. of Nuclear Engineering, Osaka, Japan

Molecular Dynamics Study on Thermal Properties of UO2

Yamada, Kazuhiro, Osaka Univ., Japan; Yamanaka, Shinsuke, Osaka Univ., Japan; Katsura, Masahiro, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2320, pp. 167-173; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The linear thermal expansion coefficient, the compressibility, and the molar specific heat of U02 were studied by a molecular dynamics (MD) technique in the temperature range of 300-1600 K. The Morse-type potential function added to the Busing-Ida type potential was used. The calculated linear thermal expansion coefficient was lower than almost all the values of experimental data, but is found to increase with temperature similar to the real uranium dioxide. The calculated compressibility was slightly higher than that of the experimental data, but increased with temperature rise. This means that the MD cell becomes soft by rising temperature similar to the real material. The calculated molar specific heat of U02 at the constant pressure agreed with those of the experimental data at high temperatures. This result indicates that the potential function used in the present study well describes the change in the internal energy of U02 with temperature. From these results, the molecular dynamics calculation is applicable to evaluate the thermal properties of U02.

Author

Molecular Dynamics; Thermodynamic Properties; Uranium Oxides; Thermal Expansion

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.

19990067240 Quantum Group, Inc., San Diego, CA USA

Small, Efficient Thermophotovoltaic Power Supply ***Final Report, 21 Feb. 1997 - 21 Feb. 1999***

Chen, K. C., Quantum Group, Inc., USA; Osborn, Dale, Quantum Group, Inc., USA; Sarmiento, Pedro A., Quantum Group, Inc., USA; Earath, Sunil, Delaware Univ., USA; Prasad, Ajay J., Delaware Univ., USA; Earath, Sunil, Delaware Univ., USA; Apr. 23, 1999; 46p; In English

Contract(s)/Grant(s): DAAG55-97-C-0003

Report No.(s): AD-A365093; AGI-0010; ARO-36332.1-RT-ST2; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The objective of this contract is to design and build a small, lightweight, stand-alone thermophotovoltaic electric generator, capable of at least 100 Watts useful output for charging 24V batteries. The prototype generator built consists of a pre-mixed burner, a cylindrical selective emitter mantle surrounded by six silicon photovoltaic concentrator arrays. The arrays are cooled with forced-air heat exchangers using self-powered fans. The generator, operated at 117,00 W (40,000 BTU/hr) of fuel input rate, produces 122 W of electrical power at 1.0% of efficiency. The cooling and pre-mix fans consume 35 W of electrical power resulting in a net 85 Watts of electrical output for charging batteries. The generator's output is capable of continuous charging five 12/24V batteries over 10 hours with a 9.07 Kg (20 lbs.) of propane gas.
DTIC
Electric Power Supplies; Electric Batteries; Solar Cells; Photovoltaic Effect

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990064333 NASA Marshall Space Flight Center, Huntsville, AL USA
The Role of Global Hydrologic Processes in Interannual and Long-Term Climate Variability
Robertson, Franklin R., NASA Marshall Space Flight Center, USA; 1997; In English; Mission to Planet Earth: Long Range Climate Monitoring and Modeling, 23-25 Sep. 1997, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The earth's climate and its variability is linked inextricably with the presence of water on our planet. El Nino / Southern Oscillation-- the major mode of interannual variability-- is characterized by strong perturbations in oceanic evaporation, tropical rainfall, and radiation. On longer time scales, the major feedback mechanism in CO2-induced global warming is actually that due to increased water vapor holding capacity of the atmosphere. The global hydrologic cycle effects on climate are manifested through influence of cloud and water vapor on energy fluxes at the top of atmosphere and at the surface. Surface moisture anomalies retain the "memory" of past precipitation anomalies and subsequently alter the partitioning of latent and sensible heat fluxes at the surface. At the top of atmosphere, water vapor and cloud perturbations alter the net amount of radiation that the earth's climate system receives. These pervasive linkages between water, radiation, and surface processes present major complexities for observing and modeling climate variations. Major uncertainties in the observations include vertical structure of clouds and water vapor, surface energy balance, and transport of water and heat by wind fields. Modeling climate variability and change on a physical basis requires accurate by simplified submodels of radiation, cloud formation, radiative exchange, surface biophysics, and oceanic energy flux. In the past, we m safely say that being "data poor' has limited our depth of understanding and impeded model validation and improvement. Beginning with pre-EOS data sets, many of these barriers are being removed. EOS platforms with the suite of measurements dedicated to specific science questions are part of our most cost effective path to improved understanding and predictive capability. This talk will highlight some of the major questions confronting global hydrology and the prospects for significant progress afforded by EOS-era measurements.
Author
Atmospheric Moisture; Climate Change; Balance; Carbon Dioxide; Global Warming; Hydrological Cycle; Marine Meteorology; Prediction Analysis Techniques; Water Vapor

19990064334 Alabama A & M Univ., Normal, AL USA
Human Migration and Agricultural Expansion: An Impending Threat to the Maya Biosphere Reserve
Sader, Steven, Alabama A & M Univ., USA; Reining, Conard, Alabama A & M Univ., USA; Sever, Thomas L., Alabama A & M Univ., USA; Soza, Carlos, Alabama A & M Univ., USA; 1997; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Evidence is presented of the current threats to the Maya Biosphere Reserve in northern Guatemala as derived through time-series LANDSAT Thematic Mapper observations and analysis. Estimates of deforestation rates and trends are examined for different management units within the reserve and buffer zones. The satellite imagery was used to quantify and monitor rates, patterns, and trends of forest clearing during a time period corresponding to new road construction and significant human migration into the newly accessible forest region. Satellite imagery is appropriate technology in a vast and remote tropical region where aerial photography and extensive field-based methods are not cost-effective and current, timely data is essential for establishing conservation priorities.
Author
Migration; Human Resources; Agriculture; Biosphere; Estimates; Aerial Photography

19990064336 NASA Marshall Space Flight Center, Huntsville, AL USA

The Multi-Center Airborne Coherent Atmospheric Wind Sensor, MACAWS

Rothermel, Jeffry, NASA Marshall Space Flight Center, USA; Cutten, Dean R., Alabama Univ., USA; Hardesty, R. Michael, National Oceanic and Atmospheric Administration, USA; Menzies, Robert T., Jet Propulsion Lab., California Inst. of Tech., USA; Howell, James, National Oceanic and Atmospheric Administration, USA; Johnson, Steven C., NASA Marshall Space Flight Center, USA; Tratt, David M., Jet Propulsion Lab., California Inst. of Tech., USA; Olivier, Lisa D., National Oceanic and Atmospheric Administration, USA; Banta, Robert M., National Oceanic and Atmospheric Administration, USA; [1997]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In 1992 the atmospheric lidar remote sensing groups of the NASA Marshall Space Flight Center, NOAA Environmental Technology Laboratory, and Jet Propulsion Laboratory began a joint collaboration to develop an airborne high-energy Doppler laser radar (lidar) system for atmospheric research and satellite validation and simulation studies. The result is the Multi-center Airborne Coherent Atmospheric Wind Sensor, MACAWS, which has the capability to remotely sense the distribution of wind and absolute aerosol backscatter in the troposphere and lower stratosphere. A factor critical to the programmatic feasibility and technical success of this collaboration has been the utilization of existing components and expertise which were developed for previous atmospheric research by the respective institutions. The motivation for the MACAWS program Is three-fold: to obtain fundamental measurements of sub-synoptic scale processes and features which may be used as a basis to improve sub-grid scale parameterizations in large-scale models; to obtain similar datasets in order to improve the understanding and predictive capabilities on the mesoscale; and to validate (simulate) the performance of existing (planned) satellite-borne sensors. Examples of the latter include participation in the validation of the NASA Scatterometer and the assessment of prospective satellite Doppler lidar for global tropospheric wind measurement. Initial flight tests were made in September 1995; subsequent flights were made in June 1996 following improvements. This paper describes the MACAWS instrument, principles of operation, examples of measurements over the eastern Pacific Ocean and western USA, and future applications.

Author

Fabrication; Infrared Lasers; Airborne Lasers; Wind Measurement; Aerosols; Backscattering; Remote Sensing; Optical Radar

19990064358 Harvard Univ., Dept. of Chemistry and Chemical Biology, Cambridge, MA USA

High-Altitude Aircraft and Balloon-Borne Observations of OH, HO2, ClO, BrO, NO2, ClONO2, ClOOCl, H2O, and O3 in Earth's Stratosphere ***Final Report, 1 Jul. 1991 - 31 Dec. 1998***

Anderson, James G., Harvard Univ., USA; Jul. 23, 1999; 38p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-1305; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Using observations from balloon-borne instruments and aircraft-borne instruments the investigation arrived at the following developments.: (1) Determination of the dominant catalytic cycles that destroy ozone in the lower stratosphere; (2) The partial derivatives of the rate limiting steps are observables in the lower stratosphere; (3) Recognition that the "Low NOx" condition is the regime that holds the greatest potential for misjudgement of Ozone loss rates; (4) Mapping of the Bromine radical contribution to the ozone destruction rate in the lower stratosphere; (5) Observation of OH, HO2 and ClO in the plume of the Concorde SST in the stratosphere; (6) Determination of the diurnal behavior of OH in the lower stratosphere; (7) Observed OH and H02 in the Troposphere and the interrelationship between Ozone and OH, HO2, CO and NO; (8) Analysis of the Catalytic Production of Ozone and Reactions that Couple OH and H02 in the Troposphere; (9) The continuing development of the understanding of the Tropopause temperatures, water vapor mixing ratios, and vertical advection and the mixing in of mid-latitude air; (10) Performed Multiple Tracer Analyses as a diagnostic of water vapor intrusion into the "Middle World" (i.e., the lowermost stratsophere); (11) Flight testing of a new instrument for the In Situ detection of ClON02 from the ER-2; (12) Laser induced fluorescence detection of NO2. There is included an in depth discussion of each of these developments and observations.

CASI

Ozone; Peroxides; Stratosphere; Troposphere; Water Vapor; Chlorine Oxides; Nitrogen Dioxide

19990064360 NASA Goddard Space Flight Center, Greenbelt, MD USA

Ozone Depletion at Mid-Latitudes: Coupling of Volcanic Aerosols and Temperature Variability to Anthropogenic Chlorine

Solomon, S., National Oceanic and Atmospheric Administration, USA; Portmann, R. W., National Oceanic and Atmospheric Administration, USA; Garcia, R. R., National Center for Atmospheric Research, USA; Randel, W., National Center for Atmospheric Research, USA; Wu, F., National Center for Atmospheric Research, USA; Nagatani, R., National Centers for Environmental Prediction, USA; Gleason, J., NASA Goddard Space Flight Center, USA; Thomason, L., NASA Langley Research Center, USA; Poole, L. R., NASA Langley Research Center, USA; McCormick, M. P., Hampton Univ., USA; Geophysical Research Letters; Jun. 01, 1998; ISSN 0094-8534; Volume 25, No. 11, pp. 1871-1874; In English

Report No.(s): Paper-98GL01293; Copyright; Avail: Issuing Activity, Hardcopy

Satellite observations of total ozone at 40-60 deg N are presented from a variety of instruments over the time period 1979-1997. These reveal record low values in 1992-3 (after Pinatubo) followed by partial but incomplete recovery. The largest post-Pinatubo reductions and longer-term trends occur in spring, providing a critical test for chemical theories of ozone depletion. The observations are shown to be consistent with current understanding of the chemistry of ozone depletion when changes in reactive chlorine and stratospheric aerosol abundances are considered along with estimates of wave-driven fluctuations in stratospheric temperatures derived from global temperature analyses. Temperature fluctuations are shown to make significant contributions to model calculated northern mid-latitude ozone depletion due to heterogeneous chlorine activation on liquid sulfate aerosols at temperatures near 200-210 K (depending upon water vapor pressure), particularly after major volcanic eruptions. Future mid-latitude ozone recovery will hence depend not only on chlorine recovery but also on temperature trends and/or variability, volcanic activity, and any trends in stratospheric sulfate aerosol.

Author

Ozone Depletion; Temperate Regions; Air Pollution; Atmospheric Composition; Aerosols; Atmospheric Temperature; Variations

19990064362 California Univ., Institute of Geophysics and Planetary Physics, Los Angeles, CA USA

The Origin of the Near-Earth Plasma Population During a Substorm on November 24, 1996

Ashour–Abdalla, M., California Univ., USA; El–Alaoui, M., California Univ., USA; Peroomian, V., California Univ., USA; Walker, R. J., California Univ., USA; Raeder, J., California Univ., USA; Frank, L. A., Iowa Univ., USA; Paterson, W. R., Iowa Univ., USA; 1999; 50p; In English

Contract(s)/Grant(s): NAG5-6689; NAGw-4553; POV50494; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We investigate the origins and the transport of ions observed in the near-Earth plasma sheet during the growth and expansion phases of a magnetospheric substorm that occurred on November 24, 1996. Ions observed at Geotail were traced backward in time in time-dependent magnetic and electric fields to determine their origins and the acceleration mechanisms responsible for their energization. Results from this investigation indicate that, during the growth phase of the substorm, most of the ions reaching Geotail had origins in the low latitude boundary layer (LLBL) and had already entered the magnetosphere when the growth phase began. Late in the growth phase and in the expansion phase a higher proportion of the ions reaching Geotail had their origin in the plasma mantle. Indeed, during the expansion phase more than 90% of the ions seen by Geotail were from the mantle. The ions were accelerated enroute to the spacecraft; however, most of the ions' energy gain was achieved by non-adiabatic acceleration while crossing the equatorial current sheet just prior to their detection by Geotail. In general, the plasma mantle from both southern and northern hemispheres supplied non-adiabatic ions to Geotail, whereas the LLBL supplied mostly adiabatic ions to the distributions measured by the spacecraft. Distribution functions computed at the ion sources indicate that ionospheric ions reaching Geotail during the expansion phase were significantly heated. Plasma mantle source distributions indicated the presence of a high-latitude reconnection region that allowed ion entry into the magnetosphere when the IMF was northward. These ions reached Geotail during the expansion phase. Ions from the traditional plasma mantle had access to the spacecraft throughout the substorm.

Author

Geomagnetic Tail; Magnetic Storms; Magnetic Fields; Electric Fields; Ions; Plasmas (Physics); Plasma Layers; Boundary Layers

19990064370 Massachusetts Inst. of Tech., Cambridge, MA USA

[Global Atmospheric Chemistry/Transport Modeling and Data-Analysis]

Prinn, Ronald G., Massachusetts Inst. of Tech., USA; [1999]; 5p; In English

Contract(s)/Grant(s): NAG1-1805; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This grant supported a global atmospheric chemistry/transport modeling and data- analysis project devoted to: (a) development, testing, and refining of inverse methods for determining regional and global transient source and sink strengths for trace gases; (b) utilization of these inverse methods which use either the Model for Atmospheric Chemistry and Transport (MATCH) which is based on analyzed observed winds or back- trajectories calculated from these same winds for determining regional and global source and sink strengths for long-lived trace gases important in ozone depletion and the greenhouse effect; (c) determination of global (and perhaps regional) average hydroxyl radical concentrations using inverse methods with multiple "titrating" gases; and (d) computation of the lifetimes and spatially resolved destruction rates of trace gases using 3D models. Important ultimate goals included determination of regional source strengths of important biogenic/anthropogenic trace gases and also of halocarbons restricted by the Montreal Protocol and its follow-on agreements, and hydrohalocarbons now used as alternatives to the above restricted halocarbons.

Author

Greenhouse Effect; Atmospheric Models; Atmospheric Chemistry; Data Processing; Computation

19990064380 NASA Goddard Space Flight Center, Greenbelt, MD USA

Ozone Depletion, UVB and Atmospheric Chemistry

Stolarski, Richard S., NASA Goddard Space Flight Center, USA; 1999; 10p; In English; 3rd; UNISPACE, 19-30 Jul. 1999, Vienna, Austria; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity, Hardcopy

The primary constituents of the Earth's atmosphere are molecular nitrogen and molecular oxygen. Ozone is created when ultraviolet light from the sun photodissociates molecular oxygen into two oxygen atoms. The oxygen atoms undergo many collisions but eventually combine with a molecular oxygen to form ozone (O3). The ozone molecules absorb ultraviolet solar radiation, primarily in the wavelength region between 200 and 300 nanometers, resulting in the dissociation of ozone back into atomic oxygen and molecular oxygen. The oxygen atom reattaches to an O2 molecule, reforming ozone which can then absorb another ultraviolet photon. This sequence goes back and forth between atomic oxygen and ozone, each time absorbing a uv photon, until the oxygen atom collides with and ozone molecule to reform two oxygen molecules.

Derived from text

Ozone Depletion; Ultraviolet Radiation; Atmospheric Chemistry; Atomic Collisions; Molecular Gases; Gas Dissociation

19990064404 NASA Goddard Space Flight Center, Greenbelt, MD USA

Icehouse Effect: A Polar Autumn and Winter Cooling Trend

Wetzel, Peter J., NASA Goddard Space Flight Center, USA; 1999; In English; 79th; Hurricanes, 10-15 Jan. 1999, Dallas, TX, USA; Sponsored by American Meteorological Society, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The icehouse effect is a hypothesized polar climate trend toward cooling (or lack of warming) in response to greenhouse warming of adjacent lower latitudes. When greenhouse warmed air from lower latitudes moves over ice and snow, it generates a stronger, more stable, cappino, inversion than in a parallel case without greenhouse warming. Because the degree of decoupling between vertically adjacent air masses is directly dependent on the strength of the inversion, the capping inversion acts somewhat analogously to the walls and roof of the icehouse of generations past. What is inside the icehouse, namely the cold polar atmospheric boundary layer (ABL) air, is preserved by the "insulation" or decoupling, provided by the warm air aloft. Observations over the Arctic Ocean have shown an unexpected lack of any detectable surface warming trend over the past 40 years. This finding strongly contradicts climate model predictions that polar regions should show the strongest effect of greenhouse warming. It also stands in contrast to the consensus reached by the Intergovernmental Panel on Climate Change (IPCC), that human caused greenhouse warming is now detectable globally. One might ask: Are these Arctic observations wrong? Or, if right, is there a plausible physical explanation for them? The published observations mentioned above used about 50,000 soundings over the Arctic Ocean. Here I present a novel analysis of ALL available Arctic rawinsonde data north of 65N--a total of more than 1.1 million soundings. The analysis confirms the previously published result: There is indeed a slight climate-cooling trend in the vast majority of the data. Importantly, there are also select conditions (very strong and very weak stability of the ABL) which show a consistent, strong Arctic warming trend. It is the juxtaposition of these warming and cooling trends which defines a unique "icehouse signature" for which an explanation can be sought.

Derived from text

Ice; Snow; Cooling; Global Warming; Atmospheric Temperature; Climate Change; Greenhouse Effect; Climate Models

19990064450 NASA Goddard Space Flight Center, Greenbelt, MD USA

A View from Space: Evolution of the 1997-98 El Nino and La Nina, *1997-1998*

Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; 1999; In English; El Nino, 7-8 Apr. 1999, Tallahassee, FL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

After the last extreme El Nino in 1982-1983, an extensive in situ observing system was deployed in the tropical Pacific Ocean in support of monitoring and predicting El Nino. Within the past ten years a series of ocean and atmosphere remote sensing satellites have been launched that serve to supplement and enhance the observations being taken at the surface, and at depth, in the equatorial Pacific Ocean. The 1997-1998 "El Nino Event of the Century" has been the best monitored El Nino on record. The 1997-1998 El Nino will be the first time a major El Nino event and subsequent La Nina will have been observed from start to finish from a combination of remotely-sensed measurements of sea surface temperature, sea surface topography, sea surface winds, ocean color, and precipitation. Among some of the lessons learned to date from the 1997-1998 event have been the need for global observations in addition to just those in the equatorial Pacific Ocean. In this presentation the evolution of the 1997-1998 El Nino will be depicted from the unique vantage point provided by these space-based observations as analyzed separately, and together

as a representation of the coupled system. Comparisons and contrasts with the evolution 1982-1983 El Nino and how the in situ and space-based observations complement each other will be discussed.
Author
Remote Sensing; Earth Observing System (EOS); Satellite Observation; El Nino; Air Water Interactions; Southern Oscillation

19990064454 NASA Langley Research Center, Hampton, VA USA
Nitrogen Species in the Post-Pinatubo Stratosphere: Model Analysis Utilizing UARS Measurements
Danilin, Michael Y., Atmospheric and Environmental Research, Inc., USA; Rodriguez, Jose M., Atmospheric and Environmental Research, Inc., USA; Hu, Wenjie, Atmospheric and Environmental Research, Inc., USA; Ko, Malcolm K. W., Atmospheric and Environmental Research, Inc., USA; Weisenstein, Debra K., Atmospheric and Environmental Research, Inc., USA; Kumer, John B., Lockheed Martin Corp., USA; Mergenthaler, John L., Lockheed Martin Corp., USA; Russell, James M., III, Hampton Univ., USA; Koike, Makoto, Nagoya Univ., Japan; Yue, Glenn K., NASA Langley Research Center, USA; Jones, Nicholas B., National Inst. of Water and Atmospheric Research, New Zealand; Johnston, Paul V., National Inst. of Water and Atmospheric Research, New Zealand; Journal of Geophysical Research; Apr. 20, 1999; ISSN 0148-0227; Volume 104, No. D7, pp. 8247-8262; In English
Contract(s)/Grant(s): NAS5-98131; NAS5-32844; NAS1-20666
Report No.(s): Paper-1999JD9000024; Copyright; Avail: Issuing Activity, Hardcopy, 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 from the cryogenic limb array etalon spectrometer (CLAES), version 7, and temperature, methane, ozone, H2O, HCl, NO and NO2 from the halogen occultation experiment (HALOE), version 18. The analysis is carried out for the UARS data obtained between January 1992 and September 1994 in the 100 - to 1- mbar (approx. 17-47 km) altitude range and over 10 deg. latitude bins from 70 deg S to 70 deg N. The spatiotemporal evolution of aerosol surface area density (SAD) is adopted from analysis of the Stratospheric Aerosol and Gas Experiment (SAGE) II 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 CIONO2; (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 monthly averaged NO(x)/NO(y) ratios and the NO, NO2, and HNO3 profiles are compared with the UARS-derived data. In general, the UARS-constrained box model captures the main features of nitrogen species partitioning in the post-Pinatubo years, such as recovery of NO(x) after the eruption, their seasonal variability and vertical profiles. However, the model underestimates the NO2 content, particularly in the 30- to 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 45 deg S and 45 deg N 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 midlatitudes in both hemispheres. Reasonable agreement is obtained for HNO3 columns at 45 deg S, suggesting some problems with nitrogen species partitioning in the model. Outstanding uncertainties are discussed.
Author
Nitrogen; Stratosphere; Models; Upper Atmosphere Research Satellite (UARS); Temperate Regions; Satellite Instruments; Atmospheric Chemistry

19990064457 NASA Goddard Space Flight Center, Greenbelt, MD USA
Advances in Understanding Decadal Climate Variability
Busalacchi, Antonio J., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; PIRATA/COSTA, 2-7 May 1999, Miami, FL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recently, a joint Brazil-France-U.S. program, known as PIRATA (Pilot Research moored Array in the Tropical Atlantic), was proposed to begin the deployment of moored measurement platforms in the tropical Atlantic in order to enhance the existing observational data base and subsequent understanding of the processes by which the ocean and atmosphere couple in key regions of the tropical Atlantic Ocean. Empirical studies have suggested that there are strong relationships between tropical Atlantic upper ocean variability, SST, ocean-atmosphere coupling and regional climate variability. During the early 1980's a coordinated set of surface wind, subsurface thermal structure, and subsurface current observations were obtained as part of the U.S.-France SEQUAL-FOCAL process experiment designed to observe the seasonal response of the tropical Atlantic Ocean to surface forcing. Since that time, however, the observational data base for the tropical Atlantic Ocean has disintegrated to a few ship-tracks measuring ocean temperatures and a small collection of tide gauge stations measuring sea level. A more comprehensive set of observations, modeling and empirical studies is now in order to make progress on understanding the regional climate variability. The

proposed PIRATA program will use mooring platforms similar to the tropical Pacific Ocean TAO array to measure surface fluxes of momentum and heat and the corresponding changes in the upper ocean thermal structure. It is anticipated that the oceanic data from this monitoring array will also be used in a predictive mode for initialization studies of regional coupled climate models. of particular interest are zonal and meridional modes of ocean-atmosphere variability within the tropical Atlantic basin that have significant impacts on the regional climate of the bordering continents.
Author
Climate Models; Climate Change; Temperature Distribution; Periodic Variations; Mooring; Measuring Instruments

19990064467 NASA Goddard Space Flight Center, Greenbelt, MD USA
Clouds, Radiation, and Climate from the Earth Observing System
King, Michael D., NASA Goddard Space Flight Center, USA; 1998; 1p; In English; 13th; National Physics Congress, 27 Sep. - 2 Oct. 1998, Perth, Australia; Sponsored by Australian Inst. of Physics, Australia; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In this presentation, I will present and discuss key areas of scientific uncertainty in understanding climate and global change, focusing on specific examples of how EOS will contribute to improving our understanding of global change. In particular, I will describe how scientists intend to use MODIS, an earth-viewing cross-track scanning spectroradiometer to be flown on the Earth Observing System (EOS) AM-1 satellite to be launched in summer 1998, for the remote sensing of cloud properties. MODIS will scan a swath width sufficient to provide nearly complete global coverage every two days from a polar-orbiting, sun-synchronous, platform at an altitude of 705 km, and will provide images in 36 spectral bands between 0.415 and 14-235 microns with spatial resolutions of 250 m (2 bands), 500 m (5 bands) and 1000 m (29 bands). These bands have been carefully selected to enable advanced studies of land, ocean, and atmosphere processes. As part of this presentation, I will review the various methods that have been developed for the remote sensing of atmospheric properties using MODIS, placing primary emphasis on the principal atmospheric applications of determining the optical, microphysical and physical properties of clouds and aerosol particles from spectral reflection and thermal emission measurements. Additional applications of MODIS data to the determination of precipitable water over land will be described, as will the MODIS cloud mask used to distinguish clouds, clear sky, heavy aerosol, shadows on the ground, and fires. The physical principles behind the determination of each of these atmospheric products will be described, together with an example of their application to aircraft and/or satellite measurements.
Author
Cloud Physics; Remote Sensing; Earth Observing System (EOS); Air Water Interactions; Satellite Observation; Atmospheric Chemistry; Imaging Spectrometers

19990064481 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Lagrangian Simulation of Subsonic Aircraft Exhaust Emissions
Schoeberl, M. R., NASA Goddard Space Flight Center, USA; Morris, G. A., Valparaiso Univ., USA; [1999]; 19p; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy

To estimate the effect of subsonic and supersonic aircraft exhaust on the stratospheric concentration of NO(y), we employ a trajectory model initialized with air parcels based on the standard release scenarios. The supersonic exhaust simulations are in good agreement with 2D and 3D model results and show a perturbation of about 1-2 ppbv of NO(y) in the stratosphere. The subsonic simulations show that subsonic emissions are almost entirely trapped below the 380 K potential temperature surface. Our subsonic results contradict results from most other models, which show exhaust products penetrating above 380 K, as summarized. The disagreement can likely be attributed to an excessive vertical diffusion in most models of the strong vertical gradient in NO(y) that forms at the boundary between the emission zone and the stratosphere above 380 K. Our results suggest that previous assessments of the impact of subsonic exhaust emission on the stratospheric region above 380 K should be considered to be an upper bound.
Author
Lagrangian Function; Simulation; Subsonic Flow; Exhaust Emission; Estimating; Supersonic Flow; Supersonic Aircraft

19990064488 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's Space Environments and Effects (SEE) Program: Contamination Engineering Technology Development
Pearson, Steven D., NASA Marshall Space Flight Center, USA; Clifton, K. Stuart, NASA Marshall Space Flight Center, USA; 1999; In English; Optical System Contamination, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy

ABSTRACT The return of the Long Duration Exposure Facility (LDEF) in 1990 brought a wealth of space exposure data on materials, paints, solar cells, etc. and data on the many space environments. The effects of the harsh space environments can

provide damaging or even disabling effects on spacecraft, its materials, and its instruments. In partnership with industry, academia, and other government agencies, National Aeronautics & Space Administration's (NASA's) Space Environments & Effects (SEE) Program defines the space environments and provides technology development to accommodate or mitigate these harmful environments on the spacecraft. This program provides a very comprehensive and focused approach to understanding the space environment, to define the best techniques for both flight and ground-based experimentation, to update the models which predict both the environments and the environmental effects on spacecraft, and finally to ensure that this information is properly maintained and inserted into spacecraft design programs. This paper will describe the current SEE Program and will present SEE contamination engineering technology development and risk mitigation for future spacecraft design.
Author
Aerospace Environments; Environment Effects; Long Duration Exposure Facility; Management; Contamination; Damage

19990064525 NASA Marshall Space Flight Center, Huntsville, AL USA
Impact of Assimilating GOES-Derived Land Surface Variables into the PSU/NCAR MM5
Lapenta, William M., NASA Marshall Space Flight Center, USA; Suggs, Ron, NASA Marshall Space Flight Center, USA; Jedlovec, Gary, NASA Marshall Space Flight Center, USA; McNider, Richard T., Alabama Univ., USA; 1999; 3p; In English; Land Surface Modeling, 21-25 Jun. 1999, Boulder, CO, USA; Copyright; Avail: Issuing Activity, Hardcopy

Land surface processes are known to have a profound impact on the overlying atmosphere over a wide range of spatial and temporal scales. Many atmospheric numerical models include special parameterizations to improve the specification and partitioning of surface fluxes which are critical to the accurate prediction of warm season boundary layer behavior, organized mesoscale circulations, and convective precipitation. However, the added degrees of freedom resulting from the inclusion of vegetation and soil schemes require the specification of additional surface parameters such as vegetative resistances, green vegetation fraction, leaf area index, soil physical and hydraulic characteristics, and the vertical distribution of soil moisture. As satellite data have become more readily available in recent years, many investigations have attempted to use these new measurements to infer missing components of the surface energy budget. Sensitivity studies have shown land-skin temperature (LST) tendencies during the mid-morning hours are strongly sensitive to the surface moisture availability (a function of soil wetness and vegetation) and less sensitive to other parameters such as surface roughness. Based upon results from these and other studies, developed a simple technique that dynamically assimilates Geostationary Operational Environmental Satellite (GOES) derived land-surface products into the surface energy budget of a mesoscale model. The purpose of this paper is to demonstrate that assimilating the GOES satellite data has the potential to improve the representation of land surface characteristics within the model without prior knowledge of the land surface characteristics. The assimilation technique is presented in Section 2 and the numerical experiments are detailed in Section 3. Preliminary results and conclusions are presented in Sections 4 and 5, respectively.
Author
Vertical Distribution; Surface Roughness; Surface Energy; Parameterization; Energy Budgets; Earth Surface; Atmospheric Models

19990064535 Pechan-Avanti Group, Durham, NC USA
National Air Pollutant Emission Trends Update, *1970 - 1997*
Nizich, S. V.; Pope, A.; Dec. 1998; 130p; In English
Report No.(s): PB99-150260; EPA/454/C-98/007; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This update is comprised of a discussion of new methodologies, a brief discussion of the greenhouse gas inventory, new toxics data, an appendix (A) listing summary tables that includes biogenic emissions, and an appendix (B) listing particulate matter and ammonia methods.
NTIS
Air Pollution; Trends; Exhaust Emission

19990064536 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Overview of the Ozark Isoprene Experiment (OZIE)
Pierce, T.; Koerber, M.; Guenther, A.; King, S.; Lengerich, S.; 1999; 16p; In English
Report No.(s): PB99-149791; EPA/600/A-99/644; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

Ozone modeling studies, such as those performed for the Ozone Transport Advisory Group (OTAG), have raised concerns about extremely high concentrations (> 50 ppbv) that have been predicted over the Ozark Plataeu in southern Missouri. The Ozark Isoprene Experiment (OZIE) took place during July 1998 and included measurements of isoprene from the surface and aloft at

several locations stretching from northeastern Oklahoma to southern Indiana. Measurements were made along a balloon tethered to nearly 1000 m, surface footprint sites at five locations upwind of the balloon, surface sites in Illinois and Indiana, and from an aircraft flying at heights ranging from 300 to 1000 m over southern Illinois, southern Indiana, and southern Missouri. Preliminary analysis of the data indicates that daytime surface isoprene concentrations ranged from 1 to 36 ppbv, and isoprene concentrations measured at 600 m ranged from 0.4 to 6 ppbv. This paper provides an overview of the study design and describes measurements taken during the experiment.
NTIS
Ozone; Atmospheric Chemistry; Photochemical Reactions

19990064537 Environmental Protection Agency, Clean Air Technology Center, Research Triangle Park, NC USA
Choosing an Adsorption System for VOC: Carbon, Zeolite, or Polymers. CATC Technical Bulletin ***Final Report***
May 1999; 40p; In English
Report No.(s): PB99-149775; EPA/456/F-99/004; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This paper will make you more familiar with the issues involved in choosing an adsorber system for your plant, company, or corporation. Carbon, zeolite, and polymer adsorbents have each been used to adsorb Volatile Organic Compounds (VOC) and other pollutants from relatively dilute concentrations in air (from tens to thousands of parts per million by volume) to control emissions. This paper discusses issues involved in deciding which adsorbent to use, what type of adsorption system to use, and whether it is the right emission control technology for you.
NTIS
Adsorption; Carbon; Zeolites; Volatility; Organic Compounds

19990064543 NASA Goddard Space Flight Center, Greenbelt, MD USA
Locating Biodiversity Data Through The Global Change Master Directory
Olsen, Lola M., NASA Goddard Space Flight Center, USA; 1998; 1p; In English, 9-12 Nov. 1998, Natural Bridge, VA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Global Change Master Directory (GCMD) presently holds descriptions for almost 7000 data sets held worldwide. The directory's primary purpose is for data discovery. The information provided through the GCMD's Directory Interchange Format (DIF) is the set of information that a researcher would need to determine if a particular data set could be of value. by offering data set descriptions worldwide in many scientific disciplines - including meteorology, oceanography, ecology, geology, hydrology, geophysics, remote sensing, paleoclimate, solar-terrestrial physics, and human dimensions of climate change - the GCMD simplifies the discovery of data sources. Direct linkages to many of the data sets are also provided. In addition, several data set registration tools are offered for populating the directory. to search the directory, one may choose the Guided Search or Free-Text Search. Two experimental interfaces were also made available with the latest software release - one based on a keyword search and another based on a graphical interface. The graphical interface was designed in collaboration with the Human Computer Interaction Laboratory at the University of Maryland. The latest version of the software, Version 6, was released in April, 1998. It features the implementation of a scheme to handle hierarchical data set collections (parent-child relationships); a hierarchical geospatial location search scheme; a Java-based geographic map for conducting geospatial searches; a Related-URL field for project-related data set collections, metadata extensions (such as more detailed inventory information), etc.; a new implementation of the Isite software; a new dataset language field; hyperlinked email addresses, and more. The key to the continued evolution of the GCMD is in the flexibility of the GCMD database, allowing modifications and additions to made relatively easily to maintain currency, thus providing the ability to capitalize on current technology while importing all existing records. Changes are discussed and approved through an online "interoperability" forum. The next major release of the GCMD is scheduled for early 1999 and will include the incorporation of a new matrix-based interface, a rapid valids-based query system; improvement in the operations facility - important for future distributed options; new streamlined code for greater performance and maintainability; improvements in the handling of seven current fields proposed through the interoperability forum (at no expense to the data providers); and the release of DOCmorph, a more robust version of DIFmorph to translate many 'standards' multi-directionally. Issues and actions will also be addressed.
Author
Biological Diversity; Climate Change; Data Management; Data Bases; Java (Programming Language); Remote Sensing

19990064564 Texas Natural Resource Conservation Commission, Office of Pollution Prevention and Recycling, Austin, TX USA

Pollution Prevention Ideas from Texas Industry: A Case Study Compendium

Aug. 1998; 105p; In English

Report No.(s): PB99-144578; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The Texas Natural Resource Conservation Commission (TNRCC) provides this compendium of successful waste reduction projects to help businesses and industries with their own efforts. The TNRCC's Office of Pollution Prevention and source reduction Recycling (OPPR) compiles this compendium as part of its source reduction and waste minimization efforts. These waste reduction case studies were submitted by companies that are concerned about their waste output, are doing something about it, and are willing to share their experience. All case studies in this document were written and edited by employees of the facilities where the projects were implemented. The case studies in this compendium illustrate that pollution prevention not only improves the environment, but also saves money, improves worker safety, and makes businesses more economically competitive.

NTIS

Pollution Control; Resources Management; Technology Assessment

19990064565 Cadmus Group, Inc., Durham, NC USA

EPA Flow Reference Method Testing and Analysis: Findings Report

Jun. 1999; 118p; In English

Report No.(s): PB99-150286; EPA/430/R-99/009A; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This report describes an experimental program sponsored by the US Environmental Protection Agency (EPA) to evaluate potentia improvements to the Agency's current reference method for measuring volumetric flow (Method 2, 40 CFR Part 60, Appendix B). Method 2 (Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)) specifies measurements to determine volumetric flow, but does not prescribe specific procedures to account for yaw or pitch angles of flow when the flow in the stack is not axial. Method 2 also allows the use of only two probe types, the Type S and the Prandtl.

NTIS

Environment Protection; Gas Flow; Field Tests

19990064566 Cadmus Group, Inc., Durham, NC USA

EPA Flow Reference Method Testing and Analysis: Data Report. Pennsylvania Electric Company, G.P.U. Genco Homer City Station, Volume 1, Test Description and Appendix A (Data Distribution Package)

Sep. 1998; 360p; In English

Report No.(s): PB99-150369; EPA/430/R-98/018A; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This report describes the test site, equipment, and procedures and presents the data obtained during field testing at G.P.U. Genco Homer City Station, August 19-24, 1997. This was the third of three field tests that the US Environmental Protection Agency (EPA) conducted in 1997 as part of a major study to evaluate potential improvements to Method 3, EPA's test method for measuring flue gas volumetric flow in stacks. The report also includes a Data Distribution Package, the official, complete repository of the results obtained at the test site.

NTIS

Environment Protection; Gas Flow; Air Pollution

19990064567 Cadmus Group, Inc., Durham, NC USA

EPA Flow Reference Method Testing and Analysis: Data Report. Texas Utilities, Lake Hubbard Steam Electric Station, Volume 1, Test Description and Appendix A (Data Distribution Package)

Sep. 1998; 292p; In English

Report No.(s): PB99-150385; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This report describes the test site, equipment, and procedures and presents the data obtained during field testing at Texas Utilities Lake Hubbard Steam Electric Station, July 8-12, 1997. This was the second of three field tests that the U.S. Environmental Protection Agency (EPA) conducted in 1997 as part of a major study to evaluate potential improvements to Method 2, EPA's test method for measuring flue gas volumetric flow in stacks. The report also includes a Data Distribution Package, the official, complete repository of the results obtained at this test site.

NTIS

Environment Protection; Gas Flow; Air Pollution

19990064568 Cadmus Group, Inc., Durham, NC USA
EPA Flow Reference Method Testing and Analysis: Data Report. Texas Utilities DeCordova Steam Electric Station, Volume 1, Test Description and Appendix A (Data Distribution Package)
Sep. 1998; 308p; In English
Report No.(s): PB99-150401; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This report describes the test site, equipment, and procedures and presents the data obtained during field testing at Texas Utilities DeCordova Steam Electric Station, June 3-8, 1997. This was the first of three field tests that the U.S. Environmental Protection Agency (EPA) conducted in 1997 as part of a major study to evaluate potential improvements to Method 2, EPA's test Method for measuring flue gas volumetric flow in stacks. The report also includes a Data Distribution Package, the official, complete repository of the results obtained at this test site.
NTIS
Environment Protection; Gas Flow; Air Pollution

19990064570 ManTech Environmental Technology, Inc., Research Triangle Park, NC USA
Lower Rio Grande Valley Transboundary Air Pollution Project (TAPP), *1996 - 1997*
Mukerjee, S.; Shadwick, D. S.; Dean, K. E.; Carmichael, L. Y.; Bowser, J. J.; Apr. 1999; 244p; In English
Report No.(s): PB99-146938; EPA/600/R-99/047; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

The Lower Rio Grande Valley Transboundary Air Pollution Project (TAPP) was a US-Mexico Border XXI project to find out if air pollutants were moving across the border from Mexico into the Lower Rio Grande Valley of Texas and to see what levels of air pollutants were present. Ambient measurements and meteorology were collected data for a year (March 1996-March 1997) at three fixed sites in and near Brownsville, Texas very close to the US-Mexico border on a continuous and 24-h internal basis. Overall levels of air pollution were similar to or lower than other areas in Texas and elsewhere. Based on wind sector analyses, transport of air pollution across the border did not appear to adversely impact air quality on the US side of the Valley. Southeasterly winds from the Gulf of Mexico were largely responsible for the clean air conditions.
NTIS
Air Pollution; Air Quality; Meteorology

19990064573 California Univ., Lawrence Berkeley Lab., Environmental Energy Technologies Div., Berkeley, CA USA
Common Indoor Sources of Volatile Organic Compounds: Emission Rates and Techniques for Reducing Consumer Exposures *Final Report*
Hodgson, A. T.; Jan. 1999; 486p; In English
Contract(s)/Grant(s): 95-302
Report No.(s): PB99-159451; ARB/R-99/673; No Copyright; Avail: CASI; A04, Microfiche; A21, Hardcopy

This investigation characterized the emissions of three groups of commonly used indoor materials: latex paints, carpets and associated materials, and vinyl flooring installations. Objectives of the study were to identify the major organic compounds emitted from these sources, quantify individual compound emission rates (including toxic air contaminants), and measure the effectiveness of various practical measures that consumers can take to reduce their exposures to volatile organic compounds (VOCs) emitted from these materials during and after home remodeling activities. Mitigation scenarios included airing out materials before they were installed, increasing ventilation during installation or application, and increasing ventilation and elevating temperature after installation or application. Results of the mitigation studies indicate that increased ventilation accelerates emissions from products and reduced predicted consumer exposure to target VOCs, though not by a substantial margin. The report provides additional information on the emissions of the test materials which can be useful to a homeowner in product selection and use.
NTIS
Indoor Air Pollution; Emission; Consumers; Volatility; Organic Compounds

19990064574 California Univ., Crocker Nuclear Lab., Davis, CA USA
Loss of Particle Nitrate from Teflon Sampling Filters: Effects on Measured Gravimetric Mass *Final Report*
Ashbaugh, L. L.; Eldred, R. A.; Sep. 1998; 108p; In English
Contract(s)/Grant(s): ARB 96-305
Report No.(s): PB99-160095; ARB/R-99/677; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The report describes analysis of three data sets to evaluate the extent of mass loss on Teflon filters due to ammonium nitrate volatilization. The effect on measured mass is site-dependent, and depends on the meteorological conditions and the fraction of

PM-10 mass that consists of ammonium nitrate particles. The highest mass loss found in the California Acid Deposition Monitoring Program network occurred during summer daytime in southern California, amounting to 30-50% of the gravimetric mass. The biased mass measurement implies that the Federal Reference Method sampler for fine particles may lead to control strategies that are biased toward sources of fugitive dust and other primary particle emission sources. This analysis also has implications for the speciation monitoring methods being considered by the EPA. Samples must be collected on nylon filters for nitrate analysis, and on Teflon and quartz filters for analysis of mass, elements, and carbon.
NTIS
Gravimetry; Particle Emission; Teflon (Trademark); Sampling; Ammonium Nitrates

19990064623 Georgia Inst. of Tech., School of Earth and Atmospheric Science, Atlanta, GA USA
Tropospheric Diagnostic Modeling Studies of PEM-Tropics Field Data: Investigation of the HO(x)/NO(x)/O3 Photochemical System and Its Coupling to Sulfur and Halogen Chemistry
Davis, Douglas D., Georgia Inst. of Tech., USA; [1999]; 3p; In English
Contract(s)/Grant(s): NAG1-1769; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Over the time period of this NASA grant the PI has helped plan and execute in the PEM-Tropics A field program. He has also helped organize and co-chair three data workshops which have focused on the detailed analysis of PEM-Tropics A data. His direct participation in these analyses has led to his major involvement in 10 manuscripts, 5 of which are in print, 3 in press, and 2 submitted. A complete list of papers is included in the report.
Derived from text
Halogens; Photochemical Reactions; Sulfur; Tropical Regions; Hydroxides; Nitrogen Oxides; Ozone

19990066638 Finnish Environment Inst., Helsinki, Finland
Uncertainties of climatic change impacts in Finnish watersheds: A Bayesian network analysis of expert knowledge
Kuikka, Sakari, Finnish Environment Inst., Finland; Varis, Olli, Helsinki Univ. of Technology, Finland; Boreal Environment Research; Mar. 14, 1997; ISSN 1239-6095; Volume 2, No. 1, pp. 109-128; In English; Sponsored in part by Minisrty of Foreign Affairs; ISBN 951-35-5801-0; Copyright; Avail: Issuing Activity (Vammalan Kirjapaino Oy, P.O.Box 92, FIN-38201 Vammala, Finland); US Sales Only, Hardcopy, Microfiche

Climatic change impact studies are among the most complicated and uncertain environmental assessments scientists have ever faced. Not only are possible scenarios on key changes and impacts needed, but also estimates of their probabilities, which are of particular relevance to policy making. In modeling, the key uncertainties lie in inaccuracies and errors in parameters, and above all (but often not fully discussed) in assumed causalities (model structure). In the present study, the views of eight Finnish experts on interactions between climatic and aquatic systems were analyzed. They were asked to assess the states of 24 key variables in the climate-water system in southern Finland, using subjective probability distributions and the causalities between those variables. The methodological approach used was based on Bayesian belief networks. The highest uncertainties were seen in the changes of floods, water pH and oxygen concentrations, problems to constructions, and the recreational value of watersheds. Positive impacts can be expected on transportation and hydropower production. The relative importance of different causalities was analyzed separately for hydrological, limnological, and interest variables. The causalities between climate and hydrology did not appear very important from the interest standpoint, because uncertainty deriving from other sources masked their effects. The causality between temperature and precipitation was important throughout the model, while expected changes in temperature and precipitation were also important in the case of most variables.
Author
Climate Change; Network Analysis; Research; Bayes Theorem; Hydroelectricity; Probability Theory

19990066639 Helsinki Univ., Dept. of Geophysics, Helsinki, Finland
The Baltic Sea ice season in changing climate
Haapala, Jari, Helsinki Univ., Finland; Lepparanta, Matti, Helsinki Univ., Finland; Boreal Environment Research; Mar. 14, 1997; ISSN 1239-6095; Volume 2, No. 1, pp. 93-108; In English; ISBN 951-35-5801-0; Copyright; Avail: Issuing Activity (Vammalan Kirjapaino Oy, P.O.Box 92, FIN-38201 Vammala, Finland); US Sales Only, Hardcopy, Microfiche

The ice pack is an important and highly sensitive component in the climatology of the Baltic Sea, which has been examined with a coupled ice-ocean model. The observed Baltic ice climate variability is well reproduced by the model. Future ice season are simulated as follows: in an average winter in 2050 ice is formed only in the Bay of Bothnia, the Archipelago Sea, the cast of Gulf of Finland and on the Estonian west coast. The freezing date has been shifted about 20 days later and the break-up date 10 earlier. The ice thickness is 20 cm thinner. Locally such degrees of change could also be obtained using a simple analytic model. The coupled ice-ocean modeled 30 year's ice statistics centered on 2050 gives a 30-65 cm range for the annual maximum ice thick-

ness in the Bay of Bothnia. The length of the ice season varied from 3.5-6 months. The latest freezing occurred in January and the ice break-up happened at the earliest in April. Some ice would still be formed in 2 1 00 at Kemi.
Author
Baltic Sea; Ice; Climatology; Climate Change; Ocean Models; Mathematical Models; Finland

19990066640 Regional Environmental Agency of Hame, Tampere, Finland
Modelling the effects of climate change on lake eutrophication
Frisk, Tom, Regional Environmental Agency of Hame, Finland; Bilaletdin, Amer, Regional Environmental Agency of Hame, Finland; Kallio, Kari, Finnish Environment Inst., Finland; Saura, Matti, Regional Environmental Agency of Hame, Finland; Boreal Environment Research; Mar. 14, 1997; ISSN 1239-6095; Volume 2, No. 1, pp. 53-67; In English; Sponsored in part by Maj and Tor Nessling Foundation; ISBN 951-35-5801-0; Copyright; Avail: Issuing Activity (Vammalan Kirjapaino Oy, P.O.Box 92, FIN-38201, Vammala, Finland); US Sales Only, Hardcopy, Microfiche

The effects of climate change on lake eutrophication were studied using a dynamic simulation model. The climate scenarios of the Finnish Research Programme on Climate Change (SILMU) were applied. As the model, a modified version of the Swedish PROBE was used. The description of water quality and growth of plankton was included in the model in Finland. There were three case study lakes: Lake Villikkalanjarvi in southern Finland and Lakes Kalliojdrvi and Lengelmavesi in central Finland. The model was successfully calibrated to all three lakes. According to the simulations the effects of climate change on the trophic status of the lakes will not be great. An increase in the spring peak of phytoplankton is expected, but the average biomasses will remain the same as at present. However, on the basis of the modelling results we can conclude that climate change may cause a risk for eutrophication in some lakes.
Author
Climate Change; Dynamic Models; Simulation; Finland

19990066641 Finnish Environment Inst., Helsinki, Finland
Effects of climatic change on hydrological patterns of a forested catchment: A physically based modeling approach
Lepisto, Ahti, Finnish Environment Inst., Finland; Kivinen, Yrjo, Finnish Environment Inst., Finland; Boreal Environment Research; Mar. 14, 1997; ISSN 1239-6095; Volume 2, No. 1, pp. 19-31; In English; ISBN 951-35-5801-0; Copyright; Avail: Issuing Activity (Vammalan Kirjapaino Oy, P.O.Box 92, FIN-38201, Vammala, Finland); US Sales Only, Hardcopy, Microfiche

Effects of climatic change on hydrological patterns on a catchment scale were evaluated using a semi-distributed, topographic TOPMODEL. The model was calibrated to a forested catchment for the period 1991-92 with a daily time step, using a model version with a snow subroutine. The main criteria in the model calibration were to fit simulated and observed runoff, to obtain an adequate water balance and to compare simulated and observed groundwater depths and water equivalents of snow. The model was tested with data from the years 1993-94, and long-term forecasts of up to 100 years were conducted. Precipitation and temperature input were obtained from the CLIGEN weather generator, which generates stochastic daily time series of these variables, according to the SILMU-policy oriented scenarios high (annual increase in precipitation 1.5%/decade and in temperature 0.6 C/decade), and low (annual increase in precipitation 0.25%/decade and in temperature 0.1 C/decade). Ten high scenarios and ten low scenarios were used as an input to TOPMODEL, in order to predict long-term changes of annual averages and interannual variability in runoff, evapotranspiration and average amount of soil water. According to the model runs conducted, first an increase of 4% (12 mm) and then a slight decrease (2-7%, i.e. 6-18 mm) in annual runoff was predicted. The most notable change in runoff was the change from the present spring high flow to a more evenly distributed winter flow. Soil moisture was predicted to increase during the autumn and winter periods and to decrease during summer. A strong reduction of 80-90% in the volume and duration of the snow cover was predicted by the high SILMU scenario during the next 100 years. The reduction by 2050 was predicted to be about 50%. Already at present, three years (1991-93) of the observation period could be considered as 'future' winters with very little snow and several distinct, short snow accumulation/melting periods.
Author
Climate Change; Forecasting; Hydrological Cycle; Evapotranspiration; Forests

19990066642 Finnish Environment Inst., Helsinki, Finland
Climate change and water resources in Finland
Vehvilainen, Bertel, Finnish Environment Inst., Finland; Huttunen, Markus, Finnish Environment Inst., Finland; Boreal Environment Research; Mar. 14, 1997; ISSN 1239-6095; Volume 2, No. 1, pp. 3-18; In English; ISBN 951-35-5801-0; Copyright; Avail: Issuing Activity (Vammalan Kirjapaino Oy, P.O.Box 92, FIN-38201, Vammala, Finland); US Sales Only, Hardcopy, Microfiche

The effects of climate change on water resources in Finland have been evaluated by conceptual watershed models. The central SILMU scenario is used as a climate change approximation for the future. The evaluated water balance terms are areal corrected

precipitations, evapotransportation, lake evaporation, water equivalent of snow, soil moisture, groundwater and runoff. Changes in in the mean values and seasonal distributions of river discharges and lake water level are also presented. The precipitation and temperature increases assumed by the central SILMU-scenario will not essentially affect annual water balance, but will strongly change the seasonal distribution of runoff and other water balance terms. Snow cover will diminish or almost vanish and its duration will be shortened by one to four month in different scenario runs due to warming. The winter will become water and snow-free due to increase precipitation and frequent thawing periods. Spring floods will diminish or vanish and winter floods will occur instead. The summers will become drier due to the longer summer season and increased evapotranspiration and lake evaporation.
Author
Climate Change; Water Resources; Finland; Snow Cover; Ground Water; Hydrology Models; Evapotranspiration

19990067232 NASA Goddard Space Flight Center, Greenbelt, MD USA
Tropical Rainfall Analysis Using TRMM in Combination With Other Satellite Gauge Data: Comparison with Global Precipitation Climatology Project (GPCP) Results
Adler, Robert F., NASA Goddard Space Flight Center, USA; Huffman, George J., NASA Goddard Space Flight Center, USA; Bolvin, David, NASA Goddard Space Flight Center, USA; Nelkin, Eric, NASA Goddard Space Flight Center, USA; Curtis, Scott, NASA Goddard Space Flight Center, USA; 1999; In English; 79th; Global Change Studies, 10-15 Jan. 1999, Dallas, TX, USA; Sponsored by American Meteorological Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

This paper describes recent results of using Tropical Rainfall Measuring Mission (TRMM) information as the key calibration tool in a merged analysis on a 1 deg x 1 deg latitude/longitude monthly scale based on multiple satellite sources and raingauge analysis. The procedure used to produce the GPCP data set is a stepwise approach which first combines the satellite low-orbit microwave and geosynchronous IR observations into a ”multi-satellite” product and than merges that result with the raingauge analysis. Preliminary results produced with the still-stabilizing TRMM algorithms indicate that TRMM shows tighter spatial gradients in tropical rain maxima with higher peaks in the center of the maxima. The TRMM analyses will be used to evaluate the evolution of the 1998 ENSO variations, again in comparison with the GPCP analyses.
Derived from text
Rain; Tropical Regions; Climatology; Measuring Instruments; Precipitation (Meteorology); Rain Gages

19990068862 NASA Goddard Space Flight Center, Greenbelt, MD USA
Contributions of the SSBUV Experiment to Long-Term Ozone Monitoring
Hilsenrath, E., NASA Goddard Space Flight Center, USA; Cebula, R. P., Hughes STX, Inc., USA; Bories, M. C., Ideas, Inc., USA; Cerullo, J. J., Ideas, Inc., USA; DeCamp, P. W., Hughes STX, Inc., USA; Huang, L.–K., Hughes STX, Inc., USA; Hui, C. N., Ideas, Inc., USA; Janz, S. J., Maryland Univ. Baltimore County, USA; Kelly, T. J., Hughes STX, Inc., USA; McCullough, K. R., Ideas, Inc., USA; Mederios J. J., Ideas, Inc., USA; Riley, J. T., NASA Goddard Space Flight Center, USA; Rice, B. K., Ideas, Inc., USA; Thorpe, C. D., NASA Goddard Space Flight Center, USA; 1996; 5p; In English; 18th; Quadrennial Ozone Symposium, 12-21 Sep. 1996, Geneva, Switzerland
Contract(s)/Grant(s): NASw-4864; NAS5-31755; NAS5-31729; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The SSBUV experiment flew eight Space Shuttle missions from October 1989 to January 1996 in conducted eight missions between October 1989 and support of the US long-term ozone monitoring program. Contributions of the SSBUV experiment are reviewed in this paper. SSBUV data are being used to provide and validate the absolute and long-term calibrations of multiple satellite-based ozone monitoring instruments. SSBUV observed a significant decrease in Northern hemisphere total ozone from the winter of 1992 to the following winter, and SSBUV data were combined with Nimbus-7 data to assess long-term ozone changes during the 1980’s. SSBUV solar irradiance measurements are being used to determine the absolute solar spectral irradiance in the middle UV, validate solar data from two UARS instruments, and independently measure long-term solar change at wavelengths important for ozone photochemistry. SSBUV data where also used to study the effects of surface reflectivity and rotational Raman scattering on the ozone retrievals, determine the NO column amount and its altitude distribution, measure the UV lunar albedo, and assist in the optimization of wavelengths for new instruments.
Author
Calibrating; Ozone; Raman Spectra; Solar Radiation; Ultraviolet Radiation

19990069591 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Correlations of Stratospheric Abundances of CH4 and N2O Derived from ATMOS Measurements
Rinsland, C. P., Atmospheric and Environmental Research, Inc., USA; Manney, G. L., Jet Propulsion Lab., California Inst. of Tech., USA; Gunson, M. R., Jet Propulsion Lab., California Inst. of Tech., USA; Rinsland, C. P., NASA Langley Research Center, USA; Zander, R., Liege Univ., Belgium; Geophysical Research Letters; Aug. 01, 1998; ISSN 0094-8534; Volume 25, No. 15, pp.

2777-2780; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS1-96022; NAS1-20666
Report No.(s): Paper-98GL01977; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Atmospheric Trace MOlecule Spectroscopy (ATMOS) measurements made over a wide range of altitudes and latitudes demonstrate compact correlations between mixing ratios of CH, and N,O. Tight but distinct correlations are observed for the tropics, the springtime Arctic vortex, and the extra-tropics/extra-vortex regions, indicating dynamical isolation between these regions. Little variability is apparent in correlations between CH4 and N20 from measurements made in different years (1992, 1993, and 1994), seasons (March/April and November), and hemispheres.
Author
Arctic Regions; Methane; Nitrogen Oxides; Stratosphere; Tropical Regions; Mixing Ratios

19990069593 NASA Goddard Space Flight Center, Greenbelt, MD USA
Atmospheric Ozone: Global Ozone Monitoring Experiments (GOME): Comparison of Back Scattered Measurements and O3 DOAS/BUV Retrievals
Burrows, J. P., Bremen Univ., Germany; Weber, M., Bremen Univ., Germany; Hilsenrath, E., NASA Goddard Space Flight Center, USA; Gleason, J., NASA Goddard Space Flight Center, USA; Janz, S., NASA Goddard Space Flight Center, USA; Cebula, R. P., Hughes STX, Inc., USA; Gu, X.–Y., Hughes STX, Inc., USA; Chance, K., Smithsonian Astrophysical Observatory, USA; Sep. 1996; 5p; In English; 18th; Quadrennial Ozone Symposium, 12-21 Sep. 1996, Geneva, Switzerland
Contract(s)/Grant(s): NASw-4864; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Global Ozone Monitoring Experiments (GOME) is a new passive remote sounding instrument launched aboard ERS-2 in 1995, whose mission is to determine the amounts and distributions of 03 and a variety of trace gases. The flight of the NASA Shuttle Solar backscatter ultraviolet (SSBUV) aboard the Space Shuttle Endeavor in January 1996 provided a unique opportunity to compare GOME and SSBUV measurements. Comparisons of both solar irradiance and radiance showed good agreement. The retrieval of the total column of 03 was compared by using an adapted Total Ozone Mapping Spectrometer (TOMS) V7 and the Gome Data Processor (GDP) Differential Optical Absorption Spectroscopy (DOAS) VI.5 algorithms on the same GOME data. Good agreement was obtained in the winter hemisphere and also in the summer hemisphere up to solar zenith angles (SZA) of 50 degrees. At higher SZA in the summer hemisphere, however, a systematic dependence on the SZA was observed, which most likely arises from the use of somewhat different 03 climatologies by the two algorithms.
Author
Ozone; Algorithms; Solar Radiation

19990069623 NASA Goddard Inst. for Space Studies, New York, NY USA
Climatic and Demographic Consequences of the Massive Volcanic Eruption of 1258
Stothers, Richard B., NASA Goddard Inst. for Space Studies, USA; [1999]; 23p; In English
Report No.(s): GCN-99-44; No Copyright; Avail: Issuing Activity, Hardcopy

Somewhere in the tropics, a volcano exploded violently during the year 1258, producing a massive stratospheric aerosol veil that eventually blanketed the globe. Arctic and Antarctic ice cores suggest that this was the world's largest volcanic eruption of the past millennium. According to contemporary chronicles, the stratospheric dry fog possibly manifested itself in Europe as a persistently cloudy aspect of the sky and also through an apparently total darkening of the eclipsed Moon. Based on a sudden temperature drop for several months in England, the eruption's initiation date can be inferred to have been probably January 1258. The frequent cold and rain that year led to severe crop damage and famine throughout much of Europe. Pestilence repeatedly broke out in 1258 and 1259; it occurred also in the Middle East, reportedly there as plague. Another very cold winter followed in 1260-1261. The troubled period's wars, famines, pestilences, and earthquakes appear to have contributed in part to the rise of the European flagellant movement of 1260, one of the most bizarre social phenomena of the Middle Ages. Analogies can be drawn with the climatic aftereffects and European social unrest following another great tropical eruption, Tambora in 1815. Some generalizations about the climatic impacts of tropical eruptions are made from these and other data.
Author
Volcanoes; Climate; Demography; Climatology; Volcanology

19990069937 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Role of HO(x) in Super- and Subsonic Aircraft Exhaust Plumes
Hanisco, T. F., Harvard Univ., USA; Wennberg, P. O., Harvard Univ., USA; Cohen, R. C., Harvard Univ., USA; Anderson, J. G., Harvard Univ., USA; Fahey, D. W., National Oceanic and Atmospheric Administration, USA; Keim, E. R., National Oceanic and Atmospheric Administration, USA; Gao, R. S., National Oceanic and Atmospheric Administration, USA; Wamsley, R. C., Na-

tional Oceanic and Atmospheric Administration, USA; Donnelly, S. G., National Oceanic and Atmospheric Administration, USA; DelNegro, L. A., National Oceanic and Atmospheric Administration, USA; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Kelly, K. K., National Oceanic and Atmospheric Administration, USA; Proffitt, M. H., National Oceanic and Atmospheric Administration, USA; Geophysical Research Letters; Jan. 01, 1997; ISSN 0094-8534; Volume 24, No. 1, pp. 65-68; In English

Report No.(s): Paper-96GL03724; Copyright; Avail: Issuing Activity, Hardcopy

The generation of sulfuric acid aerosols in aircraft exhaust has emerged as a critical issue in determining the impact of supersonic aircraft on stratospheric ozone. It has long been held that the first step in the mechanism of aerosol formation is the oxidation of SO2 emitted from the engine by OH in the exhaust plume. We report in situ measurements of OH and HO2 in the exhaust plumes of a supersonic (Air France Concorde) and a subsonic (NASA ER-2) aircraft in the lower stratosphere. These measurements imply that reactions with OH are responsible for oxidizing only a small fraction of SO2 (2%), and thus cannot explain the large number of particles observed in the exhaust wake of the Concorde.

Author

Supersonic Aircraft; Exhaust Gases; Combustion Products; Air Pollution; Sulfuric Acid; Aerosols; Plumes; Atmospheric Composition

19990069938 NASA Goddard Space Flight Center, Greenbelt, MD USA

Dehydration and Denitrification in the Arctic Polar Vortex During the 1995-1996 Winter

Hintsa, E. J., Harvard Univ., USA; Newman, P. A., NASA Goddard Space Flight Center, USA; Jonsson, H. H., Naval Postgraduate School, USA; Webster, C. R., Jet Propulsion Lab., California Inst. of Tech., USA; May, R. D., Jet Propulsion Lab., California Inst. of Tech., USA; Herman, R. L., Jet Propulsion Lab., California Inst. of Tech., USA; Lait, L. R., NASA Goddard Space Flight Center, USA; Schoeberl, M. R., NASA Goddard Space Flight Center, USA; Elkins, J. W., National Oceanic and Atmospheric Administration, USA; Wamsley, P. R., National Oceanic and Atmospheric Administration, USA; Dutton, G. S., National Oceanic and Atmospheric Administration, USA; Bui, T. P., NASA Ames Research Center, USA; Kohn, D. W., Harvard Univ., USA; Anderson, J. G., Harvard Univ., USA; Geophysical Research Letters; Feb. 15, 1998; ISSN 0094-8534; Volume 25, No. 4, pp. 501-504; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC2-913

Report No.(s): Paper-98GL00115; Copyright; Avail: Issuing Activity, Hardcopy

Dehydration of more than 0.5 ppmv water was observed between 18 and 19 km (theta approximately 450-465 K) at the edge of the Arctic polar vortex on February 1, 1996. More than half the reactive nitrogen (NO(y)) had also been removed, with layers of enhanced NO(y) at lower altitudes. Back trajectory calculations show that air parcels sampled inside the vortex had experienced temperatures as low as 188 K within the previous 12 days, consistent with a small amount of dehydration. The depth of the dehydrated layer (approximately 1 km) and the fact that trajectories passed through the region of ice saturation in one day imply selective growth of a small fraction of particles to sizes large enough (>10 micrometers) to be irreversibly removed on this timescale. Over 25% of the Arctic vortex in a 20-30 K range Transport of theta is estimated to have been dehydrated in this event.

Author

Dehydration; Denitrogenation; Stratosphere; Arctic Regions; Vortices

19990069939 NASA Ames Research Center, Moffett Field, CA USA

Troposphere-to-Stratosphere Transport in the Lowermost Stratosphere from Measurements of H2O, CO2, N2O, and O3

Hintsa, E. J., Harvard Univ., USA; Boering, K. A., Harvard Univ., USA; Weinstock, E. M., Harvard Univ., USA; Anderson, J. G., Harvard Univ., USA; Gary, B. L., Jet Propulsion Lab., California Inst. of Tech., USA; Pfister, L., NASA Ames Research Center, USA; Daube, B. C., Harvard Univ., USA; Wofsy, S. C., Harvard Univ., USA; Loewenstein, M., NASA Ames Research Center, USA; Podolske, J. R., NASA Ames Research Center, USA; Margitan, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; Bui, T. P., NASA Ames Research Center, USA; Geophysical Research Letters; Jul. 15, 1998; ISSN 0094-8534; Volume 25, No. 14, pp. 2655-2658; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC2-913; NCC2-694

Report No.(s): Paper-98GL01797; Copyright; Avail: Issuing Activity, Hardcopy

The origin of air in the lowermost stratosphere is investigated with measurements from the NASA ER-2 aircraft. Air with high water vapor mixing ratios was observed in the stratosphere at theta approximately 330-380 K near 40 N in May 1995, indicating the influence of intrusions of tropospheric air. Assuming that observed tracer-tracer relationships reflect mixing lines between tropospheric and stratospheric air masses, we calculate mixing ratios of H2O (12-24 ppmv) and CO2 for the admixed tropospheric air at theta = 352-364 K. Temperatures on the 355 K surface 20-40 N were low enough to dehydrate air to these values. While most ER-2 CO2 data in both hemispheres are consistent with tropical or subtropical air entering the lowermost stratosphere, mea-

surements from May 1995 for theta is less than 362 K suggest that entry of air from the midlatitude upper troposphere can occur in conjunction with mixing processes near the tropopause.
Author
Troposphere; Stratosphere; Atmospheric Circulation; Air Masses

19990069951 NASA Langley Research Center, Hampton, VA USA
An Evaluation of the Quality of Halogen Occultation Experiment Ozone Profiles in the Lower Stratosphere
Bhatt, Praful P., Science Applications International Corp., USA; Remsberg, Ellis E., NASA Langley Research Center, USA; Gordley, Larry L., G and A Technical Software, Inc., USA; McInerney, Joseph M., Science Applications International Corp., USA; Brackett, Vince G., Science Applications International Corp., USA; Russell, James M., III, Hampton Univ., USA; Journal of Geophysical Research; Apr. 27, 1999; ISSN 0148-0227; Volume 104, No. D8, pp. 9261-9275; In English
Report No.(s): Paper-1999JD900055; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The archived ozone profiles from the Halogen Occultation Experiment (HALOE) have already been corrected for the effects of the spectrally varying, interfering absorption due to aerosols composed of aqueous sulfuric acid, and agreement with correlative measurements in the stratosphere is generally excellent. However, comparisons of sets of coincident HALOE and ozonesonde profiles indicate occasional large differences at the lowest levels of the stratosphere. Most of those instances occur at altitudes just below a well-defined minimum in the 5.26 microns channel aerosol extinction profile, whose wavelength dependence is not represented by a sulfuric acid aerosol model. Further, when the aerosol extinction exceeds about 10(exp 3)/km, the aerosol correction to the ozone channel transmittances is both large and uncertain. After screening out the HALOE ozone profile segments whose corresponding aerosol/cirrus corrections are likely uncertain and after averaging lie ozonesonde profiles into 2.5 km thick layers, we find that the HALOE ozone areas, on average, to within 10% of their coincident ozonesonde measurements down to 100 hPa at tropical/subtropical latitudes and to 200 hPa at extratropical latitudes. A tightening of the coincidence criteria for the comparisons does not improve the mean differences for the sets nearly as much. Part of the variance of the paired differences was also accounted for when the ozonesonde profile values were integrated into those 2.5 km layers, prior to taking differences. This improvement is due mainly to the vertical averaging of the local, higher-resolution ozonesonde data, matching the lower resolution for HALOE ozone in the lower stratosphere. It is concluded that HALOE is providing accurate ozone profiles throughout the lower stratosphere, when its correction for interfering aerosols has been well characterized and when cirrus layers are not indicated.
Author
Evaluation; Halogen Occultation Experiment; Ozone; Stratosphere; Aerosols

19990070297 NASA Goddard Space Flight Center, Greenbelt, MD USA
Atmospheric Ozone Solar UV Contribution to Stratospheric Ozone Variations 1989-1994*, 1989-1994*
DeLand, Matthew T., Hughes STX, Inc., USA; Cebula, Richard P., Hughes STX, Inc., USA; Hilsenrath, Ernest, NASA Goddard Space Flight Center, USA; 1996; 5p; In English; 18th; Quadrennial Ozone Symposium, 12-21 Sep. 1996, Geneva, Switzerland
Contract(s)/Grant(s): NASw-4864; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Understanding the magnitude of variations in the solar UV flux is important for separating natural ozone from anthropogenic changes. The NOAA-II Solar Backscattering Ultra Violet (SBUV/2)instrument made ozone measurements from December 1988 to April 1995, when it was deactivated due to orbital drift and declining instrument health. As part of its regular observations, NOAA-II also made daily spectral scan measurements of solar UV irradiance in the 160-405 nanometer region from February 1989 to October 1994. The NOAA-11 solar data have recently been reprocessed, using an updated absolute calibration and revised long-term characterization. An on-board calibration system and comparisons with coincident Shuttle SBUV (SSBUV) measurements were used to correct for long-term NOAA-11 instrument sensitivity changes. Using the reprocessed NOAA-II data, we have produced time series of absolute solar irradiance data at photochemically important wavelengths for the period 1989-1994. From these results and independent estimates of ozone sensitivity to solar UV variations, we estimate a total ozone decrease of 1-2% and a decrease in 2 mb ozone of 5-7% due to the long-term decrease in solar irradiance during the declining phase of solar cycle 22.
Author
Ozone; Solar Radiation; Stratosphere; Ultraviolet Radiation; Ozone Depletion

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GEOPHYSICS

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

19990064382 Harvard Univ., Div. of Engineering and Applied Sciences, Cambridge, MA USA
Stratospheric Tracers of Atmospheric Transport (STRAT) Campaign: ER-2 Participation ***Final Report, 1 Mar. 1995 - 30 Sep. 1998***
Anderson, James G., Harvard Univ., USA; Mar. 23, 1999; 7p; In English
Contract(s)/Grant(s): NCC2-913; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The NASA Stratospheric Tracers of Atmospheric Transport (STRAT) mission was initiated to advance knowledge of the major transport mechanisms of the upper troposphere-lower stratosphere. This is the region of the atmosphere within which exchange processes take place that critically determine the response of the climate system and ozone distribution to changing conditions triggered by the release of chemicals at the surface. The mission series that extended from October 1995 to November 1997 was extremely successful. The scientific advances that emerged from that mission include analyses of- troposphere-to-stratosphere transport in the lowermost stratosphere from measurements of H2O, CO2, N2O, and O3; the effects of tropical cirrus clouds on the abundance of lower stratospheric ozone; the role of HO, in super- and subsonic aircraft exhaust plumes; and dehydration and denitrification in the arctic polar vortex during the 1995-96 winter.
Derived from text
Arctic Regions; Atmospheric Composition; Carbon Dioxide; Chemical Composition; Stratosphere; Tropical Regions; Troposphere

19990064395 NASA Marshall Space Flight Center, Huntsville, AL USA
High Time Resolution Study of the Hemispheric Power Carried by Energetic Electrons Into the Ionosphere During the May 19-20, 1996, Auroral Activity
Lummerzheim, D., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Evans, D., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Rees, M. H., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Geophysical Research Letters; [1997]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The UVI imager on board the POLAR satellite offers the opportunity to obtain high time resolution global auroral images. The spectral resolution of the imager is sufficient to separate the auroral emission from the scattered sunlight, even when the entire auroral zone is sunlit. The energy flux of the precipitating electrons is derived from the surface brightness through the LBH-long filter. Global images which have the dayglow removed are spatially integrated to yield the total hemispheric electron energy flux. This parameter, the hemispheric power, has found much application in ionospheric modeling. It can also be derived from electron spectra measured along the track of the NOAA/TIROS satellites that are combined with average empirical auroral precipitation patterns. We show that the hemispheric power input derived from the two-dimensional images represents a substantial improvement in the temporal variability of this parameter. We present an example for the period of 19/20 May 1996 by comparing power indices derived from NOAA/TIROS measurements with those derived from the UVI images.
Author
Spectral Resolution; Research; Hemispheres; Energy Spectra; Electron Energy; Auroral Zones; Ionospheric Propagation

19990064397 NASA Marshall Space Flight Center, Huntsville, AL USA
A Dayside Auroral Energy Desposition Case Study Using the Polar Ultraviolet Imager
Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Elsen, R., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Chen, L., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Geophysical Research Letters; [1997]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In this letter, we report preliminary results from a study of dayside auroral energy deposition during quiet times using global auroral images acquired by the Ultraviolet Imager experiment on the Polar spacecraft. Solar wind plasma and interplanetary magnetic field measurements from the Wind spacecraft and kp values were used to characterize the state of the magnetosphere. The auroral oval was observed for a two- hour period in spring and summer during relatively quiet times (k(sub p) approx. 0 to 1).

We find that, although the nightside energy deposition rate varied by an order of magnitude to as low as 1 x 10(exp 16) ergs per second (1 GW), the dayside was much less variable and remained between 4 and IO GW.
Author
Research; Auroras; Energy Transfer; Electromagnetic Measurement

19990064444 NASA Goddard Space Flight Center, Greenbelt, MD USA
Geospace Multiprobes
December 1997; 30p; In English; Original contains color illustrations
Report No.(s): NASA/NP-1998-09-053-GSFC; NAS 1.83:09-053-GSFC; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The foregoing science discussions, the required measurements and the detailed implementation plans should provide ample evidence in support of the contention that geospace multiprobes are the next logical step forward in exploration of our environment. The advancement of technology in areas such as mechanical engineering, power systems, circuit miniaturization, high-capacity data storage, and innovative propulsion systems all allow the implementation of multiple satellite configurations within a constrained budget. The problems that have plagued our interpretation of previous data and the advancements that could not be made without the availability of multiple platforms can now be overcome. New multiprobe missions promise to produce a real leap forward in our understanding of the geospace environment for they will allow all the required measurements to be made in all the right places. The most efficient use of resources, and application of experience and knowledge, will be achieved from a series of missions such as envisioned by Solar Terrestrial Probes. The return for our investment in a multiprobe mission sequence is the organized advancement of our understanding in two key areas. First, we will understand the geospace environment to a level that will allow real quantitative assessment of the impacts of humans and the vulnerability of human space systems. Second, this advancement will allow us to more fully evaluate present and future data from other planetary environments to assess differences important to habitability.
Author
Data Storage; Miniaturization; Planetary Environments; Vulnerability; Measuring Instruments

19990064456 NASA Goddard Space Flight Center, Greenbelt, MD USA
Impact of a Merged Precipitation Data on Global Soil Moisture Variability
Yang, Runhua, General Sciences Corp., USA; Houser, Paul R., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 3rd; Global Energy and Water Cycle (GSWP Special Section), 16-19 Jun. 1999, Beijing, China; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Accurate soil moisture information has proved to be important to climate simulations and climate and weather forecasts. However, many difficulties exist that limit our understanding of soil moisture distribution and variability. One of them is the lack of accurate precipitation with appropriate spatial and temporal resolution. Precipitation as an input forcing to the land surface greatly influences soil moisture characteristics and variability. to improve precipitation data quality, an algorithm has been developed to generate a spatially and temporally continuous 3-hourly global precipitation data for the period of 1987 to present. This precipitation product is a combination of the precipitation from Special Sensor Microwave Imager (SSMI) with the Goddard Earth Observing System-1 Data Assimilation System (GEOS-1 DAS) employing a Physical-space Statistical Analysis System (PSAS). In this study we investigate the impact of this merged/analyzed precipitation data on the global soil moisture variability using an Off-line Land-surface GEOS Assimilation (OLGA) system. Two OLGA integrations starting from 1987 to 1993 are performed forced with the analyzed and GEOS-1 DAS precipitation respectively. We examine the spatial and temporal characteristics of soil moisture variability in response to the analyzed precipitation. The influence of this merged precipitation on the soil moisture variability and regional hydrological budget is estimated throughout the comparison with the results forced with the GEOS-1 DAS precipitation only. In the OLGA the sut@-grid scale horizontal heterogeneity is explicitly represented on the tile space. This provides a means to assess the role of the surface moisture heterogeneity in the interaction with the surface atmosphere and surface hydrological budget, and to validate OLGA results at tile space with in situ observation. ABRACOS (Anglo-Brazilian Amazonian Climate Observation Study), FIFE (First ISLSCP Field Experiment) I and HAPEX data will be used in the validation.
Author
Data Systems; Precipitation (Meteorology); Soil Moisture; Statistical Analysis; Variability; Algorithms

19990064461 NASA Goddard Space Flight Center, Greenbelt, MD USA
Recent Development on O(+)-O Collision Frequency and Ionosphere-Middle Atmosphere Coupling
Omidvar, K., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; EGS General Assembly, 19-23 Apr. 1999, The Hague, Netherlands; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The collision frequency between an oxygen atom and its singly charged ion controls the transfer of energy between the solar radiation and the thermosphere. There were a long standing discrepancy, extending over a decade, between the theoretical and empirical determination of this frequency, and the empirical value of this frequency exceeded the theoretical value by a factor of 1.7. Recent improvements in theory were obtained by using accurate oxygen ion-oxygen atom potential energy curves, and partial wave quantum mechanical calculations. Similarly, recently three independent statistical methods were applied to the empirical determination of this frequency. These methods give results consistent with each other, and together with the recent theoretical improvements, bring the ratio close to unity, as it should be. It will be shown that the old statistical method for this determination contained accumulative errors, leading to a larger value for this ratio. The recent improvements lead to an average value of the empirical to the theoretical ratio equal to 0.98, with an uncertainty of +/- 8%, resolving the old discrepancy between theory and observations. The main source of uncertainties are errors in the profile of the oxygen atom density, which is of the order of 11 %. An alternative method to find the oxygen atom density is being suggested.
Author
Collision Rates; Ionic Collisions; Energy Transfer; Atomic Collisions; Solar Radiation; Thermosphere

19990064485 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Komunikasi HF, Jakarta, Indonesia
Equatorial Region Ionosphere Response Resulting from Solar Activity at the Peak of the 22nd Cycle ***Respons Ionosfer Daerah Equator Akibat Aktivitas Matahari Pada Puncak Siklus - 22***
Rachyany, Sity, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Syarifudin, Habirun, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Syarifudin, M., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April 1998; ISSN 0126-9754, No. 55, pp. 15-21; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Response of the ionosphere due to solar activity during January to June, 1989 (maximum phase of solar activity) over Pontianak and Vanimo, analyzed by using a sample of critical frequency of ionospheric F2 layer influenced by solar activity indicated by x-ray intensity and indirectly geomagnetic KP index. From the data that have been analyzed, it is obtained that generally there is no significant changes of foF2 before, during and after the accuracy x-ray, both in Pontianak and Vanimo, except during the day time in Pontianak represented negative correlation. It is likely due to median value, by which the extreme value was removed.
Author
Equatorial Regions; Ionospheres; Solar Activity; F 2 Region

19990064522 NASA Marshall Space Flight Center, Huntsville, AL USA
On the Relative Importance of Convection and Temperature on the Behavior of the Ionosphere in North American during January 6-12, 1997
Richards, P. G., NASA Marshall Space Flight Center, USA; Buonsanto, M. J., NASA Marshall Space Flight Center, USA; Reinisch, B. W., NASA Marshall Space Flight Center, USA; Holt, J., NASA Marshall Space Flight Center, USA; Fennelly, J. A., NASA Marshall Space Flight Center, USA; Scali, J. L., NASA Marshall Space Flight Center, USA; Comfort, R. H., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J., NASA Marshall Space Flight Center, USA; Brittnacher, M., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Measurements from a network of digisondes and an incoherent scatter radar In Eastern North American For January 6-12, 1997 have been compared with the Field Line Interhemispheric Plasma (FLIP) model which now includes the effects of electric field convective. With the exception of Bermuda, the model reproduces the daytime electron density very well most of the time. As is typical behavior for winter solar minimum on magnetically undisturbed nights, the measurements at Millstone Hill show high electron temperatures before midnight followed by a rapid decay, which is accompanied by a pronounced density enhancement in the early morning hours. The FLIP model reproduces the nighttime density enhancement well, provided the model is constrained to follow the topside electron temperature and the flux tube is full. Similar density enhancements are seen at Goose Bay, Wallops Island and Bermuda. However, the peak height variation and auroral images indicate the density enhancements at Goose Bay are most likely due to particle precipitation. Contrary to previously published work we find that the nighttime density variation at Millstone Hill is driven by the temperature behavior and not the other way around. Thus, in both the data and model, the overall nighttime density is lowered and the enhancement does not occur if the temperature remains high all night. Our calculations show that convections of plasma from higher magnetic latitudes does not cause the observed density maximum but it may enhance the density maximum if over-full flux tubes are convected over the station. On the other had, convection of flux tubes with high temperatures and depleted densities may prevent the density maximum from occurring. Despite the success in modeling the nighttime density enhancements, there remain two unresolved problems. First, the measured density decays much faster than

the modeled density near sunset at Millstone Hill and Goose Bay though not at lower latitude stations. Second, we cannot fully explain the large temperatures before midnight nor the sudden decay near midnight.
Author
Convection; Temperature Effects; Electric Fields; Augmentation; Electron Density (Concentration); Solar Activity Effects; Earth Ionosphere

19990064559 Columbia Univ., New York, NY USA
Balloon-Borne Submillimeter Observations of Upper Stratospheric O2 and O3
Pardo, J., Columbia Univ., USA; Pagani, L., Centre National d'Etudes Spatiales, France; Olofsson, G., Stockholm Observatory, Sweden; Febvre, P., Laboratoire de Hyperfrequences et Caracterisation; Tauber, J., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; May 01, 1999; 9p; In English; Copyright; Avail: Issuing Activity, Hardcopy

A Swedish-French submillimeter telescope consisting on a 60 cm diameter Casse-grain telescope with a liquid helium cooled supraconductor-isolator-supraconductor (SIS) heterodyne receiver flew on September 25 th 1997 in the south-west of France. It was carried out by the Pointed InfraRed Observation Gondola (PIROG, 8 flight) to a ceiling altitude of about 39.5 km. The submillimeter thermal emission of molecular oxygen (N(sub j) = 3(sub 2) yields 1(sub 2) rotational resonance at 424.7631 GHz) and ozone (lines: 241(sub 1,23) yields 24(sub 0,24) at 424.846 GHz, 28(sub 2,26) yields 27(sub 3,25) at 425.158 GHz and 17(sub 1,17) yields 16(sub 0,16) at 441.340 GHz) was collected during about 8.5 hours. These are the first submillimeter high-resolution observations of molecules in the middle atmosphere obtained by a non ground-based instrument and will be helpful in preparing future submillimeter limb-sounding missions, like EOS-MLS (NASA) and Odin (Swedish Space Corporation). We present in this paper the calibration of the atmospheric data and their analysis along with some discussions on ozone mixing ratio just above the ceiling altitude of the experiment. Some validations of our results are done by means of comparisons with temperatures and ozone mixing ratios obtained simultaneously at the Observatoire de Haute Provence (OHP) Lidar station, located also in southern France. The radiative transfer code used in this work to fit the data and retrieve temperature, pressure and ozone mixing ratio has been developed for the Odin mission. This work is an effective test of such a software package.
Author
Telescopes; Submillimeter Waves; Ozone; Optical Radar; Mixing Ratios; Infrared Radiation; Atmospheric Composition

19990064601 NASA Marshall Space Flight Center, Huntsville, AL USA
CIIs During the May 98 CMEs
Chandler, Michael O., Rutherford Appleton Lab., UK; Craven, Paul D., Rutherford Appleton Lab., UK; 1998; 1p; In English, 23 Sep. 1998, Oxfordshire, UK; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Thermal Ion Dynamics Experiment (TIDE) instrument on the ISTP/Polar spacecraft observed intense Cusp Ion Injections (CIIs) during the May 1998 series of Coronal Mass Ejections (CMEs). The energy signatures of the CIIs can be used to determine the magnetic field topology of the geomagnetic field and the Interplanetary Magnetic Field (IMF) at the reconnection site. Particle tracing using model magnetic fields and the TIDE on observations are used to locate the point of magnetopause crossing.
Author
Cusps (Landforms); Coronal Mass Ejection

19990064618 NASA Goddard Space Flight Center, Greenbelt, MD USA
Dual Spacecraft Observations of Lobe Magnetic Field Perturbations Before, During and after Plasmoid Release
Slavin, J. A., NASA Goddard Space Flight Center, USA; Hesse, M., NASA Goddard Space Flight Center, USA; Owen, C. J., Queen Mary and Westfield Coll., UK; Taguchi, S., University of Electro-Communications, Japan; Fairfield, D. H., NASA Goddard Space Flight Center, USA; Lepping, R. P., NASA Goddard Space Flight Center, USA; Kokubun, S., Nagoya Univ., Japan; Mukai, T., Tokyo Univ., Japan; Lui, A. T. Y., Johns Hopkins Univ., USA; Anderson, R. R., Iowa Univ., USA; 1999; 15p; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy

This study examines a unique data set returned by IMP8 and Geotail on January 29, 1995 during a substorm which resulted in the ejection of a plasmoid. The two spacecraft (s/c) were situated in the north lobe of the tail and both observed a traveling compression region (TCR). From single s/c observations only the length of the plasmoid in X and an estimate of its height in Z can be determined. However, we show that dual s/c measurements of TCRs can be used to model all three dimensions of the underlying plasmoid and to estimate of its rate of expansion or contraction. For this event plasmoid dimensions of Delta(X) approximates 18, Delta(Y) approximates 30, and Delta(Z) approximates 10 R(sub e) are inferred from the IMP8 and Geotail lobe magnetic field measurements. The earthward end of the plasmoid was inferred to be near the mean location of the near-earth neutral line, X approximates -26 R(sub e). Its center was underneath IMP 8 at X approximates -34 R(sub e) and its tailward end appeared to be

near X approximates -44 R(sub e). Furthermore, a factor of approximately 2 increase in the amplitude of the TCR occurred in the 1.5 min it took to move from IMP 8 to Geotail. Modeled using conservation of the magnetic flux, this increase in lobe compression implies that the underlying plasmoid was expanding at a rate of approximately 140 km/s. Such an expansion is comparable to recently reported V(sub y) speeds in ”young” plasmoids in this region of the tail. Finally, the Geotail measurements indicate that a reconfiguration of the lobe magnetic field closely followed the ejection of the plasmoid which moved magnetic flux tubes into the wake behind the plasmoid where they would convect into the near-earth neutral line and reconnect.
Author
Geomagnetic Tail; Magnetic Fields; Magnetic Storms; Plasmas (Physics); Compression Waves

19990064629 Alabama Univ., Huntsville, AL USA
POLAR/TIDE Survey of Thermal O+ Characteristics near 5000km Altitude over the Polar Cap
Stevenson, B. A., Alabama Univ., USA; Horwitz, J. L., Alabama Univ., USA; Su, Y. J., Alabama Univ., USA; Elliott, Heather A., Alabama Univ., USA; Comfort, Richard H., Alabama Univ., USA; Moore, Thomas E., Alabama Univ., USA; Giles, Barbara A., Alabama Univ., USA; Craven, Paul D., Alabama Univ., USA; Chandler, Michael O., Alabama Univ., USA; Pollock, Craig J., Alabama Univ., USA; 1998; 1p; In English, 5 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We analyze measurements of thermal 0+ parameters from the Thermal Ion Dynamics Experiment (TIDE) on POLAR for April - May, 1996 obtained near 5000 km altitude within the polar cap ionosphere - magnetosphere interface region. Certain aspects of O+ parameters in this region were explored by Su et. al. [1998]. In this report, we hope to extend our understanding of the O+ behavior by examining relationships of densities, parallel velocities, and temperatures to the convection velocities, IMF by and Bz components. Preliminary results with the convection velocities are currently being analyzed. In doing so, we are guided in part by the Cleft Ion Fountain paradigm and model developed by Horwitz and Lockwood [1985] which involves downward O+ flows in the polar magnetosphere.
Author
Tides; Polar Caps; Oxygen Ions; Temperature Measurement

19990066658 NASA Marshall Space Flight Center, Huntsville, AL USA
Ion Signatures of Magnetospheric Regions and Boundaries: The September 24, 1998 CME Event
Chandler, Michael O., NASA Marshall Space Flight Center, USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Goddard Space Flight Center, USA; 1999; In English, Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

On 24 September 1998 Earth’s magnetosphere was impacted by a large CME with an associated shock front. This impact moved the magnetopause inward by several R(sub e) and pushed dayside magnetospheric boundaries anti-sunward by more than 1 R(sub e). The resulting observations from the Polar spacecraft, which was located over the northern polar cap, show signatures of the polar cap, the cusp, and the mantle as these regions were moved across the spacecraft position. An enhanced Cleft Ion Fountain outflow was observed as Polar moved sunward towards the cusp following the shock passage. Analysis of these data shows the velocity filter/mass spectrometer nature of the CIF in association with anti-sunward convection. These signatures are used to investigate time scales for reconnection, energy transfer to the ionosphere, and CIF outflow generation.
Author
Ion Motion; Earth Magnetosphere; Shock Fronts

19990067234 NASA Marshall Space Flight Center, Huntsville, AL USA
On the Linearly-Balanced Kinetic Energy Spectrum
Lu, Huei,–Iin, NASA Marshall Space Flight Center, USA; Robertson, F. R., NASA Marshall Space Flight Center, USA; 1999; In English; 12th; Atmospheric and Oceanic Fluid Dynamics, 7-11 Jun. 1999, New York, NY, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

It is well known that the earth’s atmospheric motion can generally be characterized by the two dimensional quasi-geostrophic approximation, in which the constraints on global integrals of kinetic energy, entrophy and potential vorticity play very important roles in redistributing the wave energy among different scales of motion. Assuming the hypothesis of Kolmogrov’s local isotropy, derived a -3 power law of the equilibrium two-dimensional kinetic energy spectrum that entails constant vorticity and zero energy flows from the energy-containing wave number up to the viscous cutoff. In his three dimensional quasi-geostrophic theory, showed that the spectrum function of the vertical scale turbulence - expressible in terms of the available potential energy - possesses the same power law as the two dimensional kinetic energy spectrum. As the slope of kinetic energy spectrum in the inertial range is theoretically related to the predictability of the synoptic scales (Lorenz, 1969), many general circulation models includes

a horizontal diffusion to provide reasonable kinetic energy spectra, although the actual power law exhibited in the atmospheric general circulation is controversial. Note that in either the atmospheric modeling or the observational analyses, the proper choice of wave number Index to represent the turbulence scale Is the degree of the Legendre polynomial.
Derived from text
Kinetic Energy; Selection; Isotropy; Atmospheric General Circulation Models; Approximation; Energy Spectra

19990067265 Russian Academy of Natural Sciences, Moscow, Russia
Generation and Control of Artificial Large-Scale Ionospheric Turbulence ***Final Report, Sep. 1997 - Mar. 1999***
Erukhimov, Lev, Russian Academy of Natural Sciences, Russia; Mar. 1999; 15p; In English
Contract(s)/Grant(s): F61708-96-W-0322
Report No.(s): AD-A364969; EOARD-SPC-96-4101; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report results from a contract tasking Radiophysical Research Institute (NTRFI) as follows: The contractor will investigate generation and control of artificial large-scale ionospheric turbulence. He shall perform three primary tasks as described in his proposal: (1) seek to understand the generation and decay mechanisms of artificial large-scale turbulence (ALST) in the ionosphere; (2) study the relationship between ALST and artificial small-scale turbulence (ASST); and (3) investigate new methods of diagnostics of coherent structures in ALST.
DTIC
Atmospheric Turbulence; Ionospheric Disturbances; Space Plasmas

19990067275 NASA Marshall Space Flight Center, Huntsville, AL USA
Polar/Tide Observations of Field Aligned O(+) Flows at 5000 km Altitude over the Auroral Regions in Comparison to UVI Auroral Images
Stevenson, Benjamin Adam, Alabama Univ., USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Chandler, Michael O., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Goddard Space Flight Center, USA; Giles, Barbara L., NASA Goddard Space Flight Center, USA; Parks, G. K., Washington Univ., USA; Pollock, Craig J., Southwest Research Inst., USA; 1999; 1p; In English, 2 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Measurements of thermal O(+) ion parameters from the Thermal Ion Dynamics Experiment (TIDE) on POLAR obtained near 5000 km altitude are compared with auroral images from the Ultra Violet Imager (UVI), for southern perigee passes. Ion parameters, including parallel velocity, density, and flux are combined with simultaneous auroral images to investigate relationships between their properties and the structure and brightness of the auroral forms. Results indicate field aligned upflowing O(+) ions over bright auroral regions and downward flows over dark regions. These and other relationships will be presented for several POLAR passes when both ion measurements and auroral images are observed under favorable conditions for comparison.
Author
Observation; Oxygen Ions; Dynamic Characteristics; Thermodynamic Properties

19990067285 NASA Marshall Space Flight Center, Huntsville, AL USA
Assessment of Localized Deformations in Sand Using X-Ray Computed Tomography
Alshibli, Khalid A, NASA Marshall Space Flight Center, USA; Sture, Stein, NASA Marshall Space Flight Center, USA; Costes, Nicholas C., NASA Marshall Space Flight Center, USA; Frank, Mellisa L., NASA Marshall Space Flight Center, USA; Lankton, Mark R., NASA Marshall Space Flight Center, USA; Batiste, Susan N., NASA Marshall Space Flight Center, USA; Swanson, Roy A., NASA Marshall Space Flight Center, USA; [1999]; In English
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The internal fabric and localized deformation patterns of triaxial sand specimens were investigated using Computed Tomography (CT). Three displacement-controlled, conventional, drained axisymmetric (triaxial) experiments were conducted on dry Ottawa sand specimens at very low effective confining stresses (0.05, 0.52, and 1.30 kPa) in a microgravity environment aboard the Space Shuttle during the NASA STS-79 mission. CT scanning was p'erformed on these flight specimens, as well as on an uncompressed specimen and a specimen tested in a terrestrial laboratory at 1.30 kPa effective confining stress. CT demonstrated high accuracy in detecting specimen inhomogeneity and localization patterns. Formation of deformation patterns is dependent on the effective confining stress and gravity. Multiple symmetrical radial shear bands were observed in the specimens tested in a microgravity environment. In the axial direction, two major conical surfaces were developed. Nonsymmetrical spatial deforma-

tion was observed in the 1-G specimen. Analysis tools were developed to quantify the spatial density change. Void ratio variation within and outside the shear bands was calculated and discussed.
Author
Sands; X Rays; Deformation; Microgravity; Inhomogeneity; Fabrics

19990067828 NASA Goddard Space Flight Center, Greenbelt, MD USA
Rocket/Radar Sporadic-E Experiment Conducted during the El Coqui 2 Campaign
Pfaff, R.F., NASA Goddard Space Flight Center, USA; Acuna, M., NASA Goddard Space Flight Center, USA; Bounds, S., NASA Goddard Space Flight Center, USA; Freudenreich, H., NASA Goddard Space Flight Center, USA; Clemmons, J., Aerospace Corp., USA; Earle, G., Texas Univ. at Dallas, USA; Heelis, R., Texas Univ. at Dallas, USA; Kudeki, E., Illinois Univ., USA; Franke, S., Illinois Univ., USA; Larsen, M., Clemson Univ., USA; 1999; 1p; In English, Jul. 1999, Birmingham, UK; Sponsored by International Union of Geodesy and Geophysics; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In order to investigate the complex electrodynamics and neutral-plasma coupling inherent to sporadic-E layers in the earth's mid-latitude ionosphere, a series of rocket/radar experiments were planned as part of the NASA El Coqui H Campaign from Tortuguero Launch Range, Puerto Rico, in March-April, 1998. The rocket experiments consisted of two pairs of "mother-daughter" payloads with limited apogees so that the payloads "hovered" in the sporadic-E region (95-125 km). Each payload pair included vector DC and AC electric field detectors, a highly accurate flux-gate DC magnetometer, an ion mass spectrometer, an ionization gauge, and spaced-electric field receivers to measure the wavelength and phase velocity of the unstable plasma waves. Separate rockets were included to simultaneously carry aloft TMA trails to measure the neutral wind and its velocity shear, believed responsible for the sporadic-E layer formation. In addition to the rocket experiments, incoherent scatter radar measurements of plasma density and drift velocity were gathered almost every night during the 3 week campaign. Continuous VHF backscatter radar operations were carried out from a site near Salinas, Puerto Rico, where 3-m backscatter echoes were observed associated with sporadic-E and other types of low altitude ionospheric layers. Other radars that operated during the campaign included an HF backscatter system near Ponce, Puerto Rico, and a second VHF backscatter radar set up near Aguadila Puerto Rico. On 24 March 1998, one of the instrumented rockets was launched, attaining an apogee of 129 km. The payloads successfully pierced an intense sporadic-E layer observed by both the Arecibo radar and the in-situ density and ion mass spectrometer probes. In-situ DC electric fields revealed very low (about 1-2 mV/m) ambient fields with small amplitude structures of the same order. No high frequency (short scale) waves were observed, consistent with the VHF backscatter observations at the time of the launch. An overview of the observations will be presented.
Author
E Region; Earth Ionosphere; Electrodynamics; Neutral Atmospheres; Plasma Density; Plasma Waves; Plasmas (Physics); Sporadic E Layer; Temperate Regions; Winds Aloft

19990067831 NASA Goddard Space Flight Center, Greenbelt, MD USA
DC and Wave Electric Fields and Other Plasma Parameters Observed on Two Sounding Rockets in the Dark Cusp during IMF BZ North and South Conditions
Pfaff, R. F., NASA Goddard Space Flight Center, USA; Bounds, S., NASA Goddard Space Flight Center, USA; Acuna, M., NASA Goddard Space Flight Center, USA; Maynard, N. C., Mission Research Corp., USA; Moen, J., University Courses on Svalbard, Norway; Egeland, A., Oslo Univ., Norway; Holtet, J., Oslo Univ., Norway; Maseide, K., Oslo Univ., Norway; Sandholt, P. E., Oslo Univ., Norway; Soraas, F., Bergen Univ., Norway; 1999; 1p; In English, Jul. 1999, Birmingham, UK; Sponsored by International Union of Geodesy and Geophysics; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Two Black Brant IX sounding rockets were launched into the dark, dayside cusp near magnetic noon on December 2 and 3, 1997, from Ny Alesund, Spitzbergen at 79degN reaching altitudes of approximately 450 km. Real-time ground-based and Wind (interplanetary magnetic field) IMF data were used to determine the launch conditions. The first launch, with Bz north conditions, crossed into and back out of an open field region with merging poleward of the projected trajectory. The second flight, into Bz south conditions, was timed to coincide with an enhancement in the merging rate from a increase in the negative Bz, while the (Defense Meteorological Satellite Program) DMSP F13 satellite was situated slightly to the north of the rocket trajectory. Each payload returned DC electric and magnetic fields, plasma waves, energetic particles, photometer data, and thermal plasma data. Data from both flights will be shown, with an emphasis on the DC electric field results. In particular, the data gathered on December 2, 1997 will be used to discuss ionospheric signatures of merging and the open/closed character of the the cusp/low latitude boundary layer. In contrast, the data gathered on December 3, 1997 shows evidence of pulsed electric field structures which will

be examined in the context of cusp plasma entry processes. Both data sets returned a rich variety of plasma waves, as well as optical emissions and thermal plasma data.
Author
Electric Fields; Energetic Particles; Plasma Waves; Thermal Plasmas; Interplanetary Magnetic Fields

19990067845 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
A Global Positioning System Receiver for Monitoring Ionospheric Total Electron Content
Eftaxiadis, Kyriaky; Cervera, Manuel A.; Thomas, Richard M.; Apr. 1999; 37p; In English
Report No.(s): AD-A365519; DSTO-TR-0742; DODA-AR-010-671; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A system has been built around a dual-frequency NovAtel MiLLenniumTM Global Positioning System (GPS) receiver in order to measure the Total Electron Content (TEC) of the ionosphere and to detect radio wave scintillation. The software has been designed and developed to provide interactive control of the receiver and the logging of its data to an external removable disk. In addition, it features a graphical user interface which includes displays both in real-time and for the previous 24 hours of satellite locations and measured TEC values. Adequate calibration of TEC values is widely recognized as a difficult problem and in this implementation, calibration of the real-time results has been achieved satisfactorily to first order. The real-time displays make the equipment particularly useful for campaigns, but the more useful application is for routine unattended logging. Two systems have been deployed, one each in Malaysia and Indonesia under the Regional Engagement program. The intent is to monitor both ionospheric behaviour and GPS performance in equatorial regions as we approach the next peak in solar cycle activity in about the year 2000.
DTIC
Global Positioning System; Receivers; Ionospheric Electron Density

19990069002 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Auroral Kilometric Radiation Integrated Power Flux as a Proxy for A E
Kurth, W. S., Iowa Univ., USA; Gurnett, D. A., Iowa Univ., USA; Advances in Space Research; 1998; ISSN 0273-1177; Volume 22, No. 1, pp. 73-77; In English
Contract(s)/Grant(s): NAS5-30371; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We propose to use the integrated intensity of auroral kilometric radiation from Polar measurements as a proxy for the auroral electrojet index A(sub E) in support of studies of the response of the magnetosphere and the geomagnetic tail to changes in magnetic activity. In addition to providing event timing information to understand the effects of perturbations and substorms, the resulting space-based auroral kilometric radiation index would be useful as an input to space weather efforts as an auroral activity metric.
Author
Auroras; Geomagnetic Tail; Magnetic Variations; Radiant Flux Density; Auroral Irradiation; Auroral Electrojets; Earth Magnetosphere

19990069535 NASA Goddard Space Flight Center, Greenbelt, MD USA
Stratospheric Sudden Warmings and Slowly Propagating Zonal-Mean Zonal Wind Anomalies
Kodera, Kunihiko, Meteorological Research Inst., Japan; Kuroda, Yuhji, Meteorological Research Inst., Japan; Pawson, Steven, NASA Goddard Space Flight Center, USA; Aug. 05, 1999; 22p; In English; No Copyright; Avail: Issuing Activity, Hardcopy

The relationship between the stratospheric sudden warming (SSWS) and slowly propagating zonal wind anomalies during the northern hemisphere cold season (November to March) is investigated using two leading empirical orthogonal functions (EOFS) of 15-day mean zonal-mean zonal wind. Poleward and downward propagation of the zonal-mean zonal wind anomalies can be translated as counterclockwise rotation of state vector in a plane spanned by the two EOFS. Major SSWs occur in phase with the slowly propagating zonal wind anomalies, which implies a ”conditioning” of the atmosphere by the slowly varying state. Movement of the state vector suggests quasi-periodicity on the order of 4 months, although generally only one cycle is achieved during a major warming winter. This characteristic feature can be compared to the stratospheric vacillation cycle in a mechanistic model. It is also shown that changes in the tropospheric planetary waves associated with the slowly propagating zonal wind anomalies coincide with changes in the Arctic Oscillation.
Author
Stratospheric Warming; Wind (Meteorology); Anomalies; Research; Tropospheric Waves; Atmospheric Heating

19990069573 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Heterogeneous Chemistry of HONO on Liquid Sulfuric Acid: A New Mechanism of Chlorine Activation on Stratospheric Sulfate Aerosols

Zhang, Renyi, Jet Propulsion Lab., California Inst. of Tech., USA; Leu, Ming–Taun, Jet Propulsion Lab., California Inst. of Tech., USA; Keyser, Leon F., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Physical Chemistry; 1996; ISSN 0022-3654; Volume 100, No. 1, pp. 339-345; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Heterogeneous chemistry of nitrous acid (HONO) on liquid sulfuric acid (H2SO4) Was investigated at conditions that prevail in the stratosphere. The measured uptake coefficient (gamma) of HONO on H2SO4 increased with increasing acid content, ranging from 0.03 for 65 wt % to about 0.1 for 74 wt %. In the aqueous phase, HONO underwent irreversible reaction with H2SO4 to form nitrosylsulfuric acid (NO(+)HSO4(-). At temperatures below 230 K, NO(+)HSO4(-) was observed to be stable and accumulated in concentrated solutions (less than 70 wt % H2SO4) but was unstable and quickly regenerated HONO in dilute solutions (less than 70 wt %). HCl reacted with HONO dissolved in sulfuric acid, releasing gaseous nitrosyl chloride (ClNO). The reaction probability between HCl and HONO varied from 0.01 to 0.02 for 60-72 wt % H2SO4. In the stratosphere, ClNO photodissociates rapidly to yield atomic chlorine, which catalytically destroys ozone. Analysis of the laboratory data reveals that the reaction of HCl with HONO on sulfate aerosols can affect stratospheric ozone balance during elevated sulfuric acid loadings after volcanic eruptions or due to emissions from the projected high-speed civil transport (HSCT). The present results may have important implications on the assessment of environmental acceptability of HSCT.

Author

Sulfuric Acid; Probability Theory; Nitrous Acid; Hydrochloric Acid; Heterogeneity; Atmospheric Composition; Air Pollution

19990069594 Institute for Scientific Research, Lexington, MA USA

Mechanism for the Green Glow of the Upper Ionosphere

Guberman, Steven L., Institute for Scientific Research, USA; Science; Nov. 14, 1997; Volume 278, pp. 1276-1278; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The generation of the green line of atomic oxygen by dissociative recombination of 02 plus occurs by the capture of an electron into a repulsive state of 02 followed by dissociation along another state of a different electronic symmetry. The two states are coupled together by mixed symmetry Rydberg states. Quantum chemical calculations give a rate coefficient at room temperature of (0.39 (+ 0.31 or -0.19)) x 10 exp -8 cubic centimeters per second. The quantum yield of excited oxygen is within the range deduced from ground, rocket, and satellite observations. The rate coefficients and yields are needed in models of the optical emission, chemistry, and energy balance of planetary ionospheres.

Author

Dissociation; Light Emission; Luminescence; Oxygen; Oxygen Atoms; Oxygen Recombination; Planetary Ionospheres; Upper Ionosphere; Oxygen Ions; Elementary Particle Interactions

19990069911 NASA Marshall Space Flight Center, Huntsville, AL USA

Issues in Quantitative Analysis of Ultraviolet Imager (UV) Data: Airglow

Germany, G. A., Alabama Univ., USA; Richards, P. G., Alabama Univ., USA; Spann, J. F., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., Washington Univ., USA; Parks, G. K., Washington Univ., USA; [1999]; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The GGS Ultraviolet Imager (UVI) has proven to be especially valuable in correlative substorm, auroral morphology, and extended statistical studies of the auroral regions. Such studies are based on knowledge of the location, spatial, and temporal behavior of auroral emissions. More quantitative studies, based on absolute radiometric intensities from UVI images, require a more intimate knowledge of the instrument behavior and data processing requirements and are inherently more difficult than studies based on relative knowledge of the oval location. In this study, UVI airglow observations are analyzed and compared with model predictions to illustrate issues that arise in quantitative analysis of UVI images. These issues include instrument calibration, long term changes in sensitivity, and imager flat field response as well as proper background correction. Airglow emissions are chosen for this study because of their relatively straightforward modeling requirements and because of their implications for thermospheric compositional studies. The analysis issues discussed here, however, are identical to those faced in quantitative auroral studies.

Author

Quantitative Analysis; Images; Data Processing; Airglow

19990069934 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA

Sources and Transport of Plasma Sheet Ions During Magnetospheric Substorms

Ashour–Abdalla, M., California Univ., USA; El–Alaoui, M., California Univ., USA; Peroomian, V., California Univ., USA; Raeder, J., California Univ., USA; Walker, R. J., California Univ., USA; Frank, L. A., Iowa Univ., USA; Paterson, W. R., Iowa Univ., USA; Substorms-4; 1998, pp. 479-484; In English

Contract(s)/Grant(s): PO-V50494; NAG5-1100; NAG5-6689; Copyright; Avail: Issuing Activity, Hardcopy

This study investigates the sources and transport of ions observed in the near-Earth plasma sheet during the growth and expansion phases of a magnetospheric substorm that took place on November 24, 1996. The sources and acceleration mechanisms of ions observed at Geotail were determined by calculating the trajectories of thousands of ions backward in time. We found that during the growth phase of the substorm, most of the ions reaching Geotail had origins in the low latitude boundary layer (LLBL) and were already in the magnetosphere when the growth phase began. Late in the growth phase and in the expansion phase more plasma mantle ions reached the Geotail location. Indeed, during the expansion phase more than 90% of the ions were from the mantle. The ions were accelerated enroute to the spacecraft; however, most of the energy gained was achieved by non-adiabatic acceleration during the ions' crossing of the equatorial current sheet just prior to the detection of the ions.

Author

Ionic Mobility; Magnetic Storms; Geomagnetic Tail; Geomagnetism; Magnetospheric Instability

19990069935 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA

Self-Consistent Simulation of the Magnetotail

Peroomian, Vahe, California Univ., USA; Ashour–Abdalla, Maha, California Univ., USA; Zelenyi, Lev M., Academy of Sciences (USSR), USSR; Substorms-4; 1998, pp. 165-168; In English

Contract(s)/Grant(s): NAG5-1100; NAGw-4553; Copyright; Avail: Issuing Activity, Hardcopy

Kinetic effects may be critically important at various stages of magnetotail evolution prior to and after the break up of substorms. The quasi-adiabaticity of ion dynamics results in the appearance of pronounced off diagonal terms in the pressure tensor (an effect that cannot be reproduced using the standard MHD (magnetohydrodynamic) approach). Only the appearance of these terms could support the formation of thin current sheets that recent experimental data have repeatedly indicated. We present in this paper the results of a self-consistent large-scale kinetic simulation of the Earth's magnetotail. We launch ions from the plasma mantle and self-consistently adjust the background magnetic field by computing the perturbations magnetic field from the particle current. We find that a thin current sheet with a half-thickness of approximately 0.3 R(sub E) quickly develops in the simulation. Also, the magnetotail evolves into a periodic state where the location of the X-line in the tail oscillates between x approximately 40 R(sub E) and x approximately 70 R(sub E) on a 5-minute time scale. Evidence of this periodic motion is also seen in the auroral precipitation profile of ions.

Author

Kinetics; Magnetic Storms; Geomagnetic Tail; Planetary Magnetotails; Magnetic Fields

19990070321 NASA Marshall Space Flight Center, Huntsville, AL USA

POLAR Magnetosheath Observations on May 4,1998

Kozyra, J. U., NASA Marshall Space Flight Center, USA; Song, P., NASA Marshall Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Russell, C. T., NASA Marshall Space Flight Center, USA; Stahara, S. S., NASA Marshall Space Flight Center, USA; Spreiter, J. R., NASA Marshall Space Flight Center, USA; Shue, J. H., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 2 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The unusually high solar wind pressure and strongly southward IMF on May 4, 1998, pushed the magnetopause well into the geosynchronous orbit which exposed the POLAR satellite to the magnetosheath and solar wind. We use a gasdynamic convected field model to predict the magnetosheath quantities and then compare them with the in situ observations. The model prediction helps to reduce the uncertainty in the timing of the solar wind arrival time and provides a reference value for each physical parameter. It also helps to resolve the location of the satellite during strong magnetic fluctuations near the magnetopause. The plasma measurements from the TIDE instrument, in conjunction with the magnetometer measurements, indicate that there is a magnetospheric boundary layer during the event. There are also transient signatures near the magnetopause which may be caused by magnetospheric flux transfer events.

Author

Magnetosheath; Solar Wind; Meteorological Satellites; Solar Physics

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990064337 NASA Marshall Space Flight Center, Huntsville, AL USA
Evidence for the Absence of Conductivity Variations above Thunderstorms
Bailey, Jeff C., NASA Marshall Space Flight Center, USA; Blakeslee, Richard J., NASA Marshall Space Flight Center, USA; Driscoll, Kevin T., NASA Marshall Space Flight Center, USA; 1999; In English; 11th; Atmospheric Electricity, 7-11 Jun. 1999, Gutersville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Over the last decade, atmospheric conductivity measurements over thunderstorms have been made at 20 km with high altitude aircraft. These measurements show no significant variations in conductivity above thunderstorms once the effects of aircraft charge are removed. The polar conductivities (alpha(sub +) and alpha(sub -)) were simultaneously acquired using a pair of Gerdien probes. In addition, the vertical electric field and the aircraft self charge were measured using two field mills installed nearly symmetrically on the top and bottom of the aircraft. The measurements were collected during the COHMEX (1986), CaPE (1991), STORM-FEST (1992), TOGA COARE (1993) and CAMEX-1, 2 (1993 1995) field campaigns. This extensive data set includes more than 330 overflights of electrified storms (> 170 over storms producing lightning) and represents a broad sample of storm types, seasonal regimes, and geographical distribution. Most of the observed variations in conductivity are caused by charge induced on the aircraft (and hence on the exterior case of the conductivity probes). Theory (Swann, 1914) indicates that some ions with the same sign as the induced charge will be deflected from the air stream reducing the measured conductivity of that polarity. For the opposite polarity, the additional ions that are attracted by the induced charge are collected on the exterior case rather than the inner electrode, leaving the ambient measurement unaltered. The aircraft observations, in agreement with theory, show reductions proportional to the magnitude of the aircraft self charge for conductivity of the same polarity as the self charge and no change for conductivity of opposite polarity. After compensating for the effects of aircraft charge no significant variations in conductivity above thunderstorms have been found. These Gerdien results contrast strongly with the large (and frequent) conductivity variations reported in studies using relaxation probe techniques.
Author
Atmospheric Conductivity; Air Conductivity; Thunderstorms

19990064374 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Superposition Technique for Deriving Photon Scattering Statistics in Plane-Parallel Cloudy Atmospheres
Platnick, S., NASA Goddard Space Flight Center, USA; 1999; 30p; In English; Copyright; Avail: Issuing Activity, Hardcopy

Photon transport in a multiple scattering medium is critically dependent on scattering statistics, in particular the average number of scatterings. A superposition technique is derived to accurately determine the average number of scatterings encountered by reflected and transmitted photons within arbitrary layers in plane-parallel, vertically inhomogeneous clouds. As expected, the resulting scattering number profiles are highly dependent on cloud particle absorption and solar/viewing geometry. The technique uses efficient adding and doubling radiative transfer procedures, avoiding traditional time-intensive Monte Carlo methods. Derived superposition formulae are applied to a variety of geometries and cloud models, and selected results are compared with Monte Carlo calculations. Cloud remote sensing techniques that use solar reflectance or transmittance measurements generally assume a homogeneous plane-parallel cloud structure. The scales over which this assumption is relevant, in both the vertical and horizontal, can be obtained from the superposition calculations. Though the emphasis is on photon transport in clouds, the derived technique is applicable to any scattering plane-parallel radiative transfer problem, including arbitrary combinations of cloud, aerosol, and gas layers in the atmosphere.
Author
Cloud Physics; Photons; Scattering; Cloud Cover; Sky Brightness; Solar Radiation; Light (Visible Radiation)

19990064405 NASA Goddard Space Flight Center, Greenbelt, MD USA
Some Outstanding Products from the GATE Convection Data Set: A Personal View
Simpson, Joanne, NASA Goddard Space Flight Center, USA; Tao, W.–K., NASA Goddard Space Flight Center, USA; 1999; In English; 79th; Hurricanes, 10-15 Jan. 1999, Dallas, TX, USA; Sponsored by American Meteorology Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Concerning our knowledge of convective clouds and their important processes, GATE marks a watershed between ”seeing through a glass darkly” and ”then face to face” in some of the most vital aspects of convective systems. Two main areas will be discussed here, namely the interactions of observations and modeling in documentation of slow and fast-moving squall lines, for which the publications began in the 70’s, and the use of the GATE ships’ radar data set as the basis for demonstrating that tropical

rainfall could be measured from space, resulting in the Tropical Rainfall Measuring Mission (TRMM). The TRMM satellite was launched in 1997, with the enabling analyses reaching publication in the 1980's.
Derived from text
Convection Clouds; Radar Data; Cloud Physics; Mesoscale Phenomena; Clouds (Meteorology)

19990064406 NASA Goddard Space Flight Center, Greenbelt, MD USA
Tropical Cyclone Paka's Initial Explosive Development (10-12 December, 1997)
Rodgers, Edward B., NASA Goddard Space Flight Center, USA; Halverson, Jeff, Science Systems and Applications, Inc., USA; Simpson, Joanne, NASA Goddard Space Flight Center, USA; Olson, William, Maryland Univ. Baltimore County, USA; Pierce, Harold, Science Systems and Applications, Inc., USA; 1999; In English; Hurricanes, Jan. 1999, Dallas,TX, USA; Sponsored by American Meteorology Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Convection associated with an equatorial westerly wind burst was first observed late November during the strong El Nino of 1997 at approximately 2000 km southwest of the Hawaiian Islands. This region of convection lead to the formation of twin tropical cyclones, one in the southern hemisphere named Pam and the other in the northern hemisphere named Paka. During the first week in December, tropical cyclone Paka, the system of concern, reached tropical storm stage as it moved rapidly westward at relatively low latitudes. During the 10-12 of December, Paka rapidly developed into a typhoon.
Derived from text
Tropical Storms; Cyclones; Atmospheric Circulation; Sea Breeze; Wind Direction; Wind Measurement

19990064407 NASA Goddard Space Flight Center, Greenbelt, MD USA
Monsoon Convection during the South China Sea Monsoon Experiment Observed from Shipboard Radar and the TRMM Satellite
Rickenbach, Tom, American Meteorology Society; Cifelli, Rob, NASA Goddard Space Flight Center, USA; Halverson, Jeff, NASA Goddard Space Flight Center, USA; Kucera, Paul, NASA Goddard Space Flight Center, USA; Atkinson, Lester, NASA Goddard Space Flight Center, USA; Fisher, Brad, NASA Goddard Space Flight Center, USA; Gerlach, John, NASA Goddard Space Flight Center, USA; Harris, Kathy, NASA Goddard Space Flight Center, USA; Kaufman, Cristina, NASA Goddard Space Flight Center, USA; Liu, Ching–Hwang, NASA Goddard Space Flight Center, USA; Market, Pat, NASA Goddard Space Flight Center, USA; 1999; In English; 23rd; Hurricanes, 10-15 Jan. 1999, Dallas, TX, USA; Sponsored by American Meteorological Society, USA
Contract(s)/Grant(s): RTOP 621-15-00; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A main goal of the recent South China Sea Monsoon Experiment (SCSMEX) was to study convective processes associated with the onset of the Southeast Asian summer monsoon. The NASA TOGA C-band scanning radar was deployed on the Chinese research vessel Shi Yan #3 for two 20 day cruises, collecting dual-Doppler measurements in conjunction with the BMRC C-Pol dual-polarimetric radar on Dongsha Island. Soundings and surface meteorological data were also collected with an NCAR Integrated Sounding System (ISS). This experiment was the first major tropical field campaign following the launch of the Tropical Rainfall Measuring Mission (TRMM) satellite. These observations of tropical oceanic convection provided an opportunity to make comparisons between surface radar measurements and the Precipitation Radar (PR) aboard the TRMM satellite in an oceanic environment. Nearly continuous radar operations were conducted during two Intensive Observing Periods (IOPS) straddling the onset of the monsoon (5-25 May 1998 and 5-25 June 1998). Mesoscale lines of convection with widespread regions of both trailing and forward stratiform precipitation were observed during the active monsoon periods in a southwesterly flow regime. Several examples of mesoscale convection will be shown from ship-based and spacebome radar reflectivity data during times of TRMM satellite overpasses. Further examples of pre-monsoon convection, characterized by isolated cumulonimbus and shallow, precipitating congestus clouds, will be discussed. A strong waterspout was observed very near the ship from an isolated cell in the pre-monsoon period, and was well documented with photography, radar, sounding, and sounding data.
Author
Monsoons; Convection; Mesoscale Phenomena; Precipitation (Meteorology); Cumulonimbus Clouds; Cumulus Clouds; Meteorological Parameters; Meteorological Radar

19990064480 NASA Goddard Space Flight Center, Greenbelt, MD USA
Accuracy of the Independent Pixel Approximation at Absorbing Wavelengths
Marchak, Alexander, Maryland Univ. Baltimore County, USA; Oreopoulos, Lazaros, Maryland Univ. Baltimore County, USA; Davis, Anthony, Los Alamos National Lab., USA; Wiscombe, Warren, NASA Goddard Space Flight Center, USA; Cahalan, Robert, NASA Goddard Space Flight Center, USA; 1999; 4p; In English; 10th; Atmospheric Radiation, 28 Jun. - 2 Jul. 1999, Madison, WI, USA; Sponsored by American Meteorological Society, USA

Contract(s)/Grant(s): DE-A105-90ER-61069; NAG5-6675; Copyright; Avail: Issuing Activity, Hardcopy

In order to correctly interpret shortwave cloud radiation measured by satellites and ground-based radiometers, or by two aircraft flying above and below clouds, we need to better understand interactions between inhomogeneous clouds and solar radiation. The discrepancies between shortwave absorption inferred from measurements and predicted by models, between cloud optical depths estimated from satellites and ground measurements, between single scattering albedo retrieved from in situ radiation measurements and computed from measured droplet size distribution, among others, are strongly affected by cloud horizontal inhomogeneity. Net horizontal photon transport (i. e., horizontal fluxes) are a direct consequence of the inhomoqeneity in cloud structure. Horizontal fluxes and their effect on the accuracy of the pixel-by-pixel one-dimensional (1 D) radiative transfer calculations has recently undergone close scrutiny for conservative scattering. However, the properties and magnitude of horizontal fluxes in absorbing wavelengths are still poorly understood. As far as we are aware, only Ackerman and Cox and Titov discussed correlations between horizontal fluxes at absorbing wavelengths, though these were far from comprehensive. This paper partly fills this gap. We discuss here of whether the accuracy of the Independent Pixel Approximation (IPA), a 1 D radiative transfer approximation for each pixel, is a better model for multiple scattering at conservative or at absorbing wavelengths. Issues addressed here are: (1) dependence of net horizontal fluxes on single scattering albedo; (2) connection between pixel-by-pixel accuracy of the IPA and horizontal fluxes and (3) radiative smoothing and horizontal fluxes at absorbing wavelengths. In contrast to the traditional understanding of IPA, we study IPA accuracies not only for reflectance but also for transmittance and absorptance at both conservative and absorbing wavelengths. In spite of the apparent similarity between the three processes, dependence of IPA accuracies on single-scattering albedo is completely different. As a result, cloud optical properties retrieved from high resolution satellite images and ground-based measurements using IPA at absorbing channels will have different accuracies.

Author

Accuracy; Approximation; Pixels; Absorptance; Wavelengths; Radiation Measurement

19990064544 NASA Goddard Space Flight Center, Greenbelt, MD USA

Design, Evaluation and GCM-Performance of a New Parameterization for Microphysics of Clouds with Relaxed Arakawa-Schubert Scheme (McRas)

Sud, Y. C., NASA Goddard Space Flight Center, USA; Walker, G. K., NASA Goddard Space Flight Center, USA; 1998; 1p; In English; GEWEX Cloud System Study, 9-13 Nov. 1998, Reading, UK; Sponsored by European Centre for Medium-Range Weather Forecasts, UK; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A prognostic cloud scheme named McRAS (Microphysics of clouds with Relaxed Arakawa-Schubert Scheme) was developed with the aim of improving cloud-microphysics, and cloud-radiation interactions in GCMs. McRAS distinguishes convective, stratiform, and boundary-layer clouds. The convective clouds merge into stratiform clouds on an hourly time-scale, while the boundary-layer clouds do so instantly. The cloud condensate transforms into precipitation following the auto-conversion relations of Sundqvist that contain a parametric adaptation for the Bergeron-Findeisen process of ice crystal growth and collection of cloud condensate by precipitation. All clouds convect, advect, and diffuse both horizontally and vertically with a fully active cloud-microphysics throughout its life-cycle, while the optical properties of clouds are derived from the statistical distribution of hydrometeors and idealized cloud geometry. An evaluation of McRAS in a single column model (SCM) with the GATE Phase III data has shown that McRAS can simulate the observed temperature, humidity, and precipitation without discernible systematic errors. An evaluation with the ARM-CART SCM data in a cloud model intercomparison exercise shows reasonable but not an outstanding accurate simulation. Such a discrepancy is common to almost all models and is related, in part, to the input data quality. McRAS was implemented in the GEOS II GCM. A 50 month integration that was initialized with the ECMWF analysis of observations for January 1, 1987 and forced with the observed sea-surface temperatures and sea-ice distribution and vegetation properties (biomes, and soils), with prognostic soil moisture, snow-cover, and hydrology showed a very realistic simulation of cloud process, incloud water and ice, and cloud-radiative forcing (CRF). The simulated ITCZ showed a realistic time-mean structure and seasonal cycle, while the simulated CRF showed sensitivity to vertical distribution of cloud water which can be easily altered by the choice of time constant and incloud critical cloud water amount regulators for auto-conversion. The CRF and its feedbacks also have a profound effect on the ITCZ. Even though somewhat weaker than observed, the McRAS-GCM simulation produces robust 30-60 day oscillations in the 200 hPa velocity potential. Two ensembles of 4-summer (July, August, September) simulations, one each for 1987 and 1988 show that the McRAS-GCM simulates realistic and statistically significant precipitation differences over India, Central America, and tropical Africa. Several seasonal simulations were performed with McRAS-GEOS II GCM for the summer (June-July- August) and winter (December-January-February) periods to determine how the simulated clouds and CRFs would be affected by: i) advection of clouds; ii) cloud top entrainment instability, iii) cloud water inhomogeneity correction, and

(iv) cloud production and dissipation in different cloud-processes. The results show that each of these processes contributes to the simulated cloud-fraction and CRF.
Author
Cloud Physics; Clouds (Meteorology); Atmospheric Models; Precipitation (Meteorology); Atmospheric Temperature

19990064545 NASA Goddard Space Flight Center, Greenbelt, MD USA
Tropical Oceanic Precipitation Processes over Warm Pool: 2D and 3D Cloud Resolving Model Simulations
Tao, W.– K., NASA Goddard Space Flight Center, USA; Johnson, D., NASA Goddard Space Flight Center, USA; 1998; 1p; In English; GEWEX Cloud System Study, 9-13 Nov. 1998, Reading, UK; Sponsored by European Centre for Medium-Range Weather Forecasts, UK; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Rainfall is a key link in the hydrologic cycle as well as the primary heat source for the atmosphere, The vertical distribution of convective latent-heat release modulates the large-scale circulations of the tropics, Furthermore, changes in the moisture distribution at middle and upper levels of the troposphere can affect cloud distributions and cloud liquid water and ice contents. How the incoming solar and outgoing longwave radiation respond to these changes in clouds is a major factor in assessing climate change. Present large-scale weather and climate models simulate cloud processes only crudely, reducing confidence in their predictions on both global and regional scales. One of the most promising methods to test physical parameterizations used in General Circulation Models (GCMS) and climate models is to use field observations together with Cloud Resolving Models (CRMs). The CRMs use more sophisticated and physically realistic parameterizations of cloud microphysical processes, and allow for their complex interactions with solar and infrared radiative transfer processes. The CRMs can reasonably well resolve the evolution, structure, and life cycles of individual clouds and cloud systems, The major objective of this paper is to investigate the latent heating, moisture and momenti,im budgets associated with several convective systems developed during the TOGA COARE IFA - westerly wind burst event (late December, 1992). The tool for this study is the Goddard Cumulus Ensemble (CCE) model which includes a 3-class ice-phase microphysical scheme, The model domain contains 256 x 256 grid points (using 2 km resolution) in the horizontal and 38 grid points (to a depth of 22 km depth) in the vertical, The 2D domain has 1024 grid points. The simulations are performed over a 7 day time period. We will examine (1) the precipitation processes (i.e., condensation/evaporation) and their interaction with warm pool; (2) the heating and moisture budgets in the convective and stratiform regions; (3) the cloud (upward-downward) mass fluxes in convective and stratiform regions; (4) characteristics of clouds (such as cloud size, updraft intensity and cloud lifetime) and the comparison of clouds with Radar observations. Differences and similarities in organization of convection between simulated 2D and 3D cloud systems. Preliminary results indicated that there is major differences between 2D and 3D simulated stratiform rainfall amount and convective updraft and downdraft mass fluxes.
Author
Atmospheric General Circulation Models; Climate Models; Cloud Physics; Three Dimensional Models; Convective Heat Transfer; Climate Change

19990064546 NASA Goddard Space Flight Center, Greenbelt, MD USA
Sensitivity of Cirrus Simulations in Idealized Situations: The WG2 Test Cases
Starr, David OC., NASA Goddard Space Flight Center, USA; 1998; 1p; In English; GEWEX Cloud System Study, 9-13 Nov. 1998, Reading, UK; Sponsored by European Centre for Medium-Range Weather Forecasts, UK; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

GCSS Cirrus Cloud Systems Working Group (WG2) is presently conducting a comparison of cirrus cloud models for idealized initial conditions. The experiments involve binary (off/on) tests of model sensitivity to infrared radiative processes, and thermal stratification, and vertical wind shear for situations of weakly forced (3 cm/s uplift) cold (-60 to -70 C) and warm (-35 to -50 C) cirrus clouds. A range of model types are involved including parcel, SCM, 2-D CRM, 3-D CRM and LES models. The test cases will be described and results from 2-dimensional cirrus cloud models with bulk microphysics (implicit second moment scheme) and explicit bin microphysics will be compared. Vertical ice mass flux (particle fall speed) is a critical model component leading to significant intermodel differences. Efforts are ongoing to better quantify this aspect. Future plans of WG2 will also be briefly described and include model comparisons for a well-observed case of cold (ARM IOP) cirrus and of warm (EUCREX) cirrus, as well as, a joint activity with WG4 to consider the treatment of anvil cirrus in a variety of models.
Author
Cirrus Clouds; Simulation; Three Dimensional Models; Infrared Radiation; Wind Shear

19990064557 NASA Goddard Space Flight Center, Greenbelt, MD USA
Cloud Scaling Properties and Cloud Parameterization
Cahalan, R. F., NASA Goddard Space Flight Center, USA; Morcrette, J. J., NASA Goddard Space Flight Center, USA; 1998; 1p;

In English; GEWEX Cloud System Study, 8-14 Nov. 1998, Reading, UK; Sponsored by European Centre for Medium-Range Weather Forecasts, UK; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Cloud liquid and cloud traction variability is studied as a function of horizontal scale in the ECMWF forecast model during several 10-day runs at the highest available model resolution, recently refined from approximately 60 km (T213) down to approximately 20 km (T639). At higher resolutions, model plane-parallel albedo biases are reduced, so that models may be tuned to have larger, more realistic, cloud liquid water amounts, However, the distribution of cloud liquid assumed -within- each gridbox, for radiative and thermodynamic computations, depends on ad hoc assumptions that are not necessarily consistent with observed scaling properties, or with scaling properties produced by the model at larger scales. to study the larger-scale cloud properties, ten locations on the Earth are chosen to coincide with locations having considerable surface data available for validation, and representing a variety of climatic regimes, scaling exponents are determined from a range or scales down to model resolution, and are re-computed every three hours, separately for low, medium and high clouds, as well as column-integrated cloudiness. Cloud variability fluctuates in time, due to diurnal, synoptic and other' processes, but scaling exponents are found to be relatively stable. various approaches are considered for applying computed cloud scaling to subgrid cloud distributions used for radiation, beyond simple random or maximal overlap now in common use. Considerably more work is needed to compare model cloud scaling with observations. This will be aided by increased availability of high-resolution surface, aircraft and satellite data, and by the increasing resolution of global models,

Author

Cloud Physics; Weather Forecasting; Cloud Cover; Climatology; Diurnal Variations

19990064610 NASA Goddard Space Flight Center, Greenbelt, MD USA

Preliminary Results from Analysis of NOAA 15 HIRS/AMSU Data

Susskind, Joel, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 10th; International TOVS Study, 27 Jan. - 2 Feb. 1999, Boulder, CO, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have begun analyzing NOAA 15 MRS3/AMSU A/AMSU B data in a manner basically analogous to that used to produce the TOVS Pathfinder Data Set, with some minor improvements to the processing system. Temperature retrievals using NOAA 15 HIRS3/AMSU A are found to be similar, but superior to, those using nearly colocated NOAA 11 HMS2/MSU/SSU data. AMSU B has some calibration problems related to RFI from the transmitters on the satellite. We have developed methodology to account for this interference and have shown that the data is usable for improved moisture profiling capability over previous satellites.

Author

Data Processing; NOAA Satellites; Calibrating; Procedures; Moisture

19990064611 NASA Goddard Space Flight Center, Greenbelt, MD USA

Radiative Importance of Aerosol-Cloud Interaction

Tsay, Si–Chee, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; PIERS 1999, 22-26 Mar. 1999, Taipei, Taiwan, Province of China; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Aerosol particles are input into the troposphere by biomass burning, among other sources. These aerosol palls cover large expanses of the earth's surface. Aerosols may directly scatter solar radiation back to space, thus increasing the earth's albedo and act to cool the earth's surface and atmosphere. Aerosols also contribute to the earth's energy balance indirectly. Hygroscopic aerosol act as cloud condensation nuclei (CCN) and thus affects cloud properties. In 1977, Twomey theorized that additional available CCN would create smaller but more numerous cloud droplets in a cloud with a given amount of liquid water. This in turn would increase the cloud albedo which would scatter additional radiation back to space and create a similar cooling pattern as the direct aerosol effect. Estimates of the magnitude of the aerosol indirect effect on a global scale range from 0.0 to -4.8 W/sq m. Thus the indirect effect can be of comparable magnitude and opposite in sign to the estimates of global greenhouse gas forcing Aerosol-cloud interaction is not a one-way process. Just as aerosols have an influence on clouds through the cloud microphysics, clouds have an influence on aerosols. Cloud droplets are solutions of liquid water and CCN, now dissolved. When the cloud droplet evaporates it leaves behind an aerosol particle. This new particle does not have to have the same properties as the original CCN. In fact, studies show that aerosol particles that result from cloud processing are larger in size than the original CCN. Optical properties of aerosol particles are dependent on the size of the particles. Larger particles have a smaller backscattering fraction, and thus less incoming solar radiation will be backscattered to space if the aerosol particles are larger. Therefore, we see that aerosols and clouds modify each other to influence the radiative balance of the earth. Understanding and quantifying the spatial and seasonal patterns of the aerosol indirect forcing may have even greater consequences. Presently we know that through the use of fossil fuel and land-use changes we have increased the concentration of greenhouse gases in the atmosphere. In parallel, we have seen a modest increase of global temperature in the last century. These two observations have been linked as cause and effect by climate models,

but this connection is still experimentally not verified. The spatial and seasonal distribution of aerosol forcing is different from that of greenhouse gases, thus generating a different spatial fingerprint of climate change. This fingerprint was suggested as a method to identify the response of the climate system to anthropogenic forcing of greenhouse gases and aerosol. The aerosol fingerprint may be the only way to firmly establish the presence (or absence) of human impact on climate. Aerosol-cloud interaction through the indirect effect will be an important component of establishing this fingerprint.
Author
Aerosols; Troposphere; Biomass; Cloud Physics; Solar Radiation; Albedo; Greenhouse Effect; Backscattering

19990064617 NASA Goddard Space Flight Center, Greenbelt, MD USA
Approximate Co-location of Precipitation and Low-Level Westerlies in Tropical Monthly Means
Chao, Winston C., NASA Goddard Space Flight Center, USA; Chen, Baode, Universities Space Research Association, USA; 1999; 36p; In English; Copyright; Avail: Issuing Activity, Hardcopy

The phenomenon of the approximate co-location of precipitation and low-level westerlies in the tropical monthly means is investigated through numerical simulation with a general circulation model (GCM) and its aqua-planet version with zonally uniform sea surface temperature, along with theoretical arguments. In the monsoon seasons the co-location is close to exact in latitude, but not in longitude. The regions of maximum precipitation are far to the east of the regions of maximum westerlies. The origin of the co-location in the aqua-planet model is studied and the crucial roles of Coriolis force and surface friction in generating the westerlies are pointed out. Integrations with the full GCM with and without surface friction depict the zonally non-uniform features and reveal reasonable successful simulation of tropical convective centers and the associated circulations. Although the low-level westerlies do not appear in the aqua-planet model without surface friction, it appears in the full GCM without surface friction. In the non-monsoon seasons low-level westerlies with weaker strength can also be found in the equatorial precipitation regions with undiminished longitudinal range and the momentum balance is between pressure gradient force and surface friction. The approximate co-location in both monsoon and non-monsoon seasons are captured by the analytic solutions of Gill with a slight modification. The modified Gill solutions show westerlies in most of the precipitation regions and in the regions to the west of the precipitation. Thus the monthly mean tropical low-level westerlies can be interpreted as a part of the Rossby wave response to the longitudinally-elongated stationary heat source,
Author
Atmospheric General Circulation Models; Coriolis Effect; Equatorial Regions; Monsoons; Simulation; Tropical Regions; Ground Wind

19990064619 NASA Goddard Space Flight Center, Greenbelt, MD USA
Overview of the TRMM RCS Design, Integration and in Orbit Operations
Free, James M., NASA Glenn Research Center, USA; Glubke, Scott E., NASA Goddard Space Flight Center, USA; 1999; 12p; In English; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-2468; Copyright; Avail: Issuing Activity, Hardcopy

The Tropical Rainfall Measuring Mission (TRMM) was launched from the Tanegashima Space Center (TnSC), Japan in November 1997. The TRMM project is a joint venture between NASA and the National Space Development Agency (NASDA) of Japan. The TRMM Observatory includes the first spacecraft hydrazine propulsion system to be designed, fabricated, assembled, and tested ”in-house” at the NASA Goddard Space Flight Center (GSFC). The hydrazine propulsion subsystem (or Reaction Control Subsystem (RCS)) provides impulse for orbit insertion, altitude maintenance, attitude control, and end-of-life disposal. The RCS is pressure regulated with a maximum propellant capacity of 890 kg (1962 lbs). There are twelve 22N (5 lbf) thrusters: eight for delta-V and four for roll control. Combinations of the delta-V thrusters provide pitch and/or yaw control. This paper describes the RCS configuration, critical mission and systems design requirements, the resolution of technical issues, and the on-orbit performance of the RCS during the first 18 months of the TRMM mission.
Author
Control Systems Design; Hydrazines; Mission Planning; Spacecraft Propulsion; Trmm Satellite; Directional Control

19990064644 NASA Marshall Space Flight Center, Huntsville, AL USA
The Rondonia Lightning Detection Network: Network Description, Science Objectives, Data Processing/Archival Methodology, and First Results
Blakelee, Richard, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 6th; International Congress of the Brazillian Geophysical Society, 15-19 Aug. 1999, Rio de Janeiro, Brazil; Sponsored by Brazilian Geophysical Society, Brazil; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A four station Advanced Lightning Direction Finder (ALDF) network was recently established in the state of Rondonia in western Brazil through a collaboration of U.S. and Brazilian participants from NASA, INPE, INMET, and various universities. The network utilizes ALDF IMPACT (Improved Accuracy from Combined Technology) sensors to provide cloud-to-ground lightning observations (i.e., stroke/flash locations, signal amplitude, and polarity) using both time-of-arrival and magnetic direction finding techniques. The observations are collected, processed and archived at a central site in Brasilia and at the NASA/Marshall Space Flight Center (MSFC) in Huntsville, Alabama. Initial, non-quality assured quick-look results are made available in near real-time over the internet. The network will remain deployed for several years to provide ground truth data for the Lightning Imaging Sensor (LIS) on the Tropical Rainfall Measurement Mission (TRMM) satellite which was launched in November 1997. The measurements will also be used to investigate the relationship between the electrical, microphysical and kinematic properties of tropical convection. In addition, the long-term observations from this network will contribute in establishing a regional lightning climatological data base, supplementing other data bases in Brazil that already exist or may soon be implemented. Analytic inversion algorithms developed at NASA/MSFC are now being applied to the Rondonian ALDF lightning observations to obtain site error corrections and improved location retrievals. The processing methodology and the initial results from an analysis of the first 6 months of network operations will be presented.
Author
Cloud-to-Ground Discharges; Lightning Suppression; Atmospheric Electricity; Climatology

19990066654 NASA Marshall Space Flight Center, Huntsville, AL USA
Intercomparison of Remote and Flight Level Measured Aerosol Backscatter Coefficient During GLOBE 2 Pacific Survey Mission
Cutten, D. R., NASA Marshall Space Flight Center, USA; Spinhime, J. D., NASA Marshall Space Flight Center, USA; Menzies, R. T., NASA Marshall Space Flight Center, USA; Bowdle, D. A., NASA Marshall Space Flight Center, USA; Srivastava, V., NASA Marshall Space Flight Center, USA; Pueschel, R. F., NASA Marshall Space Flight Center, USA; Clarke, A. D., NASA Marshall Space Flight Center, USA; Rothermel, J., NASA Marshall Space Flight Center, USA; 1998; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Aerosol backscatter coefficient data are examined from two local flights undertaken during NASA's GLObal Backscatter Experiment (GLOBE) in May - June, 1990. During each of these two flights the aircraft traversed different altitudes within a region of the atmosphere defined by the same set of latitude and longitude coordinates. This provides an ideal opportunity to allow flight level measured or modeled aerosol backscafter to be compared with pulsed lidar aerosol backscafter data that were obtained at these same altitudes either earlier or later than the flight level measurements. Aerosol backscafter comparisons were made at 1.06-, 9.11- and 9.25-mm wavelengths, using data from three lidar systems and two aerosol optical counters. The best agreement between all sensor's was found in the altitude region below 7 km where backscafter values were moderately high at all three wavelengths. Above this altitude the pulsed lidar backscafter data at 1.06- and 9.25-mm wavelengths were higher than the flight level data obtained from the CW lidar or derived from the optical counters. Possible reasons are offered to explain this discrepancy. During the Japan local flight, microphysics analysis revealed: (1) evidence of a strong advected seasalt aerosol plume from the marine boundary layer, and (2) where backscatter was low, the large lidar sampling volume included many large particles which were of different chemical composition to the small particle category sampled by the particle counters.
Author
Aerosols; Backscattering; Atmospheric Boundary Layer; Chemical Composition; In-Flight Monitoring; Measuring Instruments; Optical Radar; Radiation Counters; Scattering Coefficients

19990066660 NASA Marshall Space Flight Center, Huntsville, AL USA
The Unit of Lightning
Mach, Douglas M., Alabama Univ., USA; Boeck, William L., NASA Marshall Space Flight Center, USA; Christian, Hugh J., NASA Marshall Space Flight Center, USA; 1999; In English; 11th; Atmospheric Electricity, 7-11 Jun. 1999, Guntersville, AL, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

For the past century, scientists have made quantitative measurements of lightning discharges. In the process, they refined the definition of a lightning unit, or basic quantum of lightning, in order to base it on observable parameters. Although many components of a lightning discharge have been identified, lightning usually occur in groups of discharges or pulses that, although complex, can be organized into units of flashes. This unit definition is based mainly on measurements of lightning from electric field, video, and ground flash lightning locating networks. More recent instrumentation with various combinations of high sensitivity, high temporal, or high spatial resolution often measure signals produced by lightning that do not cleanly divide into flashes. The data from these systems indicate the need or a more fundamental unit for lightning. Such a unit would be of benefit for both basic understanding of lightning and comparing lightning information between instruments. Without a common lightning unit defini-

tion, intercomparisons are difficult. For an example, the Lightning Detection and Ranging system (LDAR) at Kennedy Space Center (KSC) have detected ‚flash' rates as high as 600 per minute while analysis based on the Advanced Ground Based Field Mill network (AGBFM) detect only 33 ”flashes” per minute in the same area and time periods. The satellite based Optical Transient Detector (OTD) and Lightning Imaging Sensor (LIS) sometimes see single ”flashes” that last longer than 10 seconds. Such long duration flashes are not found in electric field records or ground strike location system data sets. The unit of lightning should be based on the fundamental components of the lightning discharge. This should make the unit as generally applicable as possible. For example, studies of NO(x) production by lightning depend on parameters of the individual lightning channels and not the summary flash characteristics. For such studies, the best unit of lightning may be closer to the classical stroke in the electric field data sets, flash in the LDAR data sets, and group in the OTD/LIS data sets. For this type of study, however, more than just the stroke count information is needed. In this paper, we will outline the current definitions of the unit of lightning and propose new basic definitions for the unit of lightning. Since different instruments detect lightning in different ways and different studies may need almost mutually exclusive aspects of the lightning discharge, there may not be a single definition of the unit of lightning that can be applied to all systems and all studies. However, common components can be found since all instrumentation are detecting aspects of the same phenomenon.
Author
Lightning; Data Acquisition; Imaging Techniques; Rangefinding; Spatial Resolution; Radiation Sources

19990066662 NASA Marshall Space Flight Center, Huntsville, AL USA
Variations in Atmospheric Water Vapor as Seen in Satellite Data and Model Reanalysis Fields
Jedlovec, Gary J., NASA Marshall Space Flight Center, USA; Chang, Fong–Chiau, Alabama Univ., USA; Suggs, Ronnie J., NASA Marshall Space Flight Center, USA; Guillory, Anthony R., NASA Marshall Space Flight Center, USA; 1998; In English; 9th; Global Change Studies, 11-16 Jan. 1998, Phoenix, AZ, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

New data sets used to describe components of the hydrologic and energy cycles of the Earth system are currently being produced and disseminated through the NASA EOS DAACs and several data assimilation centers supported by such organizations as NASA and NOAA. These data sets incorporate hybrid data analysis schemes and portray satellite and radiosonde data combined in a diagnostic sense and in a forecast mode. There is a need to develop a better understanding of the accuracy and utility of these global, relatively long-term, datasets to describe components of the hydrologic cycle and to understand atmospheric moisture variability and its relation to climatological significant events Much progress has been made in the last ten years in the development of global atmospheric models and analysis of satellite data for global studies. The atmospheric models have improved in their ability to predict both short term and longer term weather events. This has been possible through better understanding of atmosphere dynamics and very rapid advances in computer technology. Over the same period, data assimilation methods have advanced and unconventional data sources such as aircraft and satellite data, drifting buoys, etc., can be assimilated at non-synaptic times. As a result of these improvements, comprehensive global atmospheric fields based on four-dimensional data assimilation methods now provide one of the most reliable methods for studying dynamical and physical behavior in the atmosphere.
Derived from text
Atmospheric Moisture; Water Vapor; Data Bases; Hydrological Cycle; Information Systems; Models

19990066684 Arnold Engineering Development Center, Arnold AFS, TN USA
Second Report for Research and Modeling of Water Particles in Adverse Weather Simulation Facilities
Schulz, R. J.; Jul. 1998; 139p; In English
Report No.(s): AD-A364922; AEDC-TR-97-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report describes a continuation of research into the modeling of water particle freezing for application to adverse weather simulation facilities. The research was initiated in FY1996 to investigate the physics of freezing of submillimeter supercooled water particles or droplets in both natural and artificial or simulated adverse weather environments. The first phase of the research was reported and discussed in a report 1 and a paper 2. The work has continued into FY1997 and has been expanded to include work done to model three-dimensional ice accretions on surfaces, as well as modeling the near field of water spray clouds produced by air-atomized water spray nozzles. Because of the increased scope of the work, a single report cannot cover all of the work phases. Therefore, the present report covers only the continued research and development of water particulate freezing models and their application in a one-dimensional multiphase flow code to predict water spray freezing in ducted air flows.
DTIC
Water; Drops (Liquids); Simulation; Multiphase Flow; Air Flow; Particulates

19990066706 California Univ., Dept. of Land, Air and Water Resources, Davis, CA USA
Tracking the Sacramento Pollutant Plume over the Western Sierra Nevada ***Final Report***
Carroll, John J.; Dixon, Alan J.; Mar. 1998; 210p; In English
Contract(s)/Grant(s): ARB-94-334
Report No.(s): PB99-159444; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

The pollution plume from Sacramento is often directed over the Sierra Nevada foothills east-northeast of the city where the highest local concentrations of ozone are typically experienced. This study used an aircraft instrumented to measure meteorological conditions, ozone and other pollutants to examine the 3-dimensional nature of this plume. The aircraft was flown along three vertical planes oriented perpendicular to the up slope flow at 40, 80, and 120 km downwind of the city, three times each day. A fourth flight measured the same information at 40 and 80 km downwind. These measurements, as well as those documenting the meteorological setting and evolution of surface conditions, are presented. High residual ozone above the surface layer in the early morning hours appears to be necessary to produce afternoon concentrations in excess of 125 ppbv. The moderately polluted days were characterized by low residual pollutant concentrations aloft in the early morning and moderate to weak vertical stratification during the day. The cleaner days had good ventilation with deep layers of near stratification and moderate to strong winds. The maximum ozone concentrations were frequently observed in the afternoon, 40 to 80 km downwind of the city.
NTIS
Plumes; Ozone; Meteorology; Contaminants; Air Pollution

19990066712 NASA Langley Research Center, Hampton, VA USA
Radiometric Performance of the Clouds and The Earth's Radiant Energy System (CERES) Proto-Flight Model on the Tropical Rainfall Measuring Mission (TRMM) Spacecraft for 1998
Priestley, Kory J., NASA Langley Research Center, USA; Lee, Robert B., III, NASA Langley Research Center, USA; Green, Richard N., NASA Langley Research Center, USA; Thomas, Susan, Science Applications International Corp., USA; Wilson, Robert S., Science Applications International Corp., USA; 1999; 6p; In English; 10th; Atmospheric Radiation, 28 Jun. - 2 Jul. 1999, Madison, WI, USA; Sponsored by American Meteorological Society; Copyright; Avail: Issuing Activity, Hardcopy

On November 27, 1997 the CERES Proto-Flight Model (PFM) instrument package was launched on the NASA Tropical Rainfall Measuring Mission (TRMM) spacecraft National Space Development Agency) NASA /Japan launch vehicle placed the TRMM spacecraft into a low-inclination 35-deg, 350-km altitude orbit. Analysis of the first thirteen months of on-orbit internal calibration and calibration validation studies indicate that the ground-based radiometric calibrations, which were tied to ITS'90 have been successfully carried into orbit to within 0.12, 0.08, and 0.29 percent for the Total, Window and Shortwave channels respectively. Additionally, these analyses have indicated that on-orbit radiometric stability has remained at levels of better than 0.13. 0.2 and 0.2-percent for the Total Window and Shortwave channels. In TOA these levels correspond to magnitudes of less than 0.3, 0.2 and 0.15 v /sq m.
Author
Radiometers; Radiant Flux Density; Flight Instruments; Trmm Satellite; Magnetic Clouds

19990067278 NASA Marshall Space Flight Center, Huntsville, AL USA
Optical Transient Detector (OTD) Observations of a Tornadic Thunderstorm
Buechler, D. E., Alabama Univ., USA; Goodman, S. J., NASA Marshall Space Flight Center, USA; Christian, H. J., NASA Marshall Space Flight Center, USA; Driscoll, K., Alabama Univ., USA; [1999]; In English; 11th Atmospheric Electricity, 7-11 Jun. 1999, Guntersville, AL, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Total lightning observations made by the Optical Transient Detector (OTD) of a tornadic thunderstorm that occurred over Oklahoma 17 April 1995 are presented. The average flash rate of the tornadic storm during the 3.2 min observation period was 45 flashes min.with a flash rate density of 1.16 x 10(exp -4)/s sq km. The total flash rate was almost 18 times higher than the cloud-to-ground rate measured by the National Lightning Detection Network (NLDN). In addition. total lightning rates were observed to decrease prior To tornadic development.
Author
Detection; Thunderstorms; Optical Equipment

19990067282 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Variability and Predictability of Precipitation over Southeast Asian
Chang, Yehui, NASA Goddard Space Flight Center, USA; Schubert, Siegfried D., NASA Goddard Space Flight Center, USA; [1999; In English; 3rd Global Energy and Water Cycle, 16-19 Jun. 1999, Beijing, China; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The large scale atmospheric moisture budget, including precipitation, moisture flux convergence, and evaporation is described over southeast Asian. ne results are from the Goddard Earth Observing System (GEOS-1) data assimilation system for the period March 1981 - February 1995. On average, in the late spring and early summer season, precipitation is largely balanced by the atmospheric moisture flux convergence over southeast Asian; evaporation is also an important contributor. The seasonal variability of precipitation is best related to variations in the moisture flux convergence. On the monthly time scales, both the precipitable water and precipitation anomalies are most closely related to moisture flux convergence anomalies and less closely related to evaporation anomalies. The impact of the low-level jet (LLJ) on the strong low-level moisture flux convergence will be discussed. An ensemble of GEOS-2 atmospheric General Circulation Model (GCM) seasonal forecasts and long-term simulation are analyzed to assess the controlling influences of boundary forcing and memory of initial conditions. We also assess the variability and potential predictability from these experiments.
Author
Moisture; Predictions; Annual Variations; Atmospheric Moisture; Atmospheric General Circulation Models; Simulation

19990067842 Space and Naval Warfare Systems Command, San Diego, CA USA
Measurement of Low-Altitude Infrared Transmission ***Final Report***
Zeisse, C. R.; Nener, B. D.; Dewees, R. V.; Jun. 1999; 43p; In English; Prepared in collaboration with Australia Univ.
Contract(s)/Grant(s): Proj-DN302215
Report No.(s): AD-A365507; SPAWAR-TR-1797; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Infrared propagation at low altitudes is determined by extinction caused by molecules, aerosol particles, and ray bending by refraction, three effects that control the mean value of the signal (the transmission). Interference induces fluctuations of the signal (scintillation) about that mean value. This report discusses the design, calibration, and limitations of a field instrument for measuring transmission and scintillation inside the midwave and longwave infrared atmospheric passbands. The instrument, which is accurate to +/- 10% has been used to investigate aerosol, refractive, and scintillation phenomena in the marine boundary layer.
DTIC
Aerosols; Marine Meteorology; Signal Transmission; Air Water Interactions; Low Altitude

19990067844 Army Cold Regions Research and Engineering Lab., Hanover, NH USA
Existence of Traveling Wave Solutions to the Problem of Soil Freezing Described by a Model Called M sub 1
Nakano, Yoshisuke; Apr. 1999; 42p; In English
Report No.(s): AD-A365516; CRREL-99-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The scientific study of soil freezing and ice segregation began in the early 1900s. by the 1930s researchers (Taber 1930, Beskow 1935) had already found that ice segregation and the resultant frost heave are caused not only by freezing of in-situ water, but also by freezing of water transported toward a freezing front from the unfrozen part of the soil. The understanding gained in the 1930s was largely qualitative. However, the transport of water was already identified as one of major issues in the study of soil freezing. The problem has attracted the attention of many researchers (see Nakano 1991). The main constituents of saturated, frozen, and fine-grained soils are a solid porous matrix of soil particles and ice, and water in the liquid phase called unfrozen water. The physical properties of all constituents except unfrozen water are well understood. It is generally understood that the transport of water in frozen soils is mainly caused by the movement of unfrozen water and that unfrozen water exists in small spaces surrounded with surfaces of soil particles and ice. Heaving during freezing is not limited to water in soil systems. It occurs with benzene or nitrobenzene in soils (Taber 1930), water in various powder materials including hydrophobic carborundum (Horiguchi 1977), liquid helium in porous glasses (Hiroi et al. 1989), water in hydrophobic silicon-coated glass beads (Sage and Porebska 1993), and water in porous rocks (Miyata et al. 1994).
DTIC
Permafrost; Traveling Waves; Separation; Ice; Liquid Phases; Porous Materials; Freezing

19990069930 NASA Kennedy Space Center, Cocoa Beach, FL USA
The Coherence Time of Mid-Tropospheric Wind Features as a Function of Vertical Wavelength from 300 to 2 Km
Merceret, Francis J., NASA Kennedy Space Center, USA; July 1999; 26p; In English
Report No.(s): NASA/TM-1999-208547; NAS 1.15:208547; Copyright; Avail: Issuing Activity, Hardcopy
The coherence between vertical wind profiles separated by a time lag, L, is measured as a function of vertical wavenumber, k, from Doppler radar wind profiler data. Each profile covers altitudes from 6811 to 16261 meters and is Fourier transformed over a wavenumber range from 0 to 3.33 E-3/m. Time lags between profiles of 0.083, 0.25, 0.5, 1.0 and 2.0 hours are used. A correction

for instrument noise is derived and applied to the results. An empirical formula for the coherence as a function of L and k is presented and evaluated. The ”coherence time”, tau, is defined as the value of L beyond which the coherence decays below a chosen value, epsilon, at a given scale lambda where lambda = 1/k. A relation between tau and lambda is derived. The resolution of the KSC 50 MHz profiler is reassessed.
Author
Troposphere; Wind (Meteorology); Wind Measurement; Vertical Distribution; Wind Profiles; Wind Velocity; Meteorological Parameters

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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.

19990064458 NASA Goddard Space Flight Center, Greenbelt, MD USA
GPS Ocean Reflection Experiment on Spartan 251
Garrison, James L., NASA Goddard Space Flight Center, USA; Russo, Angela, NASA Goddard Space Flight Center, USA; Mickler, Dave, DU/CCAR; Katzberg, Stephen J., NASA Lewis Research Center, USA; 1999; 1p; In English; ION-GPS 1999, 14-17 Sep. 1999, Nashville, TN, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

It has recently been demonstrated that the GPS signal which has reflected from the ocean surface contains useful geophysical data from which the sea surface wind speed and other parameters can be extracted. This can be used for remote sensing, similar to present day use of radar altimeters or scatterometers, but with significantly smaller instrumentation because of the utilization of the existing GPS broadcast signal for illumination. Several campaigns of aircraft experimentation have been completed demonstrating this technique and reflected GPS data has been reliably collected from 25 km altitude on a balloon. However, there has not yet been a demonstration that the reflected GPS signal can be detected from orbit with sufficient signal to noise ratio (SNR) to make useful remote sensing measurements. A technology demonstration experiment is planned for a Space Shuttle flight in the late 2000 using the Spartan 251 recoverable carrier. This experiment will be also be the first flight validation of the PiVoT GPS receiver developed in house at the Goddard Space Flight Center. The open-architecture, design of this receiver allows the software modifications to be made which control code-correlator spacing to map out the shape of the reflected signal waveform, which is the most basic data product generated by this instrumentation. A moderate gain left-hand circularly polarized antenna, constructed from an array of off-the-shelf hemispherical antennas will be used to give approximately 6dB of additional gain. Preliminary SNR predictions have been done indicating that this antenna will offer sufficient gain to record waveform measurements. A system level description of the experiment instrumentation, including the receiver, antenna and data storage and retrieval will be given. The visibility of GPS reflections over the mission duration of several hours will be studied, including the effects of the limited beamwidth of the antenna. Additionally, because of the small size of this instrumentation, several other space flight opportunities are being considered in the near term. If these missions materialize, they will be described in the paper as well.
Author
Global Positioning System; Correlators; Data Storage; Geophysics; Ocean Surface; Remote Sensing; Signal to Noise Ratios; Waveforms

19990064462 NASA Goddard Space Flight Center, Greenbelt, MD USA
Reconstruction of the 1997/1998 El Nino from TOPEX/POSEIDON and TOGA/TAO Data Using a Massively Parallel Pacific-Ocean Model and Ensemble Kalman Filter
Keppenne, C. L., NASA Goddard Space Flight Center, USA; Rienecker, M., NASA Goddard Space Flight Center, USA; Borovikov, A. Y., NASA Goddard Space Flight Center, USA; 1999; In English; 24th; EGS General Assembly, 19-23 Apr. 1999, The Hague, Netherlands; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Two massively parallel data assimilation systems in which the model forecast-error covariances are estimated from the distribution of an ensemble of model integrations are applied to the assimilation of 97-98 TOPEX/POSEIDON altimetry and TOGA/TAO temperature data into a Pacific basin version the NASA Seasonal to Interannual Prediction Project (NSIPP)ls quasi-isopycnal ocean general circulation model. in the first system, ensemble of model runs forced by an ensemble of atmospheric model simulations is used to calculate asymptotic error statistics. The data assimilation then occurs in the reduced phase space spanned by the corresponding leading empirical orthogonal functions. The second system is an ensemble Kalman filter in which new error statistics are computed during each assimilation cycle from the time-dependent ensemble distribution. The data assimilation experiments are conducted on NSIPP’s 512-processor CRAY T3E. The two data assimilation systems are validated

by withholding part of the data and quantifying the extent to which the withheld information can be inferred from the assimilation of the remaining data. The pros and cons of each system are discussed.
Author
Atmospheric Models; Data Systems; El Nino; Estimating; Ocean Currents; Ocean Models; Orthogonal Functions

19990064613 NASA Goddard Space Flight Center, Greenbelt, MD USA
Variability of Arctic Sea Ice as Determined from Satellite Observations
Parkinson, Claire L., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 27 Jan. 1999, College Station, TX, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The compiled, quality-controlled satellite multichannel passive-microwave record of polar sea ice now spans over 18 years, from November 1978 through December 1996, and is revealing considerable information about the Arctic sea ice cover and its variability. The information includes data on ice concentrations (percent areal coverages of ice), ice extents, ice melt, ice velocities, the seasonal cycle of the ice, the interannual variability of the ice, the frequency of ice coverage, and the length of the sea ice season. The data reveal marked regional and interannual variabilities, as well as some statistically significant trends. For the north polar ice cover as a whole, maximum ice extents varied over a range of 14,700,000 - 15,900,000 sq km, while individual regions experienced much greater percent variations, for instance, with the Greenland Sea having a range of 740,000 - 1,110,000 sq km in its yearly maximum ice coverage. In spite of the large variations from year to year and region to region, overall the Arctic ice extents showed a statistically significant, 2.80% / decade negative trend over the 18.2-year period. Ice season lengths, which vary from only a few weeks near the ice margins to the full year in the large region of perennial ice coverage, also experienced interannual variability, along with spatially coherent overall trends. Linear least squares trends show the sea ice season to have lengthened in much of the Bering Sea, Baffin Bay, the Davis Strait, and the Labrador Sea, but to have shortened over a much larger area, including the Sea of Okhotsk, the Greenland Sea, the Barents Sea, and the southeastern Arctic.
Author
Sea Ice; Variability; Satellite Observation; Arctic Ocean

19990068970 National Research Inst. for Earth Science and Disaster Prevention, Tsukuba, Japan
Seasonal Variability of Ocean Salinity Structure Through Freshwater Exchange
Matsuura, Tomonori, National Research Inst. for Earth Science and Disaster Prevention, Japan; Dec. 1993; 25p; In Japanese; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The annual mean freshwater distribution over the surface in the global ocean and its seasonal variabilities are estimated by using the ocean general circulation model (OGCM) with restoring bounding conditions. The distribution of the annual average freshwater gain and loss estimated by the model shows qualitatively good correspondence to that estimated by the observational data, except for the area of river runoff and a freezing region of sea ice. The seasonally changing transports from the Amazon River and the Ganges-Brahmaputra-Godavari rivers to the sea area were also estimated. Particularly, it was found that the seasonally changing gain of fresh water off the Amazon estimated by OGCM corresponds quantitatively well to the seasonally variable transport of the Amazon River. The seasonal variability between the net evaporation minus precipitation and the salinity profile of the upper ocean correlated well on the side of the Southern Hemisphere of the western Pacific equatorial region. On the side of the Northern Hemisphere, however, the seasonal variability of the salinity distribution did not correlate with that of the net evaporation minus precipitation because the advection due to the seasonal changing wind stress influences on the salinity profile. In the Indian Ocean where seasonal variability is prominent, the sea water evaporated excessively in the Arabian Sea through all seasons. On the other hand, in Bay of Bengal, freshwater flux diminished from January to June and increased from July to December. The freshwater balance including freshwater gain from the Ganges-Brahmaputra-Godavari rivers heavily influenced the density structure in the Indian Ocean.
Author
Annual Variations; Drainage; Equatorial Regions; Fresh Water; Ocean Currents; Ocean Models; Rivers; Salinity; Sea Water

19990069602 Naval Research Lab., Oceanography Div., Stennis Space Center, MS USA
Bathymetry from Hyperspectral Sensors: A Preliminary Analysis of the Problem ***Final Report***
Holyer, Ronald J.; Sandidge, Juanita C.; May 20, 1999; 36p; In English
Contract(s)/Grant(s): Proj-F1947
Report No.(s): AD-A365138; NRL/FR/7341--98-9690; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Water depth, bottom reflectance, inherent optical properties of the water column (scattering, absorption, and fluorescence), and illumination conditions combine to determine the upwelling spectral radiance of coastal waters. If these complex optical relationships could be quantified, it would be possible to extract coastal information from spectral radiance data. We use data from

the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) to begin to characterize these relationships as a first step toward development of algorithms for retrieval of water depth from hyperspectral imagery. Data are analyzed for two areas: the western coast of Florida in the Tampa Bay area and the Florida Keys between Upper Matecumbe and Plantation Keys. A neural network approach has been used to demonstrate retrieval of reasonable depths from spectral radiance over a depth range of 0 to 6 m. The ability of the neural network to generalize, producing algorithms with some degree of universality among diverse coastal environments, has been investigated in a preliminary fashion.
DTIC
Oceanography; Bathymeters; Emission Spectra

51
LIFE SCIENCES (GENERAL)

19990064383 Creighton Univ., Omaha, NE USA
Effects of Weightlessness on Vestibular Development of Quail
Fritzsch, Bernd, Creighton Univ., USA; Bruce, Laura L., Creighton Univ., USA; [1999]; 5p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The data confirm previous findings that quail embryos can, under proper circumstances, develop until hatching in microgravity. There were no gross abnormalities in the few ears of the late embryos (we received 3 ears at E14.5 and 4 ears at E16.5). Due to inadequate numbers of samples returned and their fully insufficient fixation, no conclusions could be reached that warrant any publications.
Derived from text
Embryos; Microgravity; Weightlessness

19990066631 NASA Ames Research Center, Moffett Field, CA USA
Global Biology: An Interdisciplinary Scientific Research Program at NASA Ames Research Center
Lawless, James G., NASA Ames Research Center, USA; Colin, Lawrence, NASA Ames Research Center, USA; International Cooperation and Space Mission; 1984, pp. 464-475; In English; 34th; Congress of the International Astronautical Federation, 10-15 Oct. 19832, Budapest, Hungary
Report No.(s): AIAA Paper 83-0100; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

NASA has initiated new effort in Global Biology, the primary focus of which is to understand biogeochemical cycles. As part of this effort, an interdisciplinary team of scientists has formed at Ames Research Center to investigate the cycling of sulfur in the marine coastal zone and to study the cycling of nitrogen in terrestrial ecosystems. Both studies will use remotely sensed data, coupled with ground-based research, to identify and measure the transfer of major and minor biologically produced gases between these ecosystems and global reservoirs.
Author
Research and Development; Biology; Biogeochemistry; Ecosystems

19990066681 Los Alamos National Lab., NM USA
Measurements of the Ultraviolet Fluorescence Cross Sections and Spectra of Bacillus Anthracis Simulants ***Final Report, Jun. 1995 - Sep. 1998***
Stephens, John R., Los Alamos National Lab., USA; May 1999; 48p; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): AD-A364911; LAUR-98-4173; ECBC-CR-004; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Measurements of the ultraviolet autofluorescence spectra and absolute cross sections of the Bacillus anthracis (Ba) simulants Bacillus globigii (Bg), Bacillus megaterium (Bm), Bacillus subtilis (Bs), and Bacillus cereus (Bc) were measured. Fluorescence spectra and cross sections of pine pollen (Pins echinata) were measured for comparison. Both dried vegetative cells and spores separated from the sporulated vegetative material were studied. The spectra were obtained by suspending a small number (is less than 10) of particles in air in our Single Particle Spectroscopy Apparatus (SPSA), illuminating the particles with light from a spectrally filtered arc lamp and measuring the fluorescence spectra of the particles. The illumination was 230 nm (20 nm FWHM) and the fluorescence spectra was measured between 300 and 450 nm. The fluorescence cross section of vegetative Bg peaks at 320 nm with a maximum cross section of 5 X 10-14 sq cm/sr-nm- particle, whereas the Bg spore fluorescence peaks at 310 nm with peak fluorescence of 8 X 10-15 sq cm/sr-nm-particle. Pine pollen particles showed a higher fluorescence peaking at 353 nm with

a cross section of 1.7 X 10-13 sq cm/sr-nm-particle. Integrated cross sections ranged from 3.0 X 10-13 cm2/sr-particle for the Bg spores to 2.25 X 10-12 sq cm/sr-particle for the vegetative cells.
DTIC
Bacillus; Fluorescence; Ultraviolet Spectra; Cross Sections

19990070320 NASA Marshall Space Flight Center, Huntsville, AL USA
Beta-Adrenergic Receptor Population is Up-Regulated by Increased Cyclic Amp Concentration in Chicken Skeletal Muscle Cells in Culture
Young, Ronald B., NASA Marshall Space Flight Center, USA; Bridge, Kristin Y., NASA Marshall Space Flight Center, USA; Vaughn, Jeffrey R., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Skeletal muscle hypertrophy is promoted in vivo by administration of beta-drenergic receptor (bAR) agonists. Chicken skeletal muscle cells were treated with 1 (mu)M isoproterenol, a strong bAR agonist, between days 7 and 10 in culture. bAR population increased by approximately 40% during this treatment; however, the ability of the cells to synthesize cyclic AMP (cAMP) was diminished by two-fold. The quantity of myosin heavy chain (MHC) was not affected. To understand further the relationship between intracellular cAMP levels, bAR population, and muscle protein accumulation, intracellular cAMP levels were artificially elevated by treatment with 0-10 uM forskolin for up to three days. The basal concentration of CAMP in forskolin-treated cells increased up to 7-fold in a dose dependent manner. Increasing concentrations of forskolin also led to an increase in bAR population, with a maximum increase of approximately 40-60% at 10 uM forskolin. A maximum increase of 40-50% in the quantity of MHC was observed at 0.2 uM forskolin, but higher concentrations of forskolin reduced the quantity of MHC back to control levels. At 0.2 uM forskolin, intracellular levels of cAMP were higher by approximately 35%, and the (beta)AR population was higher by approximately 30%. Neither the number of muscle nuclei fused into myotubes nor the percentage of nuclei in myotubes were affected by forskolin at any of the concentrations studied.
Author
Adrenergics; Musculoskeletal System; Culture Techniques; Cells (Biology); Sympathetic Nervous System; Populations

19990070327 NASA Marshall Space Flight Center, Huntsville, AL USA
Beta-Adrenergic Receptor Expression in Muscle Cells
Young, Ronald B., NASA Marshall Space Flight Center, USA; Bridge, K., NASA Marshall Space Flight Center, USA; Vaughn, J. R., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; Signal Transduction and Therapeutic Strategies, 6 Feb. 1999, Houston, TX, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

beta-adrenergic receptor (bAR) agonists presumably exert their physiological action on skeletal muscle cells through the bAR. Since the signal generated by the bAR is cyclic AMP (cAMP), experiments were initiated in primary chicken muscle cell cultures to determine if artificial elevation of intracellular cAMP by treatment with forskolin would alter the population of bAR expressed on the surface of muscle cells. Chicken skeletal muscle cells after 7 days in culture were employed for the experiments because muscle cells have attained a steady state with respect to muscle protein metabolism at this stage. Cells were treated with 0-10 uM forskolin for a total of three days. At the end of the 1, 2, and 3 day treatment intervals, the concentration of cAMP and the bAR population were measured. Receptor population was measured in intact muscle cell cultures as the difference between total binding of [H-3]CGP-12177 and non-specific binding of [H-3]CGP-12177 in the presence of 1 uM propranolol. Intracellular cAMP concentration was measured by radioimmunoassay. The concentration of cAMP in forskolin-treated cells increased up to 10-fold in a dose dependent manner. Increasing concentrations of forskolin also led to an increase in (beta)AR population, with a maximum increase of approximately 50% at 10 uM. This increase in (beta)AR population was apparent after only 1 day of treatment, and the pattern of increase was maintained for all 3 days of the treatment period. Thus, increasing the intracellular concentration of cAMP leads to up-regulation of (beta)AR population. Clenbuterol and isoproterenol gave similar effects on bAR population. The effect of forskolin on the quantity and apparent synthesis rate of the heavy chain of myosin (mhc) were also investigated. A maximum increase of 50% in the quantity of mhc was observed at 0.2 UM forskolin, but higher concentrations of forskolin reduced the quantity of mhc back to control levels.
Author
Cells (Biology); Receptors (Physiology); Adrenergics; Musculoskeletal System; Sympathetic Nervous System

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AEROSPACE MEDICINE

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

19990064331 Norwegian Defence Research Establishment, Kjeller, Norway
Examination of Air Quality in Sea-King ***Undersokelse av Luftkvalitet i Sea-King***
Johnsen, Arnt, Norwegian Defence Research Establishment, Norway; Apr. 28, 1999; 16p; In Dutch
Contract(s)/Grant(s): FFITOX Proj. 311601/138
Report No.(s): FFI/RAPPORT-99/01834; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Sea-King helicopter crews have reported various forms of ill-being. Preliminary investigations of the cabin air quality indicate exhaust exposure of the crew. Air samples were collected during five different operational modi of the helicopter and the air samples were analysed for contents of CO, CO2, particles and hydrocarbons. The concentration of CO, CO2 and volatile hydrocarbons did not exceed Norwegian air quality criteria, but under several helicopter operations the particle concentration in air exceeded Norwegian air quality criteria. Relatively high concentrations of heavy n-alkanes were detected. These n-alkanes are not components in F-34 fuel and it is not likely that these n-alkanes are coming from lubricating oil or from the exhaust. It is therefore necessary to establish the source for these n-alkanes. A high concentration of particles and heavy n-alkanes in combination with relatively high concentration of CO can be the cause for the reported subjective symptoms. Due to short sampling time (10 min), the detection limits for hydrocarbons and particles were not low enough to get reliable results and it is therefore recommended to take new samples with a sampling time of 2-4 hours. According to crew experience the cabin air quality is worst on a warm summer day with little wind.
Author
Air Quality; Air Sampling; Carbon Dioxide; Flight Crews; Hydrocarbons; Sampling

19990067264 Texas Univ., Medical Branch, Galveston, TX USA
Superoxide and Nitric Oxide Mechanisms in Traumatic Brain Injury and Hemorrhagic Hypotension ***Annual Report, 1 Dec. 1997 - 30 Nov. 1998***
DeWitt, Douglas S., Texas Univ., USA; Dec. 1998; 32p; In English
Contract(s)/Grant(s): DAMD17-97-1-7008
Report No.(s): AD-A364962; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Traumatic brain injury (TB I) reduces cerebral blood flow (CBF) and renders the brain vulnerable to secondary ischemia. Hypotension contributes to poor Outcome after TBI in humans. We have prevented hypoperfusion and restored autoregulation after TBI. The goals of this project are to determine whether treatment based on our observations will prevent CBF reductions, brain edema and histological damage after TBI and hemorrhagic hypotension and to understand the mechanisms that contribute to the efficacy of the proposed treatments. Specific Aim 1 addressed the hypothesis that impairment of cerebrovascular function will result in brain injury after TBI and hemorrhagic hypotension that would not occur after hypotension alone. Specific Aim 2 addressed the hypothesis that post-TB I cerebral hypoperfusion is caused by nitric oxide (N0)-dependent mechanisms. Specific Aim 3 addressed the hypothesis that increased production of superoxide during TBI and subsequent hypotension/resuscitation is responsible for the impaired cerebrovascular reactivity. Specific Aim 4 will address the hypothesis that small volume resuscitation with hypertonic saline will restore cerebral circulatory and systemic hemodynamics without causing the pronounced changes in brain water diffusion seen after TBI and hypotension/resuscitation with shed blood.
DTIC
Brain; Brain Damage; Injuries; Nitric Oxide; Hemorrhages

19990068013 Baylor Coll. of Medicine, Houston, TX USA
A Comparison of NASA Induction Tools for the Creation of Decision Rules Regarding Treatment for Clinically Localized Prostate Cancer
Kattan, Michael W., Baylor Coll. of Medicine, USA; [1997]; 4p; In English
Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The final report includes project information, a project summary, and a short bibliography listing contributors to the project, articles written and book chapters written as a result of the project.
Derived from text
Cancer; Decision Making; Leukemias; Mathematical Models; Prostate Gland; Statistical Analysis; Neural Nets

19990068024 Istituto Superiore di Sanita, Rome, Italy
Nuclear Magnetic Resonance Spectroscopy in Biomedicine ***Spettroscopia di risonanza magnetica nucleare in biomedicina***
Marina, Marciana, Istituto Superiore di Sanita, Italy; Luciani, Anna Maria, Editor, Istituto Superiore di Sanita, Italy; Rosi, Antonella, Editor, Istituto Superiore di Sanita, Italy; 1995; ISSN 1123-3117; 213p; In Italian
Report No.(s): ISTISAN-97/40; Copyright; Avail: Issuing Activity (Istituto Superiore di Sanita, Viala Regina Elena, 299-00161 Rome Italy); US Sales Only, Hardcopy, Microfiche

Nuclear magnetic resonance (NMR) is a powerful technique that can be used in a wide range of applications, such as the structural characterization of high molecular weight molecules, conformational studies on enzymes in solution, enzyme-substrate or DNA-protein interactions, monitoring of cell metabolism in vivo, and for diagnostic purposes, employing spectroscopic and imaging techniques. This course was organized in order to introduce the participants to the fundamentals of NMR spectroscopy, and offer practical advice on performing NMR experiments on cell systems, cell and tissue extracts and animal models.ne main implications regarding human experiments were also discussed. Finally the quantification of information and the interpretation of data were considered with regard to the main nuclei observed.
Author
Biomedical Data; Medical Science; Nuclear Magnetic Resonance; Spectroscopy

19990068480 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
Aeromedical Aspects of Aircrew Training ***Les Aspects Aeromedicaux de la Formation des Equipages***
June 1999; 96p; In English, 14-18 Oct. 1998, San Diego, CA, USA; See also 19990068481 through 19990068496
Report No.(s): RTO-MP-21; AC/323(HFM)TP/8; ISBN 92-837-1016-9; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche

A RTO Human Factors and Medicine Panel Workshop held in San Diego, California, in October 1998 brought together Aeromedical Trainers to discuss current Aeromedical Training Programs and to present new approaches to this training. Various approaches to Aeromedical Training were also discussed and STANAG 3114 ”Aeromedical Training of Flight Personnel” was reviewed. Presentations included: categories of training, subjects taught, frequency of training, duration of courses, period of validity and altitude chamber profiles utilized. Most NATO countries were present and provided overviews of their programs, as did representatives from Poland and the Czech Republic. Presentations also included new approaches to Aeromedical Training including: Simulator Based Physiology Training (SYMPHYS), Simulator Based Disorientation Training and In-Flight Disorientation Training. The Workshop recommended changes to STANAG 3114 including, but not limited to: removal of the split between Rotary and Fixed-wing aircraft training requirements, addition of the requirement for instruction on aeromedical aspects of new Life Support Equipment and addition of the requirement for a practical Spatial Disorientation experience during refresher training. Also recommended was the establishment of a Working Group to study the variation between countries in rates of Decompression Illness from altitude chamber exposure. It was also recommended that NATO validate the need for a new STANAG on Night Vision Training.
Author
Aerospace Medicine; Human Factors Engineering; Training Devices; Training Simulators; Flight Training; Flight Simulation; Altitude Simulation; Flight Crews

19990068481 Royal Air Force, Aviation Training Centre, Henlow, UK
Aviation Medicine Training of Royal Air Force Aircrew
Morris, C. B., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 1-1 - 1-7; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper opens with a brief history of aviation medicine training in the Royal Air Force (RAF). The details of courses currently run by the RAF Aviation Medicine Training Centre (AMTC) are included together with information about the practical content of each course. In addition, the paper includes specific details of hypobaric chamber profiles used at AMTC and covers the possible reasons behind the lack of decompression sickness incidents experienced by the RAF. The paper closes with an explanation of the internal audit procedure employed at AMTC.
Author
Aerospace Medicine; Flight Crews; Crew Procedures (Inflight); Education; Training Analysis; Pilot Training; Classes

19990068482 Royal Air Force, Aviation Medicine Training Centre, Henlow, UK
Spatial Disorientation Training of Royal Air Force Aircrew
Daulby, D. J., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 2-1 - 2-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper gives the rationale behind the spatial disorientation training given to Royal Air Force (RAF) aircrew at the RAF Aviation Medicine Training Centre at Henlow. The link between aircrew roles, their experience levels and the training provided is explained and the content of the lecture program is covered. Details of the practical training aircrews receive is included and the way the training is matched to individual requirements is explained. The paper ends with a brief look at the future of disorientation training within the RAF.
Author
Aerospace Medicine; Flight Crews; Education; Training Analysis

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BEHAVIORAL SCIENCES

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

19990064491 Purdue Univ., West Lafayette, IN USA
Some More Sensitive Measures of Sensitivity and Response Bias
Balakrishnan, J. D., Purdue Univ., USA; Psychological Methods; 1998; ISSN 1082-989X; Volume 3, No. 1, pp. 68-90; In English
Contract(s)/Grant(s): NCC2-374; NASA Order H-2350; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this article, the author proposes a new pair of sensitivity and response bias indices and compares them to other measures currently available, including d' and Beta of signal detection theory. Unlike d' and Beta, these new performance measures do not depend on specific distributional assumptions or assumptions about the transformation from stimulus information to a discrimination judgment with simulated and empirical data, the new sensitivity index is shown to be more accurate than d' and 16 other indices when these measures are used to compare the sensitivity levels of 2 experimental conditions. Results from a perceptual discrimination experiment demonstrate the feasibility of the new distribution-free bias index and suggest that biases of the type defined within the signal detection theory framework (i.e., the placement of a decision criterion) do not exist, even under an asymmetric payoff manipulation.
Author
Sensitivity; Response Bias; Dynamic Response; Transient Response; Frequency Response

19990068483 Royal Air Force, Aviation Medicine Training Centre, Henlow, UK
Night Vision Training of Royal Air Force Aircrew
Hansford, N. G., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 3-1 - 3-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper offers a summary of the Night Operations Familiarization Course which is currently employed at the Royal Air Force (RAF) Aviation Medicine Training Centre. A brief history of the development of the course is followed by a summary of both the academic and practical aspects of the current syllabus. The paper ends with a look towards future developments in Electro-Optic Training within the RAF.
Author
Aerospace Medicine; Night Vision; Training Analysis; Education; Flight Crews; Personnel Development

19990068484 Headquarters Army Aviation, Middle Wallop, UK
Aviation Medicine and Physiology Training in the British Army
Braithwaite, M. G., Headquarters Army Aviation, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 4-1 - 4-5; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The mission of Army Aviation Medicine is to enhance the effectiveness of Army Aviation by promoting health and minimizing the deleterious physical, psychological and pathological factors associated with flight. This is delivered by providing integrated operational aeromedical guidance, education, research, and analysis to optimize the fighting power of the force and enhance flight safety. The aeromedical training to aircrew is clearly a most important function. An outline of the Aviation medicine and Physiology training given to British Army helicopter pilots is presented. Training for other aircrew is described in brief at the end of the paper.
Derived from text
Aerospace Medicine; Education; Training Analysis; Flight Crews; Pilot Training; Armed Forces (Foreign); UK

19990068485 Portuguese Air Force Aeromedical Center, Lisbon, Portugal

Portuguese Physiological Training Program

Ribeiro, Nuno, Portuguese Air Force Aeromedical Center, Portugal; Rocha, Carlos, Portuguese Air Force Aeromedical Center, Portugal; Aeromedical Aspects of Aircrew Training; June 1999, pp. 5-1 - 5-5; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Aviation physiology training for Portuguese Air Force aircrew is carried out at the Physiological Training Unit (PTU) of the Aeromedical Center (AMC) since 1984 located at Lumiar Base in Lisbon. For a better understanding of AMC integration we present the POAF organization with reference to the personnel branch and AMC structure.

Derived from text

Aerospace Medicine; Education; Training Analysis; Personnel Development; Flight Crews; Portugal; Armed Forces (Foreign)

19990068486 Royal Danish Air Force, Medical Squadron 590, Vaerloese AFB, Denmark

Royal Danish Air Force Aviation Physiological Training Program

Oldenburg, Julia N. S., Royal Danish Air Force, Denmark; Nielson, Jan Nybo, Royal Danish Air Force, Denmark; Aeromedical Aspects of Aircrew Training; June 1999, pp. 9-1 - 9-6; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper opens with a brief history of aviation physiological training in the Royal Danish Air Force (RDAF). The details of courses currently run by Medical Squadron 590 are included together with information about the content of each course. In addition, the paper includes specific details of the practical demonstrations provided to enhance learning and expand on the concepts taught during the theoretical portion of the course. The practical demonstrations included in all training courses are the unaided night vision and spatial disorientation demonstrations. An additional practical demonstration in the hypobaric chamber is included during courses for fighter (F-16), transport (C-130, G-III, Challenger, and NATO AWACS), helicopter (Westland Lynx), and high altitude parachutist (HAP) aircrew.

Author

Aerospace Medicine; Education; Training Analysis; Flight Crews; Armed Forces (Foreign); Denmark

19990068487 Institute of Aviation Medicine, Prague, Czechoslovakia

Aviation Physiology Training Programme of Czech Air Force

Dosel, Petr, Institute of Aviation Medicine, Czechoslovakia; Aeromedical Aspects of Aircrew Training; June 1999, pp. 10- 1 - 10-3; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The lecture provides the basic information about aviation physiology training of the Czech Army. It takes notice of the circumstances of that system's development. The paper emphasized that aviation physiology training system is approaching STANAG 3114 and presented the necessary changes for the future.

Author

Aerospace Medicine; Education; Training Analysis; Flight Crews; Pilot Training

19990068488 Canadian Forces Air Command, School of Aeromedical Training, Winnipeg, Manitoba Canada

Canadian Forces Aeromedical Training Programme

Glass, K. C., Canadian Forces Air Command, Canada; Aeromedical Aspects of Aircrew Training; June 1999, pp. 11-1 - 11-6; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Canadian Armed Forces has a long history of providing Aeromedical Training to its Flight Personnel. There have been as many as ten Physiology Training sites operating, including one in Lahr, Germany. The Canadian Forces School of Aeromedical Training offers Aeromedical Training, Aircrew Survival Training, Basic Night Vision Device Training and provides Hyperbaric Chamber Treatments for military personnel and emergency civilian cases.

Derived from text

Aerospace Medicine; Armed Forces; Canada; Education; Training Analysis; Flight Crews

19990068489 Institute of Aviation Medicine, Aerospace Physiology, Koenigsbrueck, Germany

Aerospace Physiology Training for German Federal Armed Forces

Valentiner, A., Institute of Aviation Medicine, Germany; Aeromedical Aspects of Aircrew Training; June 1999, pp. 12-1 - 12-8; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper provides minutes and some of the slides of the briefing presented at the HFM Workshop in San Diego, Ca., USA, from 14-16 Oct. 1998. The paper introduces our current practice of ”Aeromedical Training of Flight Personnel” in regard to STANAG 3114.
Derived from text
Aerospace Medicine; Education; Training Analysis; Personnel Development; Pilots (Personnel); Flight Crews; Armed Forces; Germany

19990068490 Hellenic Air Force General Hospital, Hellenic Center of Aviation Medicine, Athens, Greece
Aircrew Aeromedical Training Hellenic Air Force Program
Paxinos, Odysseas, Hellenic Air Force General Hospital, Greece; Aeromedical Aspects of Aircrew Training; June 1999, pp. 14-1 - 14-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Aviation physiology training and medical certification for both military and civil aircrews is carried out in Greece in the Center of Aviation Medicine (KAI). Military aircrew training is carried out with reference to STANAG 3114 and includes altitude chamber flights and spatial disorientation trainer rides. Centrifuge training for fighter pilots is provided under contract abroad. Refresher lecture courses are provided annually and practical training every 3 years. The Center is currently being upgraded to meet future needs.
Author
Aerospace Medicine; Education; Flight Crews; Greece; Armed Forces (Foreign)

19990068491 Royal Air Force, Center of Aviation Medicine, Henlow, UK
Royal Air Force High Altitude Physiological Training
Gradwell, D. P., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 15-1 - 15-4; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Royal Air Force continues to operate aircraft at altitudes in excess of 50,000 feet. to provide short-term protection against hypoxia in the event of loss of cabin pressure the aircrew are trained in the technique of positive pressure breathing and the use of counter-pressure garments at altitude. Although the life support systems of many military fast jet aircraft provide pressure breathing it is commonly limited to a pressure of 30 mmHg above ambient. The use of breathing pressures higher than 30 mmHg requires the use of counter-pressure assemblies to reduce the adverse physiological side effects of pressure breathing. The aim of the high altitude aviation medicine training is to familiarize the aircrew with the personal equipment they must wear, the operation of the aircraft’s oxygen systems in the event of a decompression at high altitude, to become competent in the performance of the correct pressure breathing technique and finally to undergoing a rapid decompression from 25,000 ft to 56,000 ft in three seconds in a hypobaric chamber.
Derived from text
Aerospace Medicine; Education; Flight Crews; Pilot Training; High Altitude; Hypobaric Atmospheres; High Altitude Breathing; High Altitude Pressure; Pressure Breathing; Emergency Breathing Techniques

19990068492 Aeromedical Inst., Soesterberg, Netherlands
Aviation Physiology and Medicine Training in the Royal Netherlands Air Force and Aeromedical Institute
Los, M. J. B., Aeromedical Inst., Netherlands; Aeromedical Aspects of Aircrew Training; June 1999, pp. 16-1 - 16-5; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Nearly all aviation physiology and aviation medicine training, from here on referred to as ’aeromedical training’ is performed at the Aeromedical Institute. In this civilian non-governmental institute both RNLAF and civilian personnel are involved in aeromedical (and psychological) training, selection, examinations and research for military and civilian aircrew from many countries. The training section within the Aeromedical Institute currently consists of four RNLAF Aviation Physiologists and a RNLAF Flight Surgeon. Besides training they are also involved in aircrew equipment, especially oxygen systems and anti-G protection. They also participate in aeromedical evaluations and research generally when the human centrifuge and the hypobaric chambers are involved. The latest asset of the training section is a six axis FSDD which stands for Flight Simulated Disorientation Demonstrator.
Derived from text
Aerospace Medicine; Education; Flight Crews; Armed Forces (Foreign); Netherlands

19990068493 Headquarters Army Aviation, Middle Wallop, UK
In-Flight Demonstration of Spatial Disorientation in the British Army
Braithwaite, M. G., Headquarters Army Aviation, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 17-1 - 17-9;

In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Following didactic instruction, most aircrew are able to experience some of the disorientating illusions and limitations of the orientational senses in a variety of ground-based devices. In order to reinforce instruction in spatial disorientation (SD) within environment in which they operate, British Army Air Corps helicopter pilots also receive an airborne demonstration of the limitations of their orientation senses. Since 1982, a specific SD sortie has been programmed towards the end of the basic rotary-wing phase of flight training approximately 6 weeks after the aeromedical training module, and before students commence rotary-wing instrument flight training. Refresher sorties are flown every 4 years. The conduct of the SD sortie is described in detail. Analysis of helicopter accidents demonstrates that this training is operationally effective by contributing towards the reduction of SD-related mishaps. It is cost-effective and the addition of this type of in-flight demonstration to the aeromedical training syllabus is regarded as being of great value to British Army helicopter aircrew. Similar instruction could be readily adopted by other services.
Author

Aerospace Medicine; Aircraft Pilots; Flight Crews; Flight Training; Education; Pilot Training; Armed Forces (Foreign); UK

19990068495 Bureau of Medicine and Surgery (Navy), Washington, DC USA

USA Navy (USN) Aviation Survival Training Program

Matthews, Robert A., Bureau of Medicine and Surgery (Navy), USA; Aeromedical Aspects of Aircrew Training; June 1999, pp. 6-1 - 6-3; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes the current USN aeromedical training program. Training requirements, training locations and training methodologies are listed. Details of curriculums, including topics, hours and training devices utilized are presented. Hypobaric chamber profiles for altitude simulations are also described.
Author

Aerospace Medicine; Education; Training Devices; Training Analysis; Personnel Development; USA; Navy

19990068496 Air Force Medical Operations Agency, Bolling AFB, Washington, DC USA

USA Air Force (USAF) Aerospace Physiology Program

Sventek, Jeffrey C., Air Force Medical Operations Agency, Bolling AFB, USA; Aeromedical Aspects of Aircrew Training; June 1999, pp. 13-1 - 13-7; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes the recent changes made to the USAF Aerospace Physiology training programs as presented during the October 14-16, 1998 Human Factors & Medicine Panel Workshop on Aeromedical Aspects of Aircrew Training. The USAF Aerospace Physiology training programs have changed in an effort to reduce risk and to make the training more operationally relevant for the students.
Author

Aerospace Medicine; Education; Flight Crews; Pilot Training; Armed Forces (USA)

19990069622 Pittsburgh Univ., Inst. for Aviation Medicine and Safety, Pittsburgh, PA USA

The Effects of Age and Practice on Aviation-Relevant Concurrent Task Performance ***Final Report***

Milke, Ramon M., Pittsburgh Univ., USA; Becker, James T., Pittsburgh Univ., USA; Lambrou, Peter, Pittsburgh Univ., USA; Harris, Howard C., Jr., Civil Aeromedical Inst., USA; Schroeder, David J., Civil Aeromedical Inst., USA; August 1999; 20p; In English

Contract(s)/Grant(s): FAA-AM-A-94-HRR-126

Report No.(s): DOT/FAA/AM-98/22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent reviews of the relationship between aging, cognition, and performance in pilots have emphasized the importance of considering age effects in aviator skills, particularly perceptual-motor, and memory. One possible conclusion is that flight experience does not appear to modify this age performance relationship, except in aviator's ability to time-share. A recent study involving the administration of an aviation-relevant neuropsychological test battery over two days provided data to examine the extent to which experience moderates the effects of aging on performance. Sixty individuals ranging in age from 20 to 65 years completed the CogScreen computerized neuropsychological test battery on five occasions on two consecutive days. Subjects were divided into three age groups of equal size and within-subject repeated measures analyses of variance (ANOVA) examined the relationship between chronological age and practice on performance. The performance of the subjects in the oldest group was consistently poorer and slower than that of the subjects in the youngest group for all of the measures. There were main effects of practice such that performance after five sessions was significantly better than that on the first practice session. On none of the measures was there a significant age by practice interaction. In the case of divided attention tasks, significant age by condition (single vs. concurrent) interactions revealed that concurrent task performance by the elderly was differentially affected, depending on the information processing demands. These data are consistent with previous reports of experience-based practice effects differentiating

subjects based on age and, by extension, suggesting that age-related factors be considered during systems design and implementation (including task execution and training for new equipment).
Author
Age Factor; Psychological Tests; Human Performance; Cognitive Psychology; Aircraft Pilots

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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.

19990066680 Civil Aeromedical Inst., Oklahoma City, OK USA
The Influence of Ergonomic Interventions on Employee Stress and Physical Symptoms ***Final Report***
Joseph, Kurt M., Civil Aeromedical Inst., USA; Thompson, Richard C., Civil Aeromedical Inst., USA; Bailey, Larry L., Civil Aeromedical Inst., USA; William, Clara A., Civil Aeromedical Inst., USA; Worley, Jody A., Civil Aeromedical Inst., USA; Jun. 1999; 9p; In English
Report No.(s): AD-A364891; DOT/FAA/AM-99/17; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

A recent report by the GAO (1997) indicates that private sector employers spend as much as $20 billion annually for employee injuries and illnesses due to musculoskeletal disorders (MSDs). While the etiologic mechanisms are poorly understood, there is increasing evidence that psychosocial risk factors related to the job and work environment play a role in the development of work-related MSDs. A longitudinal study was completed to determine the influence of six psychosocial factors and two cost-effective ergonomics interventions on physical discomfort and stress scores reported by employees within a Federal Aviation Administration organization. The results of the study revealed that stress scores decreased significantly across time. However, physical symptom scores did not change across time, nor were they affected by the ergonomic interventions. Two psychosocial factors provided significant and reliable adjustments to stress and physical discomfort scores.
DTIC
Human Factors Engineering; Musculoskeletal System; Stress (Physiology)

19990067241 Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA
Physiological, Biomechanical, and Maximal Performance Comparisons of Female Soldiers Carrying Loads Using Prototype U.S. Marine Corps Modular Lightweight Load-Carrying Equipment (MOLLE) with Interceptor Body Armor and U.S. Army All-Purpose Lightweigh
Harman, Everett, Army Research Inst. of Environmental Medicine, USA; Frykman, Peter, Army Research Inst. of Environmental Medicine, USA; Pandori, Clay, Army Research Inst. of Environmental Medicine, USA; Tharion, William, Army Research Inst. of Environmental Medicine, USA; Mello, Robert, Army Research Inst. of Environmental Medicine, USA; Feb. 1999; 56p; In English
Report No.(s): AD-A365448; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The experiment evaluated the physiological, biomechanical, and maximal performance responses of 12 female soldiers carrying loads with prototype Modular Lightweight Load-Carrying Equipment with Interceptor body armor (MOLLE/I), and All-Purpose Lightweight Individual Carrying Equipment with PASGT body armor (ALICE/P). MOLLE/I and ALICE/P did not differ on several tests including: energy cost of load carriage, 2 mile load carriage speed, sprint speed with load, knee range of motion, and heel-strike braking force The ALICE/P bested MOLLE/I for speed of getting prone and standing; speed of getting prone, rolling 3 times, and aiming a rifle; obstacle course speed, especially for the low crawl; grenade throw distance; subjective comments; total-body complaints under the fighting load; heel-strike and push-off forces; front-back pack movement; and pressure under the shoulder straps. MOLLE/I bested ALICE/P as to design modularity; walking posture; quick pack release; tightness of shot groups; shoulder complaints; complaints about all body areas other than the shoulders and hips under the sustainment load; total-body complaints under the approach and sustainment loads; time in double-support under the approach and sustainment loads; front-back trunk sway under the sustainment load; and horizontal location of pack center of mass under the sustainment load. Despite its overall superiority, the prototype MOLLE/I could be improved to enhance obstacle course performance, make its quick-release system easier to find and reach, enhance body armor comfort and fit for females, reduce its restrictiveness, and reduce interference with tightening the waist belt. Frame cracking of MOLLE prototypes has apparently been solved by improved manufacturing techniques.
DTIC
Biodynamics; Shoulders; Posture; Females; Physiology; Armor

19990067244 Curtin Univ. of Technology, School of Public Health, Perth, Australia

Field Testing of a Prototype Heat Stress Monitor: System Performance and Applicability to Commercial Mining in Australia ***Final Report***

Matthew, William T.; Gonzalez, Julio A.; Gonzalez, Richard R.; Bates, Graham; Gazey, Cathryn; Apr. 1999; 19p; In English

Contract(s)/Grant(s): DAMD17-95-C-0060

Report No.(s): AD-A364786; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Under a Cooperative Research and Development Agreement (CRDA), a prototype environmental Heat Stress Monitor (HSM) originally developed for military use, was evaluated for potential applications as a heat stress management tool in the Australian mining industry. The hand-held electronic HSM combines a thermal strain prediction model with an integrated environmental sensor suite that measures air temperature, humidity, wind speed, and solar radiation, to provide tailored guidance on hourly drinking water needs, optimal work/rest cycle limits, and maximum safe work time. Overall system performance of three prototype HSMs was evaluated at a commercial oil production facility at Barrow Island, Australia, and a single prototype was evaluated for potential use in deep copper mine environments in Queensland, Australia. Results at Barrow Island indicated that although conceptually suitable for use in those outdoor environments, additional engineering work on the HSM wind speed sensor is needed to bring that sensor within required accuracy tolerances. The deep mine evaluations identified additional system requirements that would be essential for acceptance in that production environment. These included a back-lighted liquid crystal display, autonomous data logging capability, additional program space, and computer interface support for calibration services and data download. Based on the magnitude of these system enhancements and our need to satisfy stated military requirements for a smaller/lighter device, we have concluded that a major redesign of HSM is appropriate. We recommend that a new prototype HSM with strong dual-use applicability be developed and tested in laboratory and field environments.

DTIC

Field Tests; Prototypes; Heat Tolerance; Mining; Thermal Stresses

19990067260 Northwestern Univ., Inst. for the Learning Sciences, Evanston, IL USA

Model-Based Human-Computer Interaction ***Final Report, Jun. 1994 - Dec. 1997***

Birnbaum, Lawrence; Bareiss, Ray; Apr. 1999; 123p; In English

Contract(s)/Grant(s): F30602-94-C-0219; AF Proj. B321

Report No.(s): AD-A364763; AFRL-IF-RS-TR-1999-64; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The purpose of this project was to investigate the application of explicit task modeling techniques to human-computer interaction. In the first phase of this project, reported in Part I of this document, the focus of the investigation was on techniques for wing task models to direct interface design and automatically compile user interfaces. This resulted in the development of a prototype model-based interface design tool, MODEST. The second half of the project concentrated on techniques for directly employing task models in the architecture of intelligent performance support systems. This resulted the design and implementation of a fully functioning prototype integrated performance support system in the area of Air Campaign Planning.

DTIC

Human-Computer Interface; Computer Programs; Systems Management; Software Engineering

19990069609 Eastern Research Group, Inc., Lexington, MA USA

Small Entity Compliance Guide for the Revised Respiratory Protection Standard

Sep. 30, 1998; 328p; In English

Report No.(s): AD-A365058; No Copyright; Avail: CASI; A03, Microfiche; A15, Hardcopy

This guide is intended to help small businesses comply with the Respiratory Protection standard. It provides guidance only, and does not alter or determine compliance responsibilities, which are set forth in Occupational Safety and Health Administration (OSHA) standards and the Occupational Safety and Health Act. The reader must refer to the standard to ensure compliance. Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements, the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts. The Respiratory Protection standard will protect an estimated 5 million respirator wearers.

DTIC

Respirators; Respiration

19990066707 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Rigidity of Conformal Iterated Function Systems
Mauldin, R. Daniel; Przytycki, Feliks; Urbanski, Mariusz; Jun. 03, 1999; 32p; In English
Contract(s)/Grant(s): NSF DMS-98-01583
Report No.(s): PB99-159329; IHES/M/99/44; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The paper extends the rigidity of mixing expanding repellers theorem by D. Sullivan announced at 1986 IMC (Su), see also the unpublished manuscript by the second author (Pr). The authors show that for a regular conformal, satisfying 'Open Set Condition', iterated function system of countably many holomorphic contractions of an open connected subset of a complex plane, the Radon-Nikodym derivative d(mu)/dm has a real-analytic extension on an open neighborhood of the limit set of this system, where m is the conformal measure and mu is the unique probability invariant measure equivalent with m. Next, following (Su) and (Pr), the authors introduce the concept of non-linearity for iterated function systems of countably many holomorphic contractions. Several necessary and sufficient conditions for non-linearity are established.
NTIS
Rigidity; Functions (Mathematics)

19990066708 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Thermodynamic Formalism and Multifractal Analysis of Conformal Infinite Iterated Function Systems
Hanus, Pawel; Mauldin, R. Daniel; Urbanski, Mariusz; Jun. 16, 1999; 68p; In English
Contract(s)/Grant(s): NSF DMS-98-01583
Report No.(s): PB99-159295; IHES/M/99/48; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

In this paper the authors develop the thermodynamic formalism for equilibrium states of strongly Holder families of functions. These equilibrium states are supported on the limit set generated by iterating a system of infinitely many contractions. The first five sections of this paper except Section 3 are devoted to developing the thermodynamic formalism for equilibrium states of Holder families of functions. The first two sections contain material part of which can also be found in (HU) and (Ur). These sections along with Section 3 provide the authors with the tools needed to carry out the multifractal analysis for the equilibrium states mentioned above assuming that the limit set is generated by conformal contractions. The theory of infinite systems of conformal contractions is laid out in (MU1). The multifractal analysis is then given in Section 7. In Section 8 the authors apply this theory to some examples from continued fraction systems and Apollonian packing.
NTIS
Thermodynamics; Formalism; Functions (Mathematics); Thermodynamic Equilibrium

19990066709 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Weak Solutions with Decreasing Energy of Incompressible Euler Equations
Shnirelman, A.; Feb. 26, 1999; 94p; In English
Report No.(s): PB99-159287; IHES/M/99/02; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The physical meaning of weak solutions of the Euler equations is not quite clear. The authors may assume as a hypothesis, that the velocity field of a slightly viscous and slightly compressible fluid tends to a weak solution of the Euler equations, when both viscosity and compressibility tend to zero (the authors admit an arbitrary rheology of the fluid, whatever nonlinear and nonlocal it is; important is only the fact that the viscosity is nonzero). As the authors know from the experiments, the kinetic energy of the turbulent flow (in the absence of external forces) decreases, for the fluid develops large velocity gradients, dissipating considerable amount of energy. It is a well established experimental fact, that the rate of the energy decay does not depend on the viscosity, if the last is small enough. Thus, the 'true' weak solution, describing a turbulent flow, should have decreasing kinetic energy. The first natural question is, whether there exist weak solutions with monotonically decreasing kinetic energy.
NTIS
Incompressibility; Computational Fluid Dynamics; Euler-Cauchy Equations

19990069925 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Groups Acting on Trees: From Local to Global Structure
Burger, M.; Mozes, S.; Mar. 1999; 34p; In English
Report No.(s): PB99-159253; IHES/M/99/15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The group of automorphisms Aut T of a locally finite tree T is a locally compact group. In this work the authors study a large class of groups of automorphisms of a locally finite tree which exhibit a rich structure theory, analogous to that of semisimple Lie groups. Recall that a rank one simple algebraic group G over a locally compact non archimedean field acts on the associated Bruhat-Tits tree delta. Thus G is a closed subgroup of Aut delta. Moreover its action on delta is locally infinity-transitive, that is, the stabilizer of every vertex x acts transitively on all spheres of finite radius centered at x. In this paper the authors study the structure of closed non-discrete subgroups of Aut T satisfying various local properties.
NTIS
Lie Groups; Structures; Trees (Mathematics)

19990069926 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Lattices in Product of Trees
Burger, M.; Mozes, S.; May 1999; 58p; In English
Report No.(s): PB99-159196; IHES/M/99/37; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The aim of this paper is to study the structure of lattices in products Aut TX x T2 of automorphism groups of regular trees. These lattices have a rich structure theory both parallel to the theory of lattices in semisimple Lie groups as well as exhibiting some new phenomena. A basic difference is that cocompact lattices never have dense projections. The class of lattices considered here are those whose projections in each factor satisfy various transitivity conditions, in particular that of being locally quasiprimitive. The structure theory of locally quasiprimitive subgroups of Aut T is developed in (B-M)3 and is used in an essential way in this paper. The main consequence of the theory outlined in this paper is the existence and construction of lattices which are finitely presented, torsion free, simple groups; the corresponding quotients of T1 x T2 are finite aspherical complexes with simple fundamental group, thus answering a question of G. Mess ((PLT) Probl. 5.11(c)).
NTIS
Trees (Mathematics); Automorphisms; Lattices (Mathematics)

60
COMPUTER OPERATIONS AND HARDWARE

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

19990064635 Michigan Univ., Dept. of Electrical Engineering and Computer Science, Ann Arbor, MI USA
A Microarchitecutre for Resource-Limited Superscalar Microprocessors
Basso, Todd David; Jan. 1999; 177p; In English
Report No.(s): AD-A365168; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Microelectronic components in space and satellite systems must be resistant to total dose radiation, single-event upset, and latchup in order to accomplish their missions. The demand for inexpensive, high-volume, radiation hardened (rad-hard) integrated circuits (ICs) is expected to increase dramatically as the communication market continues to expand. Motorola's Complementary Gallium Arsenide (CGaAs(TM)) technology offers superior radiation tolerance compared to traditional CMOS processes, while being more economical than dedicated rad-hard CMOS processes. The goals of this dissertation are to optimize a superscalar microarchitecture suitable for CGaAs(TM) microprocessors, develop circuit techniques for such applications, and evaluate the potential of CGaAs(TM) for the development of digital VLSI circuits.
DTIC
Microprocessors; Architecture (Computers); Microelectronics; Digital Electronics; Single Event Upsets; Radiation Tolerance

61
COMPUTER PROGRAMMING AND SOFTWARE

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

19990064339 NASA Marshall Space Flight Center, Huntsville, AL USA
Multi-Scale Fractal Analysis of Image Texture and Pattern
Emerson, Charles W., NASA Marshall Space Flight Center, USA; Lam, Nina Siu–Ngan, NASA Marshall Space Flight Center, USA; Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Analyses of the fractal dimension of Normalized Difference Vegetation Index (NDVI) images of homogeneous land covers near Huntsville, Alabama revealed that the fractal dimension of an image of an agricultural land cover indicates greater complexity as pixel size increases, a forested land cover gradually grows smoother, and an urban image remains roughly self-similar over the range of pixel sizes analyzed (10 to 80 meters). A similar analysis of LANDSAT Thematic Mapper images of the East Humboldt Range in Nevada taken four months apart show a more complex relation between pixel size and fractal dimension. The major visible difference between the spring and late summer NDVI images is the absence of high elevation snow cover in the summer image. This change significantly alters the relation between fractal dimension and pixel size. The slope of the fractal dimension-resolution relation provides indications of how image classification or feature identification will be affected by changes in sensor spatial resolution.
Author
Fractals; Vegetation; Vegetative Index; Image Enhancement; Imaging Techniques; Image Processing; Image Classification

19990064430 Atmospheric Systems and Analysis, Westminster, CO USA
Synoptic Mapping of Chemical Composition, Thermal Structure, and Air Motion from UARS Observations ***Final Report***
Salby, Murry L., Atmospheric Systems and Analysis, USA; [1999]; 2p; In English
Contract(s)/Grant(s): NAG5-2852; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An operational mapping algorithm was developed to process measurements of individual species observed by different satellite instruments on board UARS. Based on Fast Fourier Synoptic Mapping (FFSM), the algorithm accounts for the precessing orbit of UARS, the error of individual instruments, and gaps associated with instrument duty cycle and the satellite yaw maneuver. It provides synoptic structure and evolution on periods as short as 1 day, derived collectively from all observations of an individual species. The algorithm was applied to synoptically map temperature, thickness, and several chemical constituents observed by the instruments: MLS, CLAES, ISAMS, and HALOE. Each field variable observed by these instruments was mapped twice-daily in continuous global time series several months long. Mapped behavior produced via FFSM was compared against standard archived products generated via Kalman filtering. The standard map products reveal similar behavior, but are limited to features of larger scale. Tracer structure that develops through flow deformation and attending transport is therefore represented in those products more coarsely, eventually being sheared down to scales that are no longer represented properly. The synoptic time series also reveal a diurnal cycle for several of the constituents, one that emerges clearly in their space-time spectra. The zonal and meridional structure of diurnal variability was mapped by filtering the space-time spectrum, an intermediate product of FFSM, to those scales resolved by the UARS sampling. Geographical variations of the diurnal cycle have also been evaluated in its seasonal-mean structure by compositing distributions at individual local times. Both were compared to diurnal variations in chemical models and in dynamical models that account for transport by the diurnal tide. Diurnal variations were found to introduce spurious behavior into the archived products generated via Kalman filtering, behavior that is misrepresented in those synoptic time series. Aliasing by under-sampled diurnal variations introduces a bias into the time-mean structure of archived products. That systematic error is manifested as anomalous wave structure in the time-mean fields. by contrast, synoptic time series generated via FFSM faithfully represent such behavior as varying diurnally, so it does not corrupt time-mean structure. Tracer structure mapped via the above algorithm was being applied to determine the Brewer-Dobson circulation of the stratosphere through Lagrangian considerations. Preliminary results are encouraging: They reveal diabatic ascent in the tropics, balanced by diabatic descent over the winter hemisphere. This Lagrangian description of transport derived from UARS tracer measurements would be potentially valuable for diagnosing interannual changes of transport, specifically, in relation to interannual changes of total ozone. Regrettably, support was reduced to 50% of the approved funding level, leaving this component incomplete.
Derived from text
Mapping; Chemical Composition; Thermal Insulation; Deformation; Heat Transfer

19990064487 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA's TReK Project: A Case Study in Using the Spiral Model of Software Development
Hendrix, T. Dean, Auburn Univ., USA; Schneider, Michelle P., NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Software development projects face numerous challenges that threaten their successful completion. Whether it is not enough money, too little time, or a case of "requirements creep" that has turned into a full sprint, projects must meet these challenges or face possible disastrous consequences. A robust, yet flexible process model can provide a mechanism through which software

development teams can meet these challenges head on and win. This article describes how the spiral model has been successfully tailored to a specific project and relates some notable results to date.
Author
Computer Programming; Software Engineering; Software Development Tools; Systems Engineering; Programming Environments; Computer Systems Design; Applications Programs (Computers)

19990065304 Indiana Univ., Dept. of Computer Science, South Bend, IN USA
Hardware Verification Using Coinductive Assertions
Miner, Paul S., Indiana Univ., USA; June 1998; 153p; In English; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Systems of mutually recursive stream equations provide a concise model of digital hardware designs. The formal design algebra presented by Johnson illustrated the utility of this representation for design derivation. The design derivation approach has been mechanized by Bose and applied to significant case studies. However, a design optimization sometimes depends upon the semantics of the implemented function. This cannot be captured within the design algebra. Design derivation needs to be augmented with additional verification strategies. The stream equations employed in the design derivation approach are an instance of definition by corecursion. Therefore, the design derivation approach may be augmented using proof by coinduction. Coinduction is a useful strategy for proving that two sequential hardware designs have the same behavior. This enables safe substitution of an innovative optimization into a mature design. Futhermore, coinduction is useful for establishing that signals within a design satisfy invariant properties. Such invariants, called coinductive assertions, are essential to ensure the validity of aggressive design optimizations. This dissertation illustrates how design derivation is augmented using the Prototype Verification System (PVS). A PVS library to provide the basic declarations needed for reasoning about streams is developed. Stream equations are defined using corecursion, and equality between streams is proven using coinduction. The combination of derivation-based and theorem prover-based verification is illustrated using two significant examples. First, a fault-tolerant clock synchronization circuit, suitable for use in critical applications, is developed using this combined approach. A clever optimization that reduces the chip area is verified using a coinductive proof within PVS. The second example is the development of an architecture for floating-point division. A number of optimizations that reduce the cycle time of the inner loop of the algorithm are verified using the combined approach.
Author
Optimization; Computer Systems Design; Program Verification (Computers); Design Analysis; Architecture (Computers); Computer Programming; Recursive Functions

19990067631 NASA Goddard Space Flight Center, Greenbelt, MD USA
Adaptive Principal Component EXtraction (APEX) for Image Compression
Gilmore, Erwin T., Howard Univ., USA; Chouikha, Mohamed F., Howard Univ., USA; Ziyad, Nigel A., NASA Goddard Space Flight Center, USA; 1998; In English; ICSPAT 1998, 13-16 Sep. 1998, Toronto, Canada; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In this paper we collate our earlier results with that of the Adaptive Principal Component EXtraction (APEX) neural network model for applications for medical imaging, particularly image representation and compression. Previously, we introduced a method which applied a general principal component analysis (PCA) algorithm with a Hilbert Scan preprocessor as a compression scheme.
Author
Imaging Techniques; Neural Nets; Image Processing; Optical Data Processing; Video Compression

19990068438 Ministry of Defence, Ballistic Missile Defence, London, UK
Systems Engineering Aspects of the UK's BMD Programmes
Rance, M. L., Ministry of Defence, UK; Smart Procurement for Weapon Systems: Proceedings; 1999, pp. 4.1 - 4.4; In English; See also 19990068434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

UK's Ballistic Missile Defense (BMD) Program is aimed at understanding technical options and risks for defeating ballistic missiles launched at UK deployed forces. Initial emphasis is on endo-atmospheric interceptions. The paper suggests how the approach being adopted for this element of MOD's Corporate Research Programme has features for which systems engineering disciplines are appropriate, and which help to prepare MOD and industry for future work.
Author
Ballistic Missiles; Missile Defense; Government Procurement; Weapon Systems; Weapons Development; Defense Program; Government/Industry Relations

19990068741 GenCorp Aerojet, Azusa, CA USA

Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: AMSU-A1 EOS Instrument, (S/N 202) Qualification Level Vibration Tests of August/September 1998, (S/O 565632, OC-417) Plus Addendum A

Heffer, R., GenCorp Aerojet, USA; Nov. 10, 1998; 29p; In English

Contract(s)/Grant(s): NAS5-32314

Report No.(s): NASA/CR-1998-209214; NAS 1.26:209214; AEROJET-11318; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this report is to present a qualification level vibration testing performed on the S/N 202, EOS AMSU-A1 Instrument was vibration tested to qualification levels per the Ref. 1 shop order. The instrument withstood the 8 g sine sweep test, the 7.5 Grms random vibration test, and the 18.75 g sine burst test in each of the three orthogonal axes. Some loss of transmissibility, however, is seen in the lower reflector after Z-axis random vibration. The test sequence was not without incidence. Failure of Channel 7 in the Limited Performance Test (LPT) performed after completion of the 1 st (X-axis) axis vibration sequence, required replacement of the DRO and subsequent re-testing of the instrument. The post-vibration comprehensive performance test (CPT) was successfully run after completion of the three axes of vibration with the replacement component installed in the instrument. Passing the CPT signified the successful completion of the S/N 202 A1 qualification vibration testing.

Derived from text

Advanced Microwave Sounding Unit; Performance Tests; Vibration Tests; Random Vibration

19990068742 GenCorp Aerojet, Azusa, CA USA

Earth Observing System (EOS) Advanced Microwave Sounding Unit-A1. EOS Software Test Report

Cisneros, A., GenCorp Aerojet, USA; Nov. 30, 1998; 126p; In English

Contract(s)/Grant(s): NAS5-32314

Report No.(s): NASA/CR-1998-209212; NAS 1.26:209212; AEROJET-11344; CDRL-217; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This is the Software Test Report for the software to be used in the Earth Observing System (EOS) Advanced Microwave Sounding Unit-A1 (AMSU-A1) instrument. Attachment: appendix A-test data sheets.

Author

Advanced Microwave Sounding Unit; Performance Tests; Data Acquisition

19990069576 NASA Langley Research Center, Hampton, VA USA

Initial Results of an MDO Method Evaluation Study

Alexandrov, Natalie M., NASA Langley Research Center, USA; Kodiyalam, Srinivas, Engineous Software, Inc., USA; 1998; 15p; In English; 7th; Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NASA Order L-6317

Report No.(s): AIAA Paper 98-4884; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The NASA Langley MDO method evaluation study seeks to arrive at a set of guidelines for using promising MDO methods by accumulating and analvzlng computational data for such methods. The data are collected by conducting a series of reproducible experiments. In the first phase of the study, three MDO methods were implemented in the iSIGHT framework and used to solve a set of ten relatively simple problems. In this paper, we comment on the general considerations for conducting method evaluation studies and report some initial results obtained to date. In particular, although the results are not conclusive because of the small initial test set, prelimiiiarv numbers suggest that the performance of the methods tends to be consistent, with their predicted theoretical properties.

Author

Evaluation; Research; Data Acquisition

19990069577 NASA Langley Research Center, Hampton, VA USA

Preliminary Results from the Application of Automated Adjoint Code Generation to CFL3D

Carle, Alan, Rice Univ., USA; Fagan, Mike, Rice Univ., USA; Green, Lawrence L., NASA Langley Research Center, USA; 1998; 13p; In English; 7th; Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC1-234; NSF CCr-91-20008

Report No.(s): AIAA Paper 98-4807; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This report describes preliminary results obtained using an automated adjoint code generator for FORTRAN to augment a widely-used computational fluid dynamics flow solver to compute derivatives. These preliminary results with this augmented code suggest that, even in its infancy, the automated adjoint code generator can accurately and efficiently deliver derivatives for use in transonic Euler-based aerodynamic shape optimization problems with hundreds to thousands of independent design variables.
Author
Design Analysis; Computational Fluid Dynamics; Data Acquisition

19990069606 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Theory and Practice of Enterprise JavaBean(TM) Portability ***Final Report***
Dorda, Santiago C.; Robert, John; Seacord, Robert; Jun. 1999; 27p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A365068; CMU/SEI-99-TN-005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The modern enterprise information system (EIS) requires the integration of numerous technologies such as distribution, transactions, data management, security, and naming. Off-the-shelf architectures such as Enterprise JavaBeans(TM) (EJB) provide a pre-integrated solution that supports the quick development and deployment of information systems. Unfortunately, the EJB specification is extremely porous, leading to portability problems. In addition, the line between vendor extensions and EJB standard functionality is blurred, making it difficult for bean providers to know what functionality can be depended upon across server implementations. This paper presents sources of portability problems in EJB and illustrates them with some real examples. We also present our opinion about the direction the EJB specification should take to enable effective reuse of Enterprise Beans(TM) between servers.
DTIC
Software Engineering; Client Server Systems; Internets; Java (Programming Language); Computer Programs

19990070314 NASA Langley Research Center, Hampton,VA USA
Streamlining Software Aspects of Certification: Report on the SSAC Survey
Hayhurst, Kelly J., NASA Langley Research Center, USA; Dorsey, Cheryl A., Digital Flight, USA; Knight, John C., Virginia Univ., USA; Leveson, Nancy G., Massachusetts Inst. of Tech., USA; McCormick, G. Frank, Certification Services, Inc., USA; August 1999; 100p; In English
Contract(s)/Grant(s): RTOP 505-64-10-58
Report No.(s): NASA/TM-1999-209519; L-17885; NAS 1.15:209519; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
The aviation system now depends on information technology more than ever before to ensure safety and efficiency. to address concerns about the efficacy of software aspects of the certification process, the Federal Aviation Administration (FAA) began the Streamlining Software Aspects of Certification (SSAC) program. The SSAC technical team was commissioned to gather data, analyze results, and propose recommendations to maximize efficiency and minimize cost and delay, without compromising safety. The technical team conducted two public workshops to identify and prioritize software approval issues, and conducted a survey to validate the most urgent of those issues. The SSAC survey, containing over two hundred questions about the FAA's software approval process, reached over four hundred industry software developers, aircraft manufacturers, and FAA designated engineering representatives. Three hundred people responded. This report presents the SSAC program rationale, survey process, preliminary findings, and recommendations.
Author
Streamlining; Certification; Information Systems; Computer Programs; Quality Control

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990064371 Computer Sciences Corp., Lanham, MD USA
System Issues Related to Implementing on the Internet
Mackey, William, Computer Sciences Corp., USA; Bagg, Thomas C., III, Bagg (Thomas C., III), USA; 1999; 10p; In English; International Council on Systems Engineering, 6-11 Jun. 1999, Brighton, UK
Contract(s)/Grant(s): NASA Order S-04099-Y; Copyright; Avail: Issuing Activity, Hardcopy

Implementing capabilities on the World Wide Web should never be taken lightly. A good systems engineer is able to examine such implementations from all points of view, including political, legal, security, access, technical deployment, and quality. The evacuation discussed in this paper was conducted to ensure that the National Aeronautics and Space Administration (NASA) was proceeding in a correct direction by implementing RECALL a Lessons Learned System on the Web and, subsequently, did so successfully. The systems approach extended well beyond technical implementation to several issue that are not often addressed by an implementation team. The resulting evaluation increased the team's sensitivity to such issues and, in fact, the authors believe that the evaluation provided as much benefit as the system itself.
Author
Computer Systems Design; Client Server Systems; On-Line Systems; World Wide Web

19990064509 Colorado Univ., Dept. of Aerospace Engineering Science, Boulder, CO USA
HPCC Methodologies for Structural Design and Analysis on Parallel and Distributed Computing Platforms
Farhat, Charbel, Colorado Univ., USA; [1998]; 3p; In English
Contract(s)/Grant(s): NAG1-1873; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
In this grant, we have proposed a three-year research effort focused on developing High Performance Computation and Communication (HPCC) methodologies for structural analysis on parallel processors and clusters of workstations, with emphasis on reducing the structural design cycle time. Besides consolidating and further improving the FETI solver technology to address plate and shell structures, we have proposed to tackle the following design related issues: (a) parallel coupling and assembly of independently designed and analyzed three-dimensional substructures with non-matching interfaces, (b) fast and smart parallel re-analysis of a given structure after it has undergone design modifications, (c) parallel evaluation of sensitivity operators (derivatives) for design optimization, and (d) fast parallel analysis of mildly nonlinear structures. While our proposal was accepted, support was provided only for one year.
Author
Structural Design; Structural Analysis; Parallel Processing (Computers); Computer Networks; Procedures

19990066710 Helsinki Univ. of Technology, Lab. of Telecommunications Technology, Espoo, Finland
Implementation of the Server Cache Synchronisation Protcol (SCSP)
Requena, Jose Miguel Costa; 1999; ISSN 1456-7199; 90p; In English
Report No.(s): PB99-158883; Rept-2/99; ISBN 951-22-4530-2; Copyright; Avail: National Technical Information Service (NTIS), Hardcopy
The thesis is about the implementation of a software tool, developed for database synchronization and replication. In the implementation the authors have followed the protocol specifications from the Internet protocol for the Internet Community, titled 'Server Cache Synchronization Protocol' (SCSP). The synchronization is perform by a group of distributed protocol entities which compound a Server group (SG). In the second chapter, the authors describe the database system and the different Internet models for their implementation. Afterwards, the authors show an introduction to some existing databases and the mechanism for information management. In this chapter the authors also review some existing protocols with similar algorithms, to compare with the characteristics of the SCSP. In the third chapter the authors explain the framework for the implementation. The authors describe the basis of the SCSP algorithm which is borrowed from the OSPF. The fourth chapter shows the characteristics of the implementation and the authors argue the reasons for the choice of a specific language for its development. In this chapter the authors analyze the interactions between the program and the Operating System (OS). In the fifth chapter, we describe the basic implementation and the functional modules needed for the main structures. In the sixth chapter, the authors present the interface module. In fact it is an independent program with the purpose of displaying the protocol state in every moment. The seventh chapter, shows the results of the final implementation. In this chapter the authors depict the global flow diagram and the results obtained. Finally, in the eighth chapter the authors describe the conclusions and future work.
NTIS
Synchronism; Protocol (Computers); Software Engineering; Client Server Systems; Management Information Systems

19990067251 Research Associates for Defense Conversion, Inc., Marcy, NY USA
MCARM/STAP Data Analysis, Volume 1 ***Final Report, Apr. 1996 - Feb. 1998***
Cavo, Vincent, Research Associates for Defense Conversion, Inc., USA; May 1999; 84p; In English
Contract(s)/Grant(s): F30602-96-C-0053; AF Proj. 4506
Report No.(s): AD-A364943; AFRL-SN-RS-TR-1999-48-VOL-1; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy
The Multi-Channel Airborne Radar Measurement (MCARM) program was initiated to gather real airborne data. Both monostatic and bistatic data were collected, under varying environmental conditions and in different geographical areas. This report

documents the construction, maintenance, and use of the MCARM data via the Internet. The main objective of this access is to permit and promote research in the area of Space-Time Adaptive Processing. Use of real airborne data will permit researchers to better test different signal processing algorithms and hypotheses. A query form and query engine permits a user to search the data repository. The data repository is comprised of 570 data files and occupies approximately 27 gigabytes of magnetic disk storage.
DTIC
Data Bases; Signal Processing; Data Acquisition; Radar Measurement; Airborne Radar

19990067253 Cyberdynamics, Inc., Palo Alto, CA USA
Automatic Rapid Updating of ATR Target Knowledge Bases ***Final Report, 17 Dec. 1998 - 17 Jun. 1999***
Wells, Barton S.; Beckner, Frederick L.; Jun. 17, 1999; 28p; In English
Contract(s)/Grant(s): DAAH01-99-C-R077
Report No.(s): AD-A364592; CDI-CYB-9901; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The feasibility of creating a software system to perform automatic rapid updating of ATR target knowledge databases is investigated. Methods of comparing infrared images with CAD model renderings, including object detection, feature extraction, object alignment, match quality evaluation, and CAD model updating are researched and analyzed. A GUI-based software application created to demonstrate object detection, feature extraction, and automatic image alignment is described. An improved method of edge detection based on directional masks and second derivatives of pixel intensities is given. A conceptual software system for rapid updating of AIR knowledge databases is described. A technique for the comparison of images based on line features is discussed. Based on this research it is found that the development of an automatic rapid updating system is feasible.
DTIC
Targets; Knowledge Based Systems; Data Bases; Computer Programs

19990067262 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Parallel Digital Signal Processing on a Network of Personal Computers Case Study: Space-Time Adaptive Processing
Silva, Fernando, Air Force Inst. of Tech., USA; Jun. 1999; 189p; In English
Report No.(s): AD-A364944; AFIT/GCS/ENG/99J-01; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

Network based parallel computing using personal computers is currently a popular choice for concurrent scientific computing. This work evaluates the capabilities and the performance of the AFIT Bimodal Cluster (ABC); a heterogeneous cluster of PCs connected by switched fast Ethernet and using MPICH 1.1 for interprocess communication for parallel digital signal processing using Space Time Adaptive Processing (STAP) as the case study. The MITRE RT
DTIC
Signal Processing; Computer Networks; Parallel Processing (Computers)

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CYBERNETICS

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

19990066687 XonTech, Inc., Huntington Beach, CA USA
Virtual Flight Testing Concepts and Applications
Reed, Earl; Campbell, Susan; Mann, Brian; Jan. 1999; 10p; In English
Report No.(s): AD-A365001; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Virtual Flight Testing offers a world of diversity, flexibility and possibility to the test and verification community. The cost savings are tremendous, while overcoming many of the limitations associated with traditional digital simulations. Virtual flight testing allows the tester to use REAL data, on REAL objects, with REAL signatures, taken by REAL sensors in REAL environments. This overcomes many of the verification and validation issues facing the test and simulation community today. One example of a virtual flight test was presented, showing the benefits and flexibility of the process. A variety of other possible tests and applications were presented to give the reader a better appreciation as to how many different types of scenarios and tests can be performed. In today's environment of limited budgets and expensive flight tests, virtual flight testing offers a credible, proven approach to reduce cost while maintaining high levels of testing confidence.
DTIC
Flight Tests; Virtual Reality

19990067245 Imagination Engines, Inc., Saint Louis, MO USA
Integrated Substrate and Thin Film Design Methods ***Final Report, 1 May 1998 - 1 Feb. 1999***
Thaler, Stephen L.; Feb. 01, 1999; 55p; In English
Contract(s)/Grant(s): F33615-98-C-5139; AF Proj. 3005
Report No.(s): AD-A364797; IEI-0001AE; AFRL-ML-WP-TR-1999-4033; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

An artificial neural network cascade, containing 16 individual network modules and approximately 1,000 processing units, has produced an interactive database of nearly a quarter million potential binary and ternary chemical systems. While many of these hypothetical materials are anticipated to be thermodynamically stable, the are most likely kinetically inaccessible via typical bulk chemistry routes. However, since modern thin film technology allows a wide range of exotic compositions and stoichiometries via deposition, surface treatments, and nano-fabrication, it is anticipated that this newly acquired theoretical database will form a comprehensive roadmap to the formation of previously unattainable materials that offer significant technological advantages. Further, with the suite of available coating materials great expanded, thin film designers now have at their disposal the means to implement multilayer an composite thin film device designs that fulfill a much broader range of performance requirements and that are ideally matched to both underlying substrate and external working environment.
DTIC
Substrates; Thin Films; Computer Aided Manufacturing

19990067256 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
SensorVision Radiometric Equations, Version 2.2
Duong, Ninh; Wegener, Michael; Feb. 1999; 35p; In English
Report No.(s): AD-A364742; DSTO-TN-0193; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This technical note describes the radiometric equations employed by an IR scene generation COTS software package called SensorVision. The components of the radiometric equations used to compute the radiance quantities of an IR scene are discussed in detail and assumptions used in the derivation of these equations are identified. The focus of this technical note is to highlight possible sources of errors in an IR scene generated by SensorVision.
DTIC
Radiometers; Applications Programs (Computers); Software Engineering

19990067638 NASA Goddard Space Flight Center, Greenbelt, MD USA
Linear System Control Using Stochastic Learning Automata
Ziyad, Nigel, NASA Goddard Space Flight Center, USA; Cox, E. Lucien, NASA Goddard Space Flight Center, USA; Chouikha, Mohamed F., Howard Univ., USA; 1998; In English; IASTED: Control and Applications, 1214 Aug. 1998, Honolulu, HI, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper explains the use of a Stochastic Learning Automata (SLA) to control switching between three systems to produce the desired output response. The SLA learns the optimal choice of the damping ratio for each system to achieve a desired result. We show that the SLA can learn these states for the control of an unknown system with the proper choice of the error criteria. The results of using a single automaton are compared to using multiple automata.
Author
Automata Theory; Linear Systems; Stochastic Processes; Machine Learning; Adaptive Control

19990068023 Utah Univ., Salt Lake City, UT USA
Optimal Output Trajectory Redesign for Invertible Systems
Devasia, S., Utah Univ., USA; Journal of Guidance, Control, and Dynamics; 1996; Volume 19, No. 5, pp. 1189-1191; In English
Contract(s)/Grant(s): NAG2-1042; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Given a desired output trajectory, inversion-based techniques find input-state trajectories required to exactly track the output. These inversion-based techniques have been successfully applied to the endpoint tracking control of multijoint flexible manipulators and to aircraft control. The specified output trajectory uniquely determines the required input and state trajectories that are found through inversion. These input-state trajectories exactly track the desired output; however, they might not meet acceptable performance requirements. For example, during slewing maneuvers of flexible structures, the structural deformations, which depend on the required state trajectories, may be unacceptably large. Further, the required inputs might cause actuator saturation during an exact tracking maneuver, for example, in the flight control of conventional takeoff and landing aircraft. In such situations, a compromise is desired between the tracking requirement and other goals such as reduction of internal vibrations and prevention of actuator saturation; the desired output trajectory needs to redesigned. Here, we pose the trajectory redesign problem

as an optimization of a general quadratic cost function and solve it in the context of linear systems. The solution is obtained as an off-line prefilter of the desired output trajectory. An advantage of our technique is that the prefilter is independent of the particular trajectory. The prefilter can therefore be precomputed, which is a major advantage over other optimization approaches. Previous works have addressed the issue of preshaping inputs to minimize residual and in-maneuver vibrations for flexible structures; Since the command preshaping is computed off-line. Further minimization of optimal quadratic cost functions has also been previously use to preshape command inputs for disturbance rejection. All of these approaches are applicable when the inputs to the system are known a priori. Typically, outputs (not inputs) are specified in tracking problems, and hence the input trajectories have to be computed. The inputs to the system are however, difficult to determine for non-minimum phase systems like flexible structures. One approach to solve this problem is to (1) choose a tracking controller (the desired output trajectory is now an input to the closed-loop system and (2) redesign this input to the closed-loop system. Thus we effectively perform output redesign. These redesigns are however, dependent on the choice of the tracking controllers. Thus the controller optimization and trajectory redesign problems become coupled; this coupled optimization is still an open problem. In contrast, we decouple the trajectory redesign problem from the choice of feedback-based tracking controller. It is noted that our approach remains valid when a particular tracking controller is chosen. In addition, the formulation of our problem not only allows for the minimization of residual vibration as in available techniques but also allows for the optimal reduction fo vibrations during the maneuver, e.g., the altitude control of flexible spacecraft. We begin by formulating the optimal output trajectory redesign problem and then solve it in the context of general linear systems. This theory is then applied to an example flexible structure, and simulation results are provided.
Derived from text
Inversions; Linear Systems; Optimization; Slewing; Tracking Problem; Trajectories; Vibration; Actuators

19990069898 NASA Langley Research Center, Hampton, VA USA
Synthesis of Optimal Constant-Gain Positive-Real Controllers for Passive Systems
Mao, Y., Kansas State Univ., USA; Kelkar, A. G., Kansas State Univ., USA; Joshi, S. M., NASA Langley Research Center, USA; 1999; In English; American Control, 2-4 Jun. 1999, San Diego, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents synthesis methods for the design of constant-gain positive real controllers for passive systems. The results presented in this paper, in conjunction with the previous work by the authors on passification of non-passive systems, offer a useful synthesis tool for the design of passivity-based robust controllers for non-passive systems as well. Two synthesis approaches are given for minimizing an LQ-type performance index, resulting in optimal controller gains. Two separate algorithms, one for each of these approaches, are given. The synthesis techniques are demonstrated using two numerical examples: control of a flexible structure and longitudinal control of a fighter aircraft.
Author
Optimal Control; Feedback Control; Aircraft Control; Controllers; Longitudinal Control

19990070307 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Universal Learning Network and Computation of its Higher Order Derivatives
Hirasawa, Kotaro, Kyushu Univ., Japan; Ohbayashi, Masanao, Kyushu Univ., Japan; Murata, Junichi, Kyushu Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 151-163; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper, Universal Learning Network (ULN) is presented, which models and controls large scale complicated systems such as industrial plants, economic, social and life phenomena, and also a computing method of higher order derivatives of ULN is derived. The basic idea of ULN is that large scale complicated systems can be modeled by the network which consists of nonlinearly operated nodes and branches which may have arbitrary time delays including zero or minus ones. It has not been presented that the network such as U.L.N. is able to model and control naturally the large complicated systems which can be seen commonly in the social and physical worlds. and as for derivatives of networks, only computing methods of second order derivatives of multilayer networks have been studied, which can not be applied to recurrent networks like ULN.
Author
Machine Learning; Neural Nets; Differential Calculus

19990070308 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Learning Petri Network with Functions Distribution
Hirasawa, Kotaro, Kyushu Univ., Japan; Ohbayashi, Masanao, Kyushu Univ., Japan; Murata, Junichi, Kyushu Univ., Japan; Oka, Seiji, Kyushu Univ., Japan; Sakai, Shingo, Kyushu Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 139-150; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Large-scale complicated systems are required to be controlled timely and appropriately. A human brain has similar functions to those of a controller of the large-scale complicated systems; it scans and recognizes sensory inputs and outputs responses to the environments. Why does a human brain work skillfully? The key is the capability of functions distribution and learning. Functions distribution means that a specific part exists in the brain, in order to realize a specific function. For example, a live neural network has different acting parts corresponding to different network inputs or stimuli. In this paper, we have proposed a new brain-like model that we call Learning Petri Network (LPN). The fundamental idea is to revise Petri Net. Petri Net is composed of state and transition and can control firing by tokens, so it is possible for this net to realize functions distribution. The revising point is to give Petri Net the ability of learning as Neural Network (NN). And, it is the fundamental difference from NN, that learning of the proposed method is carried out on the only network pass of the token transfer.
Author
Brain; Neural Nets; Petri Nets; Machine Learning

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NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990064369 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Low-Storage, Explicit Runge-Kutta Schemes for the Compressible Navier-Stokes Equations ***Final Report***
Kennedy, Chistopher A., Sandia National Labs., USA; Carpenter, Mark H., NASA Langley Research Center, USA; Lewis, R. Michael, Institute for Computer Applications in Science and Engineering, USA; June 1999; 56p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-1999-209349; NAS 1.26:209349; ICASE-99-22; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The derivation of storage explicit Runge-Kutta (ERK) schemes has been performed in the context of integrating the compressible Navier-Stokes equations via direct numerical simulation. Optimization of ERK methods is done across the broad range of properties, such as stability and accuracy efficiency, linear and nonlinear stability, error control reliability, step change stability, and dissipation/dispersion accuracy, subject to varying degrees of memory economization. Following van der Houwen and Wray, 16 ERK pairs are presented using from two to five registers of memory per equation, per grid point and having accuracies from third- to fifth-order. Methods have been assessed using the differential equation testing code DETEST, and with the 1D wave equation. Two of the methods have been applied to the DNS of a compressible jet as well as methane-air and hydrogen-air flames. Derived 3(2) and 4(3) pairs are competitive with existing full-storage methods. Although a substantial efficiency penalty accompanies use of two- and three-register, fifth-order methods, the best contemporary full-storage methods can be pearl), matched while still saving two to three registers of memory.
Author
Runge-Kutta Method; Stability; Errors; Direct Numerical Simulation; Wave Equations; Navier-Stokes Equation

19990064372 NASA Goddard Space Flight Center, Greenbelt, MD USA
How to Estimate Attitude from Vector Observations
Markley,F. Landis, NASA Goddard Space Flight Center, USA; Mortari, Daniele, Rome Univ., Italy; 1999; 15p; In English; Astronomy, 16-19 Aug. 1999, Girdwood, AK, USA; Sponsored by American Astronomical Society; Copyright; Avail: Issuing Activity, Hardcopy

In many spacecraft attitude systems, the attitude observations are naturally represented as unit vectors. Typical examples are the unit vectors giving the direction to the sun or a star and the unit vector in the direction of the Earth's magnetic field. In 1965, Grace Wahba, proposed the following problem: Find the orthogonal matrix A with determinant +1 that minimizes the loss function L(A) is identity with 1/2(Sum from i a(sub i) (absolute value of b(sub i - A(r(sub i))(exp 2))) where the set of b(sub i) is a set of unit vectors measured in a spacecraft's body frame, the set of r(sub i) are the corresponding unit vectors in a reference frame, and the set of a(sub i) are non-negative weights. Wahba's problem can be related to Maximum Likelihood Estimation if the weights are chosen to be inverse variances, a(sub i) = sigma((sub -2). Wahba didn't assume this, but it will be convenient to assume it in this paper. Wahba'soptimality condition has provided the basis for many attitude determination algorithms. The purpose of this paper is to give an overview of the most popular and most promising algorithm and to provide accuracy and speed comparisons.
Derived from text
Attitude (Inclination); Matrices (Mathematics); Maximum Likelihood Estimates; Orthogonality; Algorithms; Eigenvectors

19990069608 Space and Naval Warfare Systems Center, San Diego, CA USA

Homomorphic-Like Random Set Representation for Fuzzy Logic Models Using Exponentiation With Applications to Data Fusion

Goodman, I. R.; Jun. 1998; 9p; In English; Pub. in Proceedings of Joint Conference on Information Sciences (3rd), v1 p271-274, Mar 97.

Contract(s)/Grant(s): Proj-ZU07

Report No.(s): AD-A365060; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary goal of this extended abstract is to show how a relatively new mathematical tool, relational event algebra, an extension of conditional event algebra, can be utilized, in conjunction with one-point random set coverages, to represent a class of fuzzy logic models which uses exponentiation to model modifiers.

DTIC

Algebra; Multisensor Fusion; Fuzzy Systems

19990069611 Space and Naval Warfare Systems Center, San Diego, CA USA

Extension of Relational Event Algebra to a General Decision Making Setting

Goodman, I. R.; Kramer, G. F.; Jun. 1998; 11p; In English; Pub. in Proceedings of International Multidisciplinary Conference, v1 p103-108, Oct 96.

Contract(s)/Grant(s): Proj-ZU07

Report No.(s): AD-A365034; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Relational Event Algebra (REA) is a new mathematical tool which provides all explicit algebraic reconstruction of events (appropriately designated as relational events) when initially only the formal probability values of such events are given as functions of known contributing event probabilities. In turn, once such relational events are obtained, one call then determine the probability of any finite logical combination, and in particular, various probabilistic distance measures among the events. A basic application of REA is to test hypotheses for the similarity of distinct models attempting to describe the same events such as in data fusion and combination of evidence. This paper considers new motivation for the use of REA, as well as a more general decision-making framework where system performance and redundancy/consistency tradeoffs are considered.

DTIC

Mathematical Models; Probability Theory; Multisensor Fusion

19990070299 Fukuoka Univ., Central Research Inst., Japan

On Generalized Fractional Calculus Operators and Their Compositions with Axisymmetric Differential Operator of the Potential Theory on Spaces F(sub p, mu) and F'(sub p, mu)

Saigo, Megumi, Fukuoka Univ., Japan; Kilbas, A. A., Fukuoka Univ., Japan; Raina, R. K., Rajasthan Agricultural Univ., India; Fukuoka University Science Reports; September 1993; ISSN 0386-118X; Volume 23, No. 2, pp. 133-154; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The properties of generalized fractional integration operators involving Fox's H-function are studied in the space of functions F(sub p, mu). The compositions of these operators with the axisymmetric differential operator of the potential theory on F(sub p, mu) and on the space of generalized functions F'(sub p, mu) are given.

Author

Calculus; Differential Equations; Assumptions

19990070300 Fukuoka Univ., Central Research Inst., Japan

Local Solutions of Quasilinear Hyperbolic Elliptic Equations, Pt. 2, Neumann Problems

Ebihara, Yukiyoshi, Fukuoka Univ., Japan; Kitada, Toshiyuki, Fukuoka Univ., Japan; Kurokiba, Masaki, Fukuoka Univ., Japan; Fukuoka University Science Reports; September 1993; ISSN 0386-118X; Volume 23, No. 2, pp. 107-131; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper, similar to Part 1., we consider the following nonlinear partial differential equations: u(sub tt)(x,t) = {C(sub 0) + u(x,t)}u(sub xx)(x, t) + C(sub 1)u(sup 2)(x, t) + C(sub 2)u(sub 2)(x, t) - C(sub 3)u(x, t), where C(sub i) (i = 0, 1, 2,3) are constants with C(sub 0) greater than 0 and C(sub 3) greater than or equal to 0, and (x, t) is a member of (0, 1) x (0, infinity). In this Part 2, we construct the local smooth solutions of the Neumann problem of the above equation, giving small initial data. Similar to Part 1, we apply the standard Galerkin-approximate scheme. As in the same manner of Part 1, we make some notations and define the

approximate solutions, give estimations of them, and prove the local existence. And, similar to Part 1, this means the solution exists at least in the interval which does not violate hyperbolicity.
Author
Elliptic Differential Equations; Hyperbolic Differential Equations; Approximation

19990070301 Fukuoka Univ., Central Research Inst., Japan
Local Solutions of Quasilinear Hyperbolic Elliptic Equations, Pt. 1, Dirichlet Problems
Ebihara, Yukiyoshi, Fukuoka Univ., Japan; Kitada, Toshiyuki, Fukuoka Univ., Japan; Kurokiba, Masaki, Fukuoka Univ., Japan; Fukuoka University Science Reports; September 1993; ISSN 0386-118X; Volume 23, No. 2, pp. 81-106; In English; No Copyright; Avail: Issuing Activity, Hardcopy

In this paper we consider the following nonlinear partial differential equations: u(sub tt)(x,t) = {C(sub 0)+u(x, t)}u(sub xx)(x, t)+C(sub 1)u(sup 2)(x, t) + C(sub 2)u(sup 2, sub x)(x, t) - C(sub 3)u(x,t), where C(sub)i (i = 0, 1, 2,3) are constants with C(sub 0) greater than 0 and C(sub 3) greater than or equal to 0, and (x, t) is a member of (0, 1) x (0, infinity). As you see if u(x, t) is smaller than -C(sub 0), the equation (0.1) is not hyperbolic, that is, it is elliptic. These equations are considered as the mathematical model of hyperbolic-elliptic phenomena with the nonlinear interactions, for example; the surface flow of the stream in a river with the conditions that the shores are frozen and the middle paxts are not frozen; electro-magnetic wave through a body which has non uniform magnetic field. Linear mathematical models of elliptic-hyperbolic phenomena have been studied. and in the related topics the textbooks R. Courant and K. 0. Friedrichs and L. Bers, and the papers C. S. Morawetz, H. Hattori and S. Yanagi are interesting. It seems to be few results concerning the existence of smooth solutions for (0.1). Our interest is to find points (x, t) such that u(x, t) = -C(sub 0), which determine the border line of the elliptic paxt and the hyperbolic part for given initial data u(sub 0) and u(sub l). However, the treatment is so much difficult. So we begin with the construction of the local smooth solutions giving small initial data. This means the solution exists at least in the interval which does not violate hyperbolicity.
Derived from text
Hyperbolic Differential Equations; Elliptic Differential Equations; Nonlinear Equations

19990070302 Fukuoka Univ., Central Research Inst., Japan
Continuation of Holomorphic Sections of Holomorphic Fiber Bundles Over Domains of Infinite Dimensional Spaces Equipped with the Finite Open Topology
Kajiwara, Joji, Kyushu Univ., Japan; Lin, Li, Kyushu Univ., Japan; Nishihara, Masaru, Fukuoka Univ., Japan; Yoshida, Mamoru, Fukuoka Univ., Japan; Fukuoka University Science Reports; September 1993; ISSN 0386-118X; Volume 23, No. 2, pp. 69-79; In English
Contract(s)/Grant(s): MOE-04640082; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We extend the results of Yoshida et al. to holomorphic mappings of domains over infinite dimensional complex spaces into complex Lie groups modelled with Banach spaces.
Author
Topology; Fiber Composites; Analytic Functions

19990070311 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Method of Project Scheduling Under Fuzziness in Estimation of Durations, Precedence Relationships, and Interruptions of Activities
Chishaki, Takeshi, Kyushu Univ., Japan; Tseng, Hao–Hsi, Kyushu Univ., Japan; Tatsh, Mohamed, Kyushu Univ., Japan; Tatsumi, Hiroshi, Kyushu Univ., Japan; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 97-113; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A fundamental limitation of traditional project scheduling techniques is that they are not able to manipulate the uncertainty and fuzziness which exist greatly in construction works. So, deterministic traditional approaches for scheduling often produce unrealistic result. In this paper, fuzzy PERT as a method for project scheduling is developed in consideration of fuzziness associated with durations, precedence relationships and interruptions of activities. to measure the possibility of the execution for a specific schedule, membership functions of those fuzziness are introduced, of which different values would provide the decision-maker with different alternative schedules. The fuzzy PERT mathematically results in an optimal model of linear programming and the process of calculation is illustrated on a small network.
Author
Pert; Project Management; Management Planning; Scheduling

65
STATISTICS AND PROBABILITY

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

19990069610 Space and Naval Warfare Systems Center, San Diego, CA USA
Extension of Relational and Conditional Event Algebra to Random Sets With Applications to Data Fusion
Goodman, I. R.; Kramer, G. F.; Jun. 1998; 36p; In English; Pub. in Proceedings of IMA Workshop on Applications and Theory of Random Sets, v97 p209-239, 1997.
Contract(s)/Grant(s): Proj-ZU07
Report No.(s): AD-A365037; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Conditional event algebra (CEA) was developed in order to represent conditional probabilities with differing antecedents by the probability evaluation of well-defined individual ”conditional” events in a single larger space extending the original unconditional one. These conditional events can then be combined logically before being evaluated. A major application of CEA is to data fusion problems, especially the testing of hypotheses concerning the similarity or redundancy among inference rules through use of probabilistic distance functions which critically require probabilistic conjunctions of conditional events. Relational event algebra (REA) is a further extension of CEA, whereby functions of probabilities formally representing single event probabilities - not just divisions as in the case of CEA - are shown to represent actual ”relational” events relative to appropriately determined larger probability spaces. Analogously, utilizing the logical combinations of such relational events allows for testing of hypotheses of similarity between data fusion models represented by functions of probabilities. Independent of, and prior to this work, it was proven that a major portion of fuzzy logic - a basic tool for treating natural language descriptions - can be directly related to probability theory via the use of one point random set coverage functions. In this paper, it is demonstrated that a natural extension of the one point coverage link between fuzzy logic and random set theory can be used in conjunction with CEA and REA to test for similarity of natural language descriptions.
DTIC
Fuzzy Systems; Multisensor Fusion; Algebra

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990066676 Joint Test Force, Kirtland AFB, NM USA
JADS/Joint Stars End-to-End Test is an Outstanding Success
Apr. 06, 1999; 3p; In English
Report No.(s): AD-A364809; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

KIRKLAND AIR FORCE BASE, NM - The Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) announced that the live test missions flown on 25 and 31 March 1999 achieved outstanding success and completed the fourth and final phase of the JADS End-to-End (ETE) Test. The ETE Test was designed to evaluate the utility of advanced distributed simulation (ADS), including distributed interactive simulation (DIS), for both developmental and operational test and evaluation of command, control, communications, computers and intelligence (C4I) systems. The ETE Test consisted of four phases: (1) development of the synthetic environment, (2) developmental and operational testing in the laboratory, (3) transition to the prime mission equipment(aircraft, and (4) two live test missions using ADS to populate the battle space with thousands of threat vehicles and then link friendly C4I/weapon system co-actors. The C4I system used in the ETE Test was a Northrop Grumman E-8C Joint Surveillance Target Attack Radar System (Joint STARS). The E-8C aircraft, flown by the Joint STARS Joint Test Force based in Melbourne, Florida, was equipped with an onboard radar processing simulation and integrator called the Virtual Surveillance Target Attack Radar System (VS TARS) that was designed and built by the prime contractor, Northrop Grumman, together with Lockheed Martin and Motorola under a JADS contract During the live test mission, VSTARS, while running concuxrently with the E-8C’s radar, accepted virtual target information from a Janus war game scenario generator remotely located at the White Sands Missile Range, New Mexico Information was sent over a standardized DIS network and radio frequency linked to the aircraft via a satellite communications (SATCOM) link. VSTARS then converted the data elements into virtual radar reports and seamlessly combined them with live target information the E-8C’s radar was collecting from a 1st Cavalry Divis
DTIC
Aircraft Equipment; Electronic Aircraft; Distributed Interactive Simulation; Command and Control; Communication Networks; End-to-End Data Systems

67
THEORETICAL MATHEMATICS

Includes topology and number theory.

19990064332 Geophysical Observatory, Helsinki, Finland
Oscillation Theory of Higher Order Differential Equations in the Complex Plane
Wu, Peng–Cheng, Geophysical Observatory, Finland; 1999; ISSN 1239-6303; In English
Report No.(s): Rept-120; ISBN 951-41-0865-5; Copyright; Avail: Issuing Activity (Dept. of Mathematics, P.O. Box 4, FIN-00014 University of Helsinki, Finland), Hardcopy

Since 1982, a substantial amount of research has been devoted to describing the frequency of zeros of solutions to linear differential equations of the type f" + A(z)f = 0, where A(z) is a transcendental entire function. In the seminal paper, Bank and Laine conjectured that if f(sub 1), and f(sub 2) are two linearly independent solutions of f" + A(z)f, then max (lambda(f(sub l)), lambda(f(sub 2)) = infinity, whenever the order rho(A) of A(z) is finite and nonintegral. Up to now, this conjecture still remains open in general. However, several special cases and also some more general equations have been considered from this point of view.
Derived from text
Oscillations; Differential Equations

19990067255 Cornell Univ., Center for Foundations of Intelligent Systems, Ithaca, NY USA
Topologies, Continuity and Bisimulations
Davoren, J. M.; Oct. 25, 1998; 19p; In English
Contract(s)/Grant(s): DAAH04-96-1-0341
Report No.(s): AD-A364718; TR-98-13; ARO-35873.98-MA-MUR; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The notion of a bisimulation relation is of basic importance in many areas of computation theory and logic. of late, it has come to take a particular significance in work on the formal analysis and verification of hybrid control systems, based on the modal mu-calculus. Our purpose here is to give an analysis of the concept, starting with the observation that the zig zag conditions are suggestive of some form of continuity. We give a topological characterization of bisimularity for preorders, and then use the topology as a route to examining the algebraic semantics for the mu-calculus and its relation to the standard set-theoretic semantics.
DTIC
Continuity (Mathematics); Mathematical Logic; Fixed Points (Mathematics)

19990069949 NASA Lewis Research Center, Cleveland, OH USA
Improving the Accuracy of Quadrature Method Solutions of Fredholm Integral Equations that Arise from Nonlinear Two-Point Boundary Value Problems
Sidi, Avram, Technion - Israel Inst. of Tech., Israel; Pennline, James A., Technion - Israel Inst. of Tech., Israel; Journal of Integral Equations and Applications; 1999; Volume 11, No. 1, pp. 103-139; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we are concerned with high-accuracy quadrature method solutions of nonlinear Fredholm integral equations of the form y(x) = r(x) + integral(0 to 1) g(x,t) F(t, y(t)) dt, 0 less than or equal to x less than or equal to 1, where the kernel function g(x,t) is continuous, but its partial derivatives have finite jump discontinuities across x = t. Such integrals equations arise, e.g., when one applies Green's function techniques to nonlinear two-point boundary value problems of the form U''(x) = f(x,y(x)), 0 less than or equal to x less than or equal to 1, with y(0) = y(sub 0) and g(l) = y(sub 1), or other linear boundary conditions. A quadrature method that is especially suitable and that has been employed for such equations is one based on the trapezoidal rule that has a low accuracy. by analyzing the corresponding Euler-Maclaurin expansion, we derive suitable correction terms that we add to the trapezoidal thus obtaining new numerical quadrature formulas of arbitrarily high accuracy that we also use in defining quadrature methods for the integral equations above. We prove an existence and uniqueness theorem for the quadrature method solutions, and show that their accuracy is the same as that of the underlying quadrature formula. The solution of the nonlinear systems resulting from the quadrature methods is achieved through successive approximations whose convergence is also proved. The results are demonstrated with numerical examples.
Author
Accuracy; Integral Equations; Nonlinear Equations; Boundary Conditions; Existence Theorems; Quadratures

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ACOUSTICS

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

19990064408 Technische Univ., Eindhoven, Netherlands
Acoustic Modeling and Design of MRI Scanners
Kuijpers, Adrianus Henricus Wouterus Maria, Technische Univ., Netherlands; 1999; 148p; In English
Report No.(s): NUGI-841; ISBN 90-386-0648-6; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A magnetic resonance imaging (MRI) scanner is a medical diagnostic device for imaging of the internal structures of the human body. A well known problem of MRI scanners is their large noise production (up to 90 - 120 dB(A)) during the scanning process. The noise is produced by the strong vibration of the so-called gradient coil system. In the future, it is expected that new, faster scanning techniques will increase the noise problem. In the interest of patients, operators, and medical staff, it will be necessary to reduce these noise levels considerably in future scanners. Therefore, it is necessary to assess the acoustic performance of the MRI scanner early in the design phase to obtain substantially quieter scanners. A model for the noise production of MRI scanners can be subdivided in two parts: a structural and an acoustic part. The structural part of the model deals with the generation of structural vibrations due to Lorentz forces excitations. The acoustic part describes the transformation of the structural vibrations into audible noise. This thesis only deals with models for the acoustic part of the noise problem. The companion doctoral thesis, covers the structural part of the MRI noise problem and structural-acoustic optimization techniques. An adequate acoustic model for low-noise design of MRI scanners should satisfy two important demands: the model must incorporate the relevant aspects of the MRI scanner noise problem and at the same time be practically manageable for the developers of MRI scanners. Therefore, the objective of research presented in this thesis is twofold. On the one hand the research is aimed at the development of accurate and efficient numerical tools to model the noise problem of the MRI scanner. On the other hand it tries to identify the acoustically relevant parameters in the design of a more quiet MRI scanner. In order to reach the first part of the objective, the development of accurate and efficient numerical tools, three acoustic formulations were developed to model the acoustic radiation of the MRI scanner: A semi-analytical formulation for the acoustic radiation of a finite duct with open ends mounted with infinite flanges. An acoustic boundary element method (BEM) with Fourier elements. A modal description of the acoustics based on the radiation modes formulation. The semi-analytical formulation was developed to gain insight into the physics of this specific acoustic problem. The method is derived within the general linear duct acoustics theory. The acoustic field inside the finite duct with infinite flanges is described with Fourier-Bessel duct modes.
Derived from text
Acoustic Properties; Structural Vibration; Sound Waves; Noise Intensity; Mathematical Models; Models; Magnetic Resonance

19990064515 Department of the Navy, Washington, DC USA
Cavitation-Resistant Sonar Array
Ruffa, Anthony A., Inventor; Stottlemyer, Thomas R., Inventor; Sep. 17, 1998; 12p; In English
Patent Info.: Filed 17 Sep. 1998; US-Patent-Appl-SN-09,158,974
Report No.(s): AD-D019356; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A cavitation-resistant sonar array having reduced spacing between transducer elements is provided. The array has a series of transducer elements attached to an array fixture with spacing between elements being fixed at one-quarter wavelength or closer. Cavitation caused by this close spacing is eliminated by replacing the water spaces between elements with a rho-c rubber which matches the acoustic impedance, z, of water, that is z = pc. The rho-c material is bonded to element to prevent loss of contact between the element and the spacer. A processing computation correcting signal data is provided to account for any differences in the speed of sound, c, in the rho-c material when compared to the speed of sound in water.
DTIC
Sonar; Cavitation Flow

19990064519 Department of the Navy, Washington, DC USA
Acoustic Bolt Removal
Ruffa, Anthony A., Inventor; Sep. 11, 1998; 16p; In English
Patent Info.: Filed 11 Sep. 1998; US-Patent-Appl-SN-9,152,477
Report No.(s): AD-D019361; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A method and apparatus for acoustically removing a frozen bolt from a metal structure having a bolt hole formed therein is discussed. The bolt includes a head and a shank portion depending from the head, the shank of the bolt being inserted into the bolt hole of the metal structure. A material inhibiting removal of the bolt from the bolt hole of the metal structure substantially sur-

rounds the shank of the bolt, and an acoustic transducer is removably mounted to the head of the bolt, the acoustic transducer being responsive to a frequency specific resonance applied thereto at a predetermined amplitude. A socket wrench head surrounds the acoustic transducer and the head of the bolt, the socket wrench head applying torque to the head of said bolt and confining the acoustic transducer to the head of the bolt. The frequency specific resonance applied to the acoustic transducer at the predetermined amplitude correspondingly excites the bolt at that frequency specific resonance and predetermined amplitude, thereby loosening the bolt from the bolt hole.
DTIC
Bolts; Ultrasonics; Electroacoustic Transducers

19990066677 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Estimating the Straightness of Vertical Line Arrays using Finite Element Analysis
Davis, Michael H.; Mar. 1999; 37p; In English
Report No.(s): AD-A364875; DSTO-TN-0197; DODA-AR-010-878; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

As Vertical Line Arrays (VLA) are used at increasingly higher frequencies (3 kHz), the importance of the straightness of the array increases. Finite Element Analysis (FEA) has been used to estimate the shape of typical VLAs subject to currents in shallow water. Two typical VLA configurations have been modelled and the results presented.
DTIC
Linear Arrays; Laser Arrays; Beamforming

19990068450 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Computation of Trailing-Edge Noise at Low Mach Number using LES and Acoustic Analogy ***Annual Report***
Wang, Meng, Stanford Univ., USA; Annual Research Briefs, 1998; December 1998, pp. 91-106; In English; See also 19990068442
Contract(s)/Grant(s): N00014-95-1-0221; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The present work is a continuation of the work described in the previous annual research briefs (Wang 1996, 1997). The objectives of the project are twofold: (1) to develop numerical prediction methods for trailing-edge noise, using a combination of large-eddy simulation (LES) and Lighthill's theory; and (2) to generate a reliable numerical database for the study of noise source mechanisms.
Derived from text
Trailing Edges; Noise Generators; Noise Measurement; Large Eddy Simulation; Turbulent Boundary Layer; Boundary Layer Separation

19990069612 Space and Naval Warfare Systems Center, San Diego, CA USA
SSC San Diego In-House Laboratory Independence Research 1998 Annual Report ***Final Report, Oct. 1997 - Sep. 1998***
Apr. 1999; 162p; In English
Report No.(s): AD-A365029; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The work detailed in this report was carried out in FY 98 as part of the Office of Naval Research In-house Laboratory Independent Research (ILIR) program. Summaries of the projects are presented, and three projects are described in detail: Development of Ultramicroelectrode (UME) Arrays for Use in a Remote Probe; Underwater Acoustic Array Processing in High-Slope Shallow-Water Environments; and A New Sparse Complete Orthogonal Factorization Method as Applied to Bistatic Target-Strength Prediction.
DTIC
Underwater Acoustics; Research

19990069950 NASA Langley Research Center, Hampton, VA USA
XV-15 Tiltrotor Low Noise Approach Operations
Conner, David, Army Aviation and Missile Command, USA; Marcolini, Michael A., NASA Langley Research Center, USA; Decker, William A., NASA Ames Research Center, USA; Cline, John H., Army Research Lab., USA; Edwards, Bryan D., Bell Helicopter Co., USA; Nicks, Colby O., Bell Helicopter Co., USA; Klein, Peter D., Bell Helicopter Co., USA; 1999; In English; 55th, 25-27 May 1999, Montreal, Quebec, Canada; Sponsored by American Helicopter Society, Inc., USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Acoustic data have been acquired for the XV- 15 tiltrotor aircraft performing approach operations for a variety of different approach profile configurations. This flight test program was conducted jointly by NASA, the U.S. Army, and Bell Helicopter

Textron, Inc. (BHTI) in June 1997. The XV-15 was flown over a large area microphone array, which was deployed to directly measure the noise footprint produced during actual approach operations, The XV- 15 flew realistic approach profiles that culminated in IGE hover over a landing pad. Aircraft tracking and pilot guidance was provided by a Differential Global Positioning System (DGPS) and a flight director system developed at BHTT. Approach profile designs emphasized noise reduction while maintaining handling qualities sufficient for tiltrotor commercial passenger ride comfort and flight safety under Instrument Flight Rules (IFR) conditions. A discussion of the approach profile design philosophy is provided. Five different approach profiles are discussed in detail -- 3deg., 6 deg., and 9 deg. approaches, and two very different 3 deg. to 9 deg. segmented approaches. The approach profile characteristics are discussed in details, followed by the noise footprints and handling qualities. Sound exposure levels are also presented on an averaged basis and as a function of the sideline distance for a number of up-range distances from the landing point. A comparison of the noise contour areas is also provided. The results document the variation in tiltrotor noise due to changes in operating condition, and indicate the potential for significant noise reduction using the unique tiltrotor capability of nacelle tilt.
Author
Acoustic Properties; Data Acquisition; Aircraft Detection; XV-15 Aircraft; Controllability; Exposure; Flight Tests; Instrument Flight Rules; Low Noise; Noise Reduction

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990064359 NASA Johnson Space Center, Houston, TX USA
Medium Modified Nucleon-Nucleon Cross Sections in a Nucleus
Tripathi, R. K., Hampton Univ., USA; Cucinotta, F. A., NASA Johnson Space Center, USA; Wilson, J. W., NASA Langley Research Center, USA; Nuclear Instruments and Methods in Physics Research B; 1999; ISSN 0168-583X; Volume 152, pp. 425-431; In English
Contract(s)/Grant(s): NCC1-242; Copyright; Avail: Issuing Activity, Hardcopy

A simple reliable formalism is presented for obtaining nucleon-nucleon cross sections within a nucleus in nuclear collisions for a given projectile and target nucleus combination at a given energy for use in transport, Monte Carlo and other calculations. The method relies on extraction of these values from experiments and has been tested for absorption experiments to give excellent results.
Author
Nucleon-Nucleon Interactions; Particle Collisions; Nucleon-Nucleon Scattering; Atomic Collisions; Nuclear Particles; Atomic Excitations

19990064455 NASA Marshall Space Flight Center, Huntsville, AL USA
The Screening Effect in Electromagnetic Production of Electron Positron Pairs in Relativistic Nucleus-Atom Collisions
Wu, Jianshi, Fayetteville State Univ., USA; Derrickson, J. H., NASA Marshall Space Flight Center, USA; Parnell, T. A., NASA Marshall Space Flight Center, USA; Strayer, M. R., Oak Ridge National Lab., USA; Apr. 19, 1999; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We study the screening effects of the atomic electrons in the electromagnetic production of electron-positron pairs in relativistic nucleus-atom collisions for fixed target experiments. Our results are contrasted with those obtained in bare collisions, with particular attention given to its dependence on the beam energy and the target atom.
Author
Screen Effect; Electromagnetic Properties; Electron-Positron Pairs; Particle Production; Research

19990067224 High Energy Accelerator Research Organization, Tsukuba, Japan
Perturbative and Non-Perturbative Studies of the SU(2)-Higgs Model on Lattices with Asymmetric Lattice Spacings
Csikor, F., Eoetvoes LORANd Univ., Hungary; Fodor, Z., High Energy Accelerator Research Organization, Japan; Heitger, J., Muenster Univ., Germany; April 1998; 30p; In English; Sponsored in part by the Hungarian Ministry of Education
Contract(s)/Grant(s): OTKA-T016248; LTKA-T022929; FKFP-0128/1997
Report No.(s): KEK-TH-563; KEK-Preprint-98-27; ITP-Budapest-528; MS-TPI-97-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a calculation of the O(g(sup 2), lambda) perturbative corrections to the coupling anisotropies of the SU(2)-Higgs model on lattices with asymmetric lattice spacings. These corrections are obtained by a one-loop calculation requiring the rotational invariance of the gauge and Higgs boson propagators in the continuum limit. The coupling anisotropies are also determined from numerical simulations of the model on appropriate lattices. The one-loop perturbation theory and the simulation results agree with high accuracy. It is demonstrated that rotational invariance is also restored for the static potential determine from space-space and space-time Wilson loops.
Author
Perturbation Theory; Research; Nuclear Models; Lattices (Mathematics); Computation

19990067225 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan
Moduli Space of Global Symmetry in N=1 Supersymmetric Theories and the Quasi Nambu Goldstone Bosons
Nitta, Muneto, Osaka Univ., Japan; June 1998; 48p; In English
Report No.(s): KEK-TH-572; KEK-Preprint-98-62; hep-th/9805038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We derive the moduli space for the global symmetry in N = 1 supersymmetric theories. We show, at the generic points, it coincides with the space of quasi-Nambu-Goldstone (QNG) bosons, which appear besides the ordinary Nambu-Goldstone (NG) bosons when global symmetry G breaks down spontaneously to its subgroup H with preserving N = 1 supersymmetry. At the singular points, most of the NG bosons change to the QNG bosons and the unbroken global symmetry is enhanced. The G-orbits parametrized by the NG bosons are the fibre at the moduli space and the singular points correspond to the point where H-orbit (in G-orbit) shrinks. We also show the low-energy effective Lagrangian is the arbitrary function of the orbit map.
Author
Supersymmetry; Bosons; Lagrangian Function; Molecular Interactions

19990067226 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan
B Meson Decay Constant and Non Relativistic Interpretation of Wilson and Clover Fermion Actions for Heavy Quark
Aoki, S., Tsukuba Univ., Japan; Fukugita, M., Tokyo Univ., Japan; Hashimoto, S., High Energy Accelerator Research Organization, Japan; Ishizuka, N., Tsukuba Univ., Japan; Iwasaki, Y., Tsukuba Univ., Japan; Kanaya, K., Tsukuba Univ., Japan; Kuramashi, Y., High Energy Accelerator Research Organization, Japan; Okawa, M., High Energy Accelerator Research Organization, Japan; Ukawa, A., Tsukuba Univ., Japan; Yoshie, T., Tsukuba Univ., Japan; August 1997; 14p; In English; Lattice QCD on Parallel Computers, 10-15 Mar. 1997, Tsukuba, Japan
Contract(s)/Grant(s): MOESSC-08640349; MOESSC-08640350; MOESSC-08640404; MOESSC-08740189; MOESSC- 08740221
Report No.(s): KEK-CP-061; KEK-Preprint-97-121; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on our effort toward a determination of the heavy-light decay constant in quenched QCD. Simulation results are analyzed in terms of the non-relativistic interpretation of relativistic fermions fully incorporating one-loop corrections in the mass and current renormalization factors for massive quark. For the Wilson action for which the analysis is completed, we obtain f(sub D) = 192(30) MeV, f(sub D,sub s) = 214(33) MeV, f(sub B) = 171(29) MeV and f(sub B, sub s) = 193(32)MeV in the continuum limit.
Author
Particle Decay; Mesons; Simulation; Constants

19990067227 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan
CP Violation via rho(omega) Interference
Enomoto, Ryoji, High Energy Accelerator Research Organization, Japan; Tanabashi, Masaharu, Tohoku Univ., Japan; June 1997; 20p; In English, 24-27 Mar. 1997, Hawaii, USA
Contract(s)/Grant(s): MOESSC-09740185; MOESSC-09246203
Report No.(s): KEK-Preprint-97-67; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We consider B(sup +/- ,0) approaches rho(sup 0)(omega)h(sup +/-, 0), where rho(sup 0)(omega) decays to pi(+)pi(-) and h is any hadronic final state, such as ppi or K. We find a large direct CP asymmetry in B-meson decays via rho(omega) interference. A possible method to determine weak phases, such as phi(sub 2, 3), is discussed. The experimental feasibility is also shown.
Author
Particle Decay; Mesons; Feasibility

19990067228 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan

Scaling Analysis of Chiral Phase Transition for Two Flavors of Kogut-Susskind Quarks

Aoki, S., Tsukuba Univ., Japan; Fukugita, M., Tokyo Univ., Japan; Hashimoto, S., High Energy Accelerator Research Organization, Japan; Ishizuka, N., Tsukuba Univ., Japan; Iwasaki, Y., Tsukuba Univ., Japan; Kanaya, K., Tsukuba Univ., Japan; Kuramashi, Y., High Energy Accelerator Research Organization, Japan; Mino, H., Yamanashi Univ., Japan; Okawa, M., Tsukuba Univ., Japan; Ukawa, A., Tsukuba Univ., Japan; Yoshie, T., High Energy Accelerator Research Organization, Japan; August 1997; 10p; In English; Lattice QCD on Parallel Computers, 10-15 Mar. 1997, Tsukuba, Japan

Contract(s)/Grant(s): MOE-08640349; MOE-08640350; MOE-08640404; MOE-08740189; MOE-08740221

Report No.(s): KEK-CP-062; KEK-Preprint-97-122; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Report is made of a systematic scaling study of the finite-temperature chiral phase transition of two-flavor QCD with the Kogut-Susskind quark action based on simulations on L(exp 3) x 4 (L = 8, 12 and 16) lattices at the quark mass of m(sub q) = 0.075, 0.0375, 0.02 and 0.01. Our finite-size data show that a phase transition is absent for m(sub q) greater than or equal to 0.02, and quite likely also at m(sub q) = 0.01. The scaling behavior of susceptibilities as a function of m(sub q) is consistent with a second-order transition at m(sub q) = 0. However, the exponents deviate from the O(2) or O(4) values theoretically expected.

Author

Chiral Dynamics; Phase Transformations; Quarks

19990067257 Princeton Univ., Dept. of Chemistry, NJ USA

Issues and Theoretical Tools to Guide the Achievement of Molecular Control ***Final Report, 1 Apr. 1995 - 31 Jan. 1998***

Rabitz, Herschel; Feb. 02, 1999; 9p; In English

Contract(s)/Grant(s): DAAH04-95-1-0184

Report No.(s): AD-A364749; ARO-33587.9-PH; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This research concerned the control of chemical and physical phenomena at the molecular scale. Theoretical design tools were employed, pulling together concepts from engineering, control, and quantum dynamics. The research explored the boundaries of achievable control over molecular-scale event, especially using external optical fields. These studies indicate that a broad spectrum of molecular-scale processes should be amenable to successful laboratory control. In addition, the foundations were established for using similar concepts to extract fundamental Hamiltonian information from associated ultrafast dynamics observations. It is concluded that, in general, various quantum learning control techniques would be most effective for both manipulating molecules and deducing information about their interactions.

DTIC

Control Systems Design; Quantum Chemistry; Optimal Control; Molecular Dynamics

19990068528 Tokyo Univ., Dept. of Mechanical Engineering, Japan

The Construction of Collision Model of Diatomic Molecules

Tokumasu, Takashi, Tokyo Univ., Japan; Matsumoto, Yoichiro, Tokyo Univ., Japan; Colloquium on Nonequilibrium Phenomena of Low-Density Jets in Space; 1998, pp. 93-100; In English; Nonequilibrium Phenomena of Low-Density Jets in Space, 12-13 Feb. 1998, Kyoto, Japan; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Using the Molecular Dynamics (MD) method, the collision of N2 molecules is simulated. The energy transfer between translational and rotational energies is investigated numerically at low temperature where the vibrational degree of freedom is negligible (under 2000 K). The results show that the energies after the collision distribute over a wide range, having its peak at the initial energy. by using these results, the Dynamic Molecular Collision (DMC) model of diatomic molecule is constructed. This model is applied for the Direct Simulation Monte Carlo (DSMC) method to simulate the energy distribution at equilibrium condition, viscosity coefficient and the structure of normal shock wave in order to validate this model. It is shown that the collision process of diatomic molecules can be calculated precisely enough by this model.

Author

Dynamic Models; Diatomic Molecules; Collisions; Nitrogen; Energy Transfer

19990068752 Emory Univ., Dept. of Chemistry, Atlanta, GA USA

The Effect of Rotation on Resonances

Bowman, Joel M., Emory Univ., USA; Molecular Quantum States at Dissociation; 1998, pp. 51-55; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

Resonances are metastable states of a molecular complex. They are formed in many cases by vibrational excitation of a molecular complex above a dissociation threshold. This excitation can be (and statistically is most often) in vibrational modes not associated with dissociation. Thus, the lifetime of the complex can be many periods of an average vibration. The decay of a resonance

is due to the coupling between excited modes and the dissociation mode(s), and thus our understanding of resonance properties is challenged by the non-linear dynamics in the high energy (and possibly chaotic) region of the spectrum. However, because of their long lifetimes, resonances share a number of features in common with ordinary bound states, including the possibility of making spectroscopic assignments of them. In particular, in understanding the effect of overall rotation on resonance properties, we and others have shown that there is a strong correspondence with the rotational properties of bound states.
Derived from text
Dissociation; Rotational States; Rotational Spectra; Molecular Excitation; Resonance; Vibration

19990068753 Durham Univ., Dept. of Chemistry, UK
Regular and Irregular Vibrational Wavefunctions of Ar3
Wright, Nicholas J., Durham Univ., UK; Hutson, Jeremy M., Durham Univ., UK; Molecular Quantum States at Dissociation; 1998, pp. 46-50; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

The coupling of molecular beam techniques with laser technology has led to the development of powerful experimental techniques for probing highly excited states of molecules. The results of such experiments present a major challenge to theory. The ”traditional” approach of predicting spectra from an effective Hamiltonian based on normal mode analysis no longer works, because the large-amplitude motions characteristic of highly excited states invalidate any approach based upon small deviations from a reference geometry. We have calculated the the wavefunctions for the J = 0 states of Ar3, using a high-quality pairwise-additive potential energy surface and a potential-optimized discrete variable representation (PO-DVR) method.
Derived from text
Molecular Beams; Laser Applications; Laser Spectroscopy; Argon

19990068754 Max-Planck-Inst. fuer Stroemungsforschung, Goettingen, Germany
Dynamics and Statistics in the Unimolecular Dissociation of NO2
Grebenshchikov, S. Y., Max-Planck-Inst. fuer Stroemungsforschung, Germany; Beck, C., Max-Planck-Inst. fuer Stroemungsforschung, Germany; Hauschildt, J., Max-Planck-Inst. fuer Stroemungsforschung, Germany; Floethmann, H., Max-Planck-Inst. fuer Stroemungsforschung, Germany; Schinke, R., Max-Planck-Inst. fuer Stroemungsforschung, Germany; Molecular Quantum States at Dissociation; 1998, pp. 33-39; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

This paper discuss the dynamical (quantum and classical) and statistical dissociation rates for nitrogen dioxide, NO2, the benchmark system which has been the focus ot many systematic experimental and theoretical studies. The goal is to see which features of the dissociation process are correctly grasped by the transition state theory (TST).
CASI
Dissociation; Nitrogen Dioxide; Spectrum Analysis

19990068755 California Univ., Dept. of Chemistry, Irvine, CA USA
Getting the Most Out of Time Signals: From NMR to Quantum Dynamics Calculations
Mandelshtam, V. A., California Univ., USA; Molecular Quantum States at Dissociation; 1998, pp. 29-32; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

We briefly review some very recent results associated with the filter diagonalization method (FDM), which is a rapidly developing approach for the spectral analysis of time signals arising, in particular, in molecular dynamics calculations, including calculations of quantum spectra of molecular systems at dissociation. We point out that the FDM for solving C(t) = Sum(sub k) d(sub k)e(exp -itE(sub k)) seems to have become an essentially ”black box” numerical algorithm, also being very stable with respect to various kinds of noise.
Derived from text
Time Signals; Spectrum Analysis; Molecular Dynamics; Nuclear Magnetic Resonance

19990068756 Warwick Univ., Mathematics Inst., Coventry UK
Highly Excited Rotational Dynamics of H3(+)
Kozin, I. N., Warwick Univ., UK; Roberts, R. M., Warwick Univ., UK; Molecular Quantum States at Dissociation; 1998, pp. 17-21; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

The present work gives a detailed description of all relative equilibria of the H3(+) ion and how they change as the total angular momentum increases, assuming an isolated ground electronic state. We are aware of the fact that at high energies the influence of other electronic states must be taken into account and our analysis at energies close to dissociation should only be considered as giving a rough idea of what might happen. We found that the global maps of relative equilibria of H3(+) as functions of J are

qualitatively similar for a model pairwise potential based on just one Morse function and for the recent very accurate potential due to Dinelli, Polyansky and Tennyson.
Derived from text
Dissociation; Electron States; Ground State; Excitation; Energy Levels; Quantum Theory

19990068757 University Coll., Dept. of Physics and Astronomy, London, UK
Quantum States of Triatomic Molecules at Dissociation
Prosmiti, Rita, University Coll., UK; Mussa, Hamse Y., University Coll., UK; Tennyson, Jonathan, University Coll., UK; Molecular Quantum States at Dissociation; 1998, pp. 12-16; In English
Contract(s)/Grant(s): CEC-ERBFMBICT-960901; CEC-ERBFMGECT-950052; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

This paper explores the use of novel computer architectures to solve the problem that exist with the calculation using the Parallel Triatomic Discrete Variable Representation programs (PDVR3D). The calculations using PDVR3D have been performed on a number of triatomics. In particular ozone, HCP and most recently on the astronomically important N2H(+) molecular ion, for which vibrational levels were obtained up to dissociation.
CASI
Architecture (Computers); Computer Programs; Triatomic Molecules; Dissociation

19990068975 Durham Univ., Dept. of Chemistry, UK
Long-Range Interactions Involving Atomic and Molecular Ions
Hutson, Jeremy M., Durham Univ., UK; Law, Mark M., Durham Univ., UK; Meuwly, Markus, Durham Univ., UK; Molecular Quantum States at Dissociation; 1998, pp. 5-11; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

The long-range interactions between atoms and simple ions are of great importance in understanding solvation processes, in determining ion mobilities and capture cross sections and in processes such as Penning ionisation. However, high-quality experimental information on such interactions has been hard to come by. Over the last few years, Alan Carrington's group at Southampton has developed novel ion beam methods for measuring the microwave spectra of ions in highly excited vibrational states, very close to dissociation. The methods depend on the fact that ionic states within a few 1/cm of the dissociation limit can be dissociated by an electric field.
Derived from text
Atomic Interactions; Molecular Interactions; Molecular Ions; Dissociation; Atomic Energy Levels; Quantum Numbers

19990069081 Consejo Superior de Investigaciones Cientificas, Inst. de Matematicas y Fisica Fundamental, Madrid, Spain
Predissociation Dynamics of HeBr2 Near the Br2 (B) Dissociation Limit
Hernandez, Marta I., Consejo Superior de Investigaciones Cientificas, Spain; Gonzalez–Lezana, Tomas, Consejo Superior de Investigaciones Cientificas, Spain; Molecular Quantum States at Dissociation; 1998, pp. 40-45; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

The potential energy surface used in our work is constructed as a sum of pairwise Br-Br and Br-He interactions. Morse parameters for the Br-He interaction were fitted to reproduce, at low v(sub 0) levels, experimental spectral shifts, lifetimes, and averaged structures. Performance of this PES in the more intriguing region of high Br2 vibrational levels is thus tested by comparing the results of the calculations with the available data.
Derived from text
Dissociation; Helium Compounds; Rare Gases; Bromine; Intermolecular Forces

19990069536 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Effects of Velocity Space Diffusion Acting on Ions with Superthermal Kappa Function Distributions
Collier, Michael R., NASA Goddard Space Flight Center, USA; Apr. 04, 1999; 22p; In English; No Copyright; Avail: Issuing Activity, Hardcopy

Velocity space diffusion acting on superthermal ions whose distributions resemble kappa functions (Maxwellian core with a power law tail) will cause the distributions to evolve so that the high energy spectral index, kappa, is linearly related to core temperature with a constant of proportionally that (1) scales inversely with the distribution's characteristic energy, (2) is independent of the diffusion coefficient and (3) has a positive intercept. This type of behavior has been observed in five different studies covering the magnetospheres of Earth, Jupiter, and Saturn as well as the solar wind. These results indicate: (1) velocity space diffusion frequently plays the dominant role in shaping particle distribution functions in many diverse space plasma environments and

(2) hotter distributions with steeper spectral indices are ”older” distributions in that they have evolved considerably from the source distribution.
Author
Velocity; Diffusion Coefficient; Space Plasmas; Ions

19990069597 Virginia Commonwealth Univ., Dept. of Physics, Richmond, VA USA
Electronic Structure and Magnetism of Mixed Atomic Clusters ***Final Report, 1 Apr. 1995 - 1 Jul. 1998***
Jena, P.; Khanna, S. N.; Rao, B. K.; Jan. 15, 1999; 9p; In English
Contract(s)/Grant(s): DAAH04-95-1-0158
Report No.(s): AD-A365196; ARO-34024.22-PH; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

During this project we have studied the magnetic behavior of Ni, V, Rh, Gd, and Mn Clusters, interaction of metal clusters with substrates and hydrogen, iron-carbon clusters, the hydrogen-vacancy complexes and have explained anomalies spectroscopic data on metal cluster anions. Our studies have enabled: (1) an understanding of the magnetic behavior of clusters of conventional ferromagnetic metals Fe, Co, Ni, (2) predicted ferromagnetism in Rh(n) clusters, (3) examined spin canting in Gd(n) clusters, and (4) predicted that clusters of antiferromagnetic solids like Mn are magnetic. We have offered the first explanation of the anomalies in the negative ion spectroscopy of Li(n) clusters and have provided a basic understanding of the Hydrogen-vacancy complexes.
DTIC
Electronic Structure; Atomic Clusters; Ferromagnetism

19990069598 Princeton Univ., Dept. of Chemistry, NJ USA
Protocols for Creating Atomic and Molecular Quantum Computing Elements ***Final Report, 1 Jul. 1996 - 30 Jun. 1998***
Rabitz, Herschel; Feb. 15, 1999; 21p; In English
Contract(s)/Grant(s): DAA04-96-1-0300
Report No.(s): AD-A365195; ARO-35778.1-PH-QC; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Under this grant, a constructive procedure was developed for generating a prescribed unitary transform via the optically driven evolution of a multilevel atom. Assuming a clean separation of the coupled levels, the procedure employed the rotating wave approximation together with a decomposition of a unitary matrix into simpler matrix factors with specified structure. Applications to state preparation and observation were also provided.
DTIC
Quantum Chemistry; Protocol (Computers); Atoms; Molecular Dynamics

19990070344 Rutherford Appleton Lab., ISIS Facility, Chilton, UK
Static and Dynamic Properties of a Dimerized Quantum-Spin Chain
Fritz, Oliver, Rutherford Appleton Lab., UK; Lovesey, Stephen W., Rutherford Appleton Lab., UK; Watson, Greg I., Rutherford Appleton Lab., UK; March 1998; ISSN 1356-6254; 5p; In English
Contract(s)/Grant(s): ERBFMB1-CT961209
Report No.(s): RAL-TR-98-026; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

Various static spin-correlation functions and the weights of the spin excitations, or collective normal-modes, in the van Hove response function, observed in neutron scattering experiments, are calculated as a function of temperature for a model quantum-spin chain. The spins interact through an isotropic Heisenberg exchange that extends to nearest neighbor spins. In our model, spins of magnitude 1/2 form a dimerized chain with alternating exchange interactions. We explore the static and dynamic properties for ferromagnetic and antiferromagnetic exchange interactions. Results for the various properties are shown to be exact in the limit of a large temperature, and we argue the results are very good at small temperatures. The results are also exact in the limit of strong dimerization, i.e. non-interacting coupled pairs of spins.
Author
Dynamic Characteristics; Static Characteristics; Dimerization; Neutron Scattering

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NUCLEAR AND HIGH-ENERGY PHYSICS

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

19990066620 High Energy Accelerator Research Organization, Tsukuba, Japan
Construction of a 714-MHz RF System for the ATF Damping Ring
Sakanaka, S., High Energy Accelerator Research Organization, Japan; Kubo, K., High Energy Accelerator Research Organization, Japan; Hinode, F., High Energy Accelerator Research Organization, Japan; Hayano, H., High Energy Accelerator Research Organization, Japan; Urakawa, J., High Energy Accelerator Research Organization, Japan; Minty, M. G., Stanford Linear Accelerator Center, USA; 19970501; 6p; In English; Particle Accelerator, 12-15 May 1997, Vancouver, British Columbia, Canada; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A 714-MHz RF system for the Accelerator Test Facility (ATF) damping ring has been constructed and commissioned. The RF system comprises two higher-order-mode (HOM) damped cavities, a 50-kW klystron, a WR-1150 waveguide network and low-level RF electronics. by using HOM-damped cavities, longitudinal and transverse coupled-bunch instabilities can be avoided even at a maximum beam current of 600mA. A low-level control scheme, which can manage heavy transient beam loading, was designed, and a subset of the system was implemented. We report in this paper the construction and commissioning of this RF system.
Author
Test Facilities; Damping; Klystrons; Waveguides

19990067222 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan
The Design and R and D Works for the 50-GeV Synchrotron of Japan Hadron Facility
Mori, Y., High Energy Accelerator Research Organization, Japan; June 1998; 5p; In English; 1st; Asian Particle Accelerator (APAC98), 23-27 Mar. 1998, Tsukuba, Japan
Report No.(s): KEK-Preprint-98-68; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The present status of the design and R&D works for the synchrotrons of Japan Hadron Facility (JHF) are expressed.
Author
Japan; Synchrotrons; Research Facilities; Design Analysis; Fabrication

19990067229 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan
High Beam Current Handling in the JHF Main Ring
Machida, S., High Energy Accelerator Research Organization, Japan; Mori, Y., High Energy Accelerator Research Organization, Japan; Ohmori, C., High Energy Accelerator Research Organization, Japan; Ishi, Y., High Energy Accelerator Research Organization, Japan; Shibuya, S., High Energy Accelerator Research Organization, Japan; Tomizawa, M., High Energy Accelerator Research Organization, Japan; June 1997; 6p; In English; Particle Accelerator, 12-16 May 1997, Vancouver, British Columbia, Canada
Report No.(s): KEK-Preprint-97-71; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Japan Hadron Facility (JHF) synchrotrons are expected to store and accelerate ten times larger number of protons than that of the machines under operation (2 x l0(exp 14) protons in the 50 GeV main ring and 5 x 10(exp 13) protons in the 3 GeV booster). A stable operation with a very small beam loss is essential. Beam dynamics not only of the beam core but of the tail and halo should be considered. More specifically, transverse space charge effects have to be taken into account from the design stage of the lattice. In that sense, a conventional way of the lattice optimization, such as maximizing dynamic aperture and minimizing smear, may not be applicable. We have started to simulate commissioning of a high intensity machine. As a first attempt, the tune survey with space charge effects is simulated. Beam loss and emittance growth are examined in the wide range of tune space. Those results are compared with dynamic aperture without space charge effects.
Author
Beam Currents; High Current; Synchrotrons; Protons; Losses; Space Charge

19990068987 Osaka Univ., Faculty of Engineering, Osaka, Japan
X-Ray Spectroscopic Measurements of Direct-Drive Implosion with Low Modal Non-Uniformity
Ochi, Yoshihiro, Osaka Univ., Japan; Nishimura, Hiroaki, Osaka Univ., Japan; Fujita, Kazuhisa, Osaka Univ., Japan; Naruo, Shuji, Osaka Univ., Japan; Niki, Isamu, Osaka Univ., Japan; Sunahara, Atsushi, Osaka Univ., Japan; Shiraga, Hiroyuki, Osaka Univ., Japan; Azechi, Hiroshi, Osaka Univ., Japan; Takabe, Hideaki, Osaka Univ., Japan; Nakai, Sadao, Osaka Univ., Japan; Mima, Kunioki, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15, 1998; ISSN 0030-6177; Volume 48, No. 2319,

pp. 157-166; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Fusion pellet implosion by direct laser irradiation was investigated by means of time- and space-resolved spectroscopic measurements. Deuterium fuel gas was seeded with a small amount of Ar in order to observe influence of temporal variation of argon line emissions and their spatial extent on low modal non-uniformity imposed artificially by changing a pellet irradiation condition. The experimental results were compared with two-dimensional hydro-code simulations, which were post-processed with an X-ray spectrum analysis code. The experimental results for a focal condition d/R = - 4 (d is the distance between the focus point and the center of pellet with radius R) were well replicated when a velocity perturbation of 20 percent of the average is supplied for the mode number 6, whereas those for the d/R = -3 showed earlier appearance of the Ar line emissions than the simulations. These results are examined in terms of shell breaking due to the low-modal non-uniformity.

Author

X Ray Analysis; Implosions; Mechanical Drives; Spectrum Analysis; Two Dimensional Models; Temporal Distribution

19990068998 Hokkaido Univ., Faculty of Engineering, Sapporo, Japan

A Study of an Electron Gun Controlled with a Meshless Grid for a Linear Accelerator

Homma, A., Hokkaido Univ., Japan; Nakata, K., Hokkaido Univ., Japan; Sawamura, T., Hokkaido Univ., Japan; Narita, M., Hokkaido Univ., Japan; Bulletin of the Faculty of Engineering, Hokkaido University; May 1996; ISSN 0385-602X, No. 177, pp. 35-40; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An electron gun for a linear accelerator with a control grid of meshless electrode (meshless grid) is expected to overcome some disadvantages of beam quality using an ordinary mesh grid. A gun of this type was designed and its characteristics were numerically analyzed. The simulation program code Egn2 with a boundary setting routine POLYGON was used. The result indicated that the grid can control the beam launched from the cathode to the anode electrode. It also indicated the I(sub p) - V(sub p) and I(sub p) - V(sub p) characteristics which are different from an ordinary triode gun with a mesh-grid. The mutual conductance gm of 0.4 [mS], the maximum average current of 1.6 [A] and cut-off voltage -200[V] were obtained under a condition of 200[kV] acceleration voltage.

Author

Computerized Simulation; Electron Guns; Cathodes; Anodes; Electric Potential; Electrodes

19990068999 Hokkaido Univ., Faculty of Engineering, Sapporo, Japan

A Study of the Influence of a Wake-Field Generated by an Electron Beam Passing Through a Linac Beam Exit Window on Measurement of the Beam 2

Homma, A., Hokkaido Univ., Japan; Tanaka, H., Hokkaido Univ., Japan; Kitaichi, M., Hokkaido Univ., Japan; Sawamura, T., Hokkaido Univ., Japan; Narita, M., Hokkaido Univ., Japan; Okuda, S., Hokkaido Univ., Japan; Yamamoto, T., Hokkaido Univ., Japan; Suemine, S., Hokkaido Univ., Japan; Bulletin of the Faculty of Engineering, Hokkaido University; May 1996; ISSN 0385-602X, No. 177, pp. 25-34; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The influence of a wake-field on measurements of a beam waveform and a method for suppressing that influence were studied. Beam entrance holes of various dimensions were inserted in front of a pickup loop, whose function was to suppress the field generated by the beam passing through the entrance-hole end. The suppression was observed in experiments with a single-bunch electron beam at ISIR of Osaka University Linac. Numerical analysis with a beam cavity interaction code (BCI code) was also performed in order to corroborate the suppression in experiments. The main pulse caused by the electron bunch and the oscillating signal following the main pulse due to the residual wake-field was observed. The power-ratio of the former to the latter were compared with the calculation. There was fair agreement in several different hole geometries.

Author

Beam Interactions; Waveforms; Electron Bunching; Electron Beams; Wakes

19990069923 Boeing Defense and Space Group, Huntsville, AL USA

To the Die Smartly: Heavy Ion Testing of PEMs on COTS Boards Through the Plastic

Wert, J. L., Boeing Defense and Space Group, USA; Normand, E., Boeing Defense and Space Group, USA; Oberg, D. L., Boeing Defense and Space Group, USA; Stevens, L., Boeing Defense and Space Group, USA; Blumer, J., Boeing Defense and Space Group, USA; Fisher, E., Boeing Defense and Space Group, USA; Wode, G., Boeing Defense and Space Group, USA; 1999; 5p; In English; Nuclear and Space Radiation Effects, 12-16 Jul. 1999, Norfolk, VA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): NAS8-50000; No Copyright; Avail: Issuing Activity, Hardcopy

Seven commercial off the shelf (COTS) boards containing electronic devices (all in plastic packages, PEMS), under consideration for use in a spacecraft subsystem, were exposed to beams of very high energy ions at the National Superconducting Cyclotron

Laboratory (MSU). The ion energies were high enough that an entire board could be exposed in air, and it could still penetrate through the plastic and reach the silicon die. A total of about 300 runs were made, and for each, the LET of the ion entering the silicon die had to be determined, based on the thickness of the plastic lid and the thickness of overlaying materials (e.g., aluminum degraders). Single event latchup (SEL) and functional interrupt (SEFI) were determined during each run, the SEFI by means of simple programs being continuously written to and read from the boards to monitor functionality, while each part was being exposed to the heavy ions.
Author
Electronic Equipment; Heavy Ions; Latch-Up; Radiation Dosage

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OPTICS

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

19990064368 NASA Goddard Space Flight Center, Greenbelt, MD USA
Contamination Effects on EUV Optics *Final Report*
Tveekrem, J., NASA Goddard Space Flight Center, USA; June 1999; 40p; In English
Report No.(s): NASA/TP-1999-209264; M-926; NAS 1.60:209264; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During ground-based assembly and upon exposure to the space environment, optical surfaces accumulate both particles and molecular condensibles, inevitably resulting in degradation of optical instrument performance. Currently, this performance degradation (and the resulting end-of-life instrument performance) cannot be predicted with sufficient accuracy using existing software tools. Optical design codes exist to calculate instrument performance, but these codes generally assume uncontaminated optical surfaces. Contamination models exist which predict approximate end-of-life contamination levels, but the optical effects of these contamination levels can not be quantified without detailed information about the optical constants and scattering properties of the contaminant. The problem is particularly pronounced in the extreme ultraviolet (EUV, 300-1,200 A) and far (FUV, 1,200-2,000 A) regimes due to a lack of data and a lack of knowledge of the detailed physical and chemical processes involved. Yet it is in precisely these wavelength regimes that accurate predictions are most important, because EUV/FUV instruments are extremely sensitive to contamination.
Author
Contamination; Extreme Ultraviolet Radiation; Optical Properties; Physical Optics; Aerospace Environments; Design Analysis

19990064378 NASA Goddard Space Flight Center, Greenbelt, MD USA
Some Aspects on the Mechanical Analysis of Micro-Shutters
Fettig, Rainer K., Raytheon Co., USA; Kuhn, Jonathan L., NASA Goddard Space Flight Center, USA; Moseley, S. Harvey, NASA Goddard Space Flight Center, USA; Kutyrev, Alexander S., Raytheon Co., USA; Orloff, Jon, Maryland Univ., USA; Lu, Shude, Maryland Univ., USA; Jul. 02, 1999; In English; Micromachining and Microfabrication, 21 Sep. 1999, Santa Clara, CA, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy

An array of individually addressable micro-shutters is being designed for spectroscopic applications. Details of the design are presented in a companion paper. The mechanical design of a single shutter element has been completed. This design consists of a shutter blade suspended on a torsion beam manufactured out of single crystal silicon membranes. During operation the shutter blade will be rotated by 90 degrees out of the array plane. Thus, the stability and durability of the beams are crucial for the reliability of the devices. Structures were fabricated using focused ion beam milling in a FEI 620 dual beam machine, and subsequent testing was completed using the same platform. This allowed for short turn around times. We performed torsion and bending experiments to determine key characteristics of the membrane material. Results of measurements on prototype shutters were compared with the predictions of the numerical models. The data from these focused studies were used in conjunction with experiments and numerical models of shutter prototypes to optimize the design. In this work, we present the results of the material studies, and assess the mechanical performance of the resulting design.
Author
Mechanical Engineering; Microanalysis; Microelectromechanical Systems; Scanning Electron Microscopy; Milling Machines

19990064403 NASA Marshall Space Flight Center, Huntsville, AL USA
Affordable Precursor Flight Experiment for Ultra Lightweight Mirror Technologies
Guffin, Orville T., NASA Marshall Space Flight Center, USA; Ames, Gregory H., NASA Marshall Space Flight Center, USA;

1999; In English; Defense and Civil Space Programs, 29 Oct. 1998, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

As a follow-on to the spectacular success of the Hubble Space Telescope (HST), NASA is currently conducting pre-phase A studies of an even larger aperture telescope, called NGST (Next Generation Space Telescope), that will continue the phenomenal flow of astrophysical discoveries well into the next millennium. Because of the very large aperture required, current NGST concepts have been driven to elaborate schemes of foldable ultra thin and ultra light mirror segment systems that can be deployed on orbit. Due to the complexity of these optical systems, it is imperative that adequate demonstration experiments be flown to verify these new technology concepts before committing to the final design and implementation of the NGST. This paper presents a proposal for a very simple, inexpensive Hitchhiker flight experiment that will determine gravity release effects on very thin mirror segments made from current competitive materials. These experiments will provide the initial data that will be needed before more extensive demonstration flights of the NGST system can be flown.

Author

Hubble Space Telescope; Spaceborne Astronomy; Space Infrared Telescope Facility; Infrared Space Observatory (ISO); NASA Programs

19990064452 NASA Goddard Space Flight Center, Greenbelt, MD USA

Optical Design of the Developmental Cryogenic Active Telescope Testbed (DCATT)

Davila, Pam, NASA Goddard Space Flight Center, USA; Wilson, Mark, NASA Goddard Space Flight Center, USA; Young, Eric W., NASA Goddard Space Flight Center, USA; Lowman, Andrew E., Jet Propulsion Lab., California Inst. of Tech., USA; Redding, David C., Jet Propulsion Lab., California Inst. of Tech., USA; 1997; In English; Astronomical Telescopes and Instrumentation, 20-28 Mar. 1998, Kona, HI, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In the summer of 1996, three Study teams developed conceptual designs and mission architectures for the Next Generation Space Telescope (NGST). Each group highlighted areas of technology development that need to be further advanced to meet the goals of the NGST mission. The most important areas for future study included: deployable structures, lightweight optics, cryogenic optics and mechanisms, passive cooling, and on-orbit closed loop wavefront sensing and control. NASA and industry are currently planning to develop a series of ground testbeds and validation flights to demonstrate many of these technologies. The Deployed Cryogenic Active Telescope Testbed (DCATT) is a system level testbed to be developed at Goddard Space Flight Center in three phases over an extended period of time. This testbed will combine an actively controlled telescope with the hardware and software elements of a closed loop wavefront sensing and control system to achieve diffraction limited imaging at 2 microns. We will present an overview of the system level requirements, a discussion of the optical design, and results of performance analyses for the Phase 1 ambient concept for DCATT,

Author

Cryogenics; Active Control; Telescopes; Ground Truth; Optical Equipment; Design Analysis

19990064510 Department of the Navy, Washington, DC USA

Assembly and Method for Furcating Optical Fibers

Brown, xcGair D., Inventor; Jeleniewski, Yancy T., Inventor; Throm, Robert A., Inventor; May 14, 1999; 16p; In English

Patent Info.: Filed 14 May 99,; US-Patent-Appl-SN-311,900

Report No.(s): AD-D019350; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

An assembly that includes a fiber-containing structure that contains a plurality of optical fibers and a furcation tube assembly that includes a plurality of loose tube optical fiber cables is discussed. Each of the loose tube optical fiber cables includes a hollow inner tube; a support structure that includes strength members, the support structure surrounding the hollow inner tube; and, a protective jacket surrounding the support structure. The assembly further includes a heat shrink tube that joins the fiber-containing structure and the furcation tube assembly and a protective tube surrounded by the heat shrink tube and disposed in surrounding relationship to the furcation tube assembly. The support structure extends in a first direction between an outer surface of the fiber-containing structure and an inner surface of the protective tube proximate a first end of the protective tube.

DTIC

Optical Fibers; Fiber Optics; Transmission Lines

19990064517 Department of the Navy, Washington, DC USA

High Resolution Imaging Using Optically Transparent Phosphors

Huston, Alan L., Inventor; Justus, Brian L., Inventor; Apr. 01, 1999; 16p; In English

Patent Info.: Filed 1 Apr. 1999; US-Patent-Appl-SN-09,310,681

Report No.(s): AD-D019359; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

Images are formed by exposing optically transparent, optically stimulable luminescent glasses including luminescent centers and trapping centers, to patterned, ionizing radiation. The images may be read immediately, using scintillation, or may be stored in the glasses for subsequent reading using optically stimulated detrapping of stored charges.

DTIC

Phosphors; Images; Imaging Techniques; Image Resolution

19990064578 Department of the Navy, Washington, DC USA

Fiber Optic Cable Furcation Unit

Brown, Gair D., Inventor; Apr. 06, 1999; 12p; In English

Patent Info.: Filed 6 Apr. 1999; US-Patent-Appl-SN-09/286-844

Report No.(s): AD-D019345; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A low cost rugged sealed fiber optic cable furcation unit is provided. The furcation unit has an outer heat shrink tube which encloses a protective tube. Within the protective tube, a spacer/fiber guide is located along with a sealant material. When installed and sealed, the sealed furcation unit includes fiber ends and cables. The furcation unit allows loose tube fiber optic cables or tube ducts within Air Blown Fiber (ABF) cables to be furcated into multiple single fiber cables. The furcation unit is compatible with both 250 micrometer and 500 micrometer coated optical fibers. The furcation unit is also compatible with common single fiber optical connectors and splices.

DTIC

Optical Fibers; Fiber Optics; Transmission Lines; Electronic Equipment

19990066661 NASA Marshall Space Flight Center, Huntsville, AL USA

Electroformed Nickel Mirrors for the Next Generation Space Telescope

Redmon, John W., NASA Marshall Space Flight Center, USA; Engelhaupt, Darrel, Alabama Univ., USA; 1998; In English; 43rd; Optical Science, Engineering and Instrumentation Advanced Materials for Optics and Precision Structures, 19-24 Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

This paper summarizes the work to date on a novel mirror fabrication technique being developed at the Marshall Space Flight Center for potential use on the Next Generation Space Telescope (NGST). This technique involves forming an extremely lightweight mirror by electroplating nickel and nickel based alloys onto a highly polished precision mandrel. The resulting mirror shell can then be backed up with or attached to a lightweight structure to produce a mirror element that is on the order of 15 kg/sq m areal density. Since the mirrors are fabricated from a mandrel (or master), subsequent mirrors can be made with very high economy; this technique is particularly suited to segmented mirrors schemes whereby large apertures are achieved through the deployment of smaller segments. Control of the electroplating process is the key element for producing high quality optics; bath chemistry and real time control of the plating current density yields uniform grained electroforms with zero residual stress. To accomplish this, a special electronic sensor was developed whereby the residual stress can be monitored as the nickel is electrolytically deposited. This information is used in a feedback loop to modulate current density which, in turn, directly governs the residual stress. Details pertaining to this and other aspects of the fabrication of a half meter mirror will be published along with test results and metrology data.

Author

Electroforming; Mirrors; Nickel; Technology Assessment; Fabrication; Electroplating; Segmented Mirrors

19990067230 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan

Spatial Coherency of the Synchrotron Radiation at the Visible Light Region and its Application for the Electron Beam Profile Measurement

Mitsuhashi, Toshiyuki, High Energy Accelerator Research Organization, Japan; June 1997; 6p; In English

Report No.(s): KEK-Preprint-97-56; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A spatial coherence of SR beam at visible light region were measured both a and pi-polarized components at Photon Factory. A wave-front division type polarized interferometer was designed and constructed for this experiment. Interferograms were observed clearly in the vertical direction, pi phase difference of the interference fringe was observed between interferograms corresponding to sigma and pi-polarized components. Degree of spatial coherence was measured and by means of the van Citterut-Zernike's theorem, a vertical beam profile was obtained by the Fourier transform of the degree of spatial coherence.

Author

Synchrotron Radiation; Electron Beams; Radiation Counters; Coherent Scattering

19990067231 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan

Beam Profile Monitoring of Synchrotron Radiation by Adaptive Optics

Takeuchi, N., Tsukuba Univ., Japan; Mitsuhashi, T., High Energy Accelerator Research Organization, Japan; Itoh, M., Tsukuba Univ., Japan; Yatagai, T., Tsukuba Univ., Japan; June 1997; 5p; In English; 1997 Non-Astronomical Adaptive Optic, 15-17 Jun. 1997, Munich, Germany

Report No.(s): KEK-Preprint-97-54; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A beam profile monitor system for the synchrotron radiation was designed to evaluate distribution of cross section of the electron in high energy accelerator storage ring. The Shack-Hartmann wavefront sensor was designed and constructed for a measurement of wavefront error caused by a deformation of an extraction beryllium mirror for the visible synchrotron radiation. An adaptive optical system was designed for this monitor to correct wavefront distortion.

Author

Beamforming; Monitors; Synchrotron Radiation; Adaptive Optics; Design Analysis; Error Analysis

19990067247 D-STAR Technologies, Inc., Manhattan Beach, CA USA

Fabrication of Ultrastrong Fiber Bragg Gratings Through the Polymer Coating ***Final Report, 1 Aug. 1998 - 28 Feb. 1999***

Feinberg, J.; Starodubov, D. S.; Grubsky, V.; Feb. 28, 1999; 19p; In English

Contract(s)/Grant(s): F49620-98-C-0076

Report No.(s): AD-A364900; AFRL-SR-BL-TR-99-0164; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

D-STAR Technologies, Inc. has developed a technique for writing gratings through the polymer coating of commercially available optical fibers. In this Phase I project we discovered how to make our gratings thermally stable without destroying their polymer coating. This last discovery is an exciting breakthrough, for without it D-STAR's gratings would not have been commercially attractive. D-STAR now has the ability to both write and anneal gratings without removing their polymer coating. D-STAR's near-UV grating fabrication technique is a practical and inexpensive alternative for producing fiber gratings for diode laser stabilization, sensors and filters. We demonstrated that the concentration of germanium oxygen-deficient centers in the fiber core correlates well with the photosensitivity of fibers, and this concentration can vary by a factor of approx. 2 in supposedly identical fibers according to the detailed fiber preparation conditions. We showed that tin-doped fibers may prove useful for extending the response of hydrogen-loaded fibers into the near UV and visible. A plastic phase mask with a polymer film is feasible for fabrication of Bragg gratings using near UV light, but the absorption of the polymer film must be decreased to prevent its thermal damage.

DTIC

Bragg Gratings; Fiber Lasers; Optical Fibers; Coating; Polymeric Films; Ultraviolet Radiation; High Strength

19990067833 NASA Goddard Space Flight Center, Greenbelt, MD USA

Broadband Infrared Antireflection Structured Silicon Surfaces

Stewart, Kenneth, NASA Goddard Space Flight Center, USA; Fettig, Rainer, NASA Goddard Space Flight Center, USA; Allen, Christine, NASA Goddard Space Flight Center, USA; Fettig, Rainer, Raytheon Co., USA; Larocque, Jennifer, Saint Michael's Coll., USA; 1999; 1p; In English, 20-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Silicon and germanium are materials often used for IR windows and optical elements. However they have a very high index of refraction, in the order of three to four, which causes large reflection losses on each surface. These losses are especially high under large angles of incidence which are often desirable if signals are faint and fast optics are to be used. Solid antireflection coatings are either not available because materials with appropriate index of refraction do not exist, or their use is limited to a small wavelength range and small angles of incidence. We will present the status of our work to calculate, create, and test the performance of graded structures in Si to reduce its surface reflection. The structures are expected to work over the very broad wavelength range of 10 microns to 1000 microns and a wide range of angle of incidence. We have identified several high aspect ratio MEMS process techniques to create the structures and have done 3D electromagnetic modeling, which predicts significant effects. Measurements on different samples have validated our modeling.

Author

Antireflection Coatings; Broadband; Refractivity; Silicon

19990068003 NASA Marshall Space Flight Center, Huntsville, AL USA

Electrically-Tunable Group Delays Using Quantum Wells in a Distributed Bragg Reflector

Nelson, Thomas R., Jr., Air Force Research Lab., USA; Loehr, John P., Air Force Research Lab., USA; Fork, Richard L., Alabama Univ., USA; Cole, Spencer, Alabama Univ., USA; Jones, Darryl K., Alabama Univ., USA; Keys, Andrew, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; AeroSense 1999, 4-9 Apr. 1999, Orlando, FL, USA

Contract(s)/Grant(s): RTOP 632-20-28; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

There is a growing interest in the fabrication of semiconductor optical group delay lines for the development of phased arrays of Vertical-Cavity Surface-Emitting Lasers (VCSELs). We present a novel structure incorporating In(x)GA(1-x)As quantum wells in the GaAs quarter-wave layers of a GaAs/AlAs distributed Bragg reflector (DBR). Application of an electric field across the quantum wells leads to red shifting and peak broadening of the el-hhl exciton peak via the quantum-confined Stark effect. Resultant changes in the index of refraction thereby provide a means for altering the group delay of an incident laser pulse. We discuss the tradeoffs between the maximum amount of change in group delay versus absorption losses for such a device. We also compare a simple theoretical model to experimental results, and discuss both angle and position tuning of the BDR band edge resonance relative to the exciton absorption peak. The advantages of such monolithically grown devices for phased-array VCSEL applications will be detailed.

Author

Beamforming; Bragg Reflectors; Delay Circuits; Pulsed Lasers; Quantum Wells; Surface Emitting Lasers

19990068997 Hokkaido Univ., Faculty of Engineering, Sapporo, Japan

Beam Scanning BulkQuasi-Phase-Matching Second Harmonic Generation Modulators Using Pockels Effect

Koyanagi, Kojiro, Hokkaido Univ., Japan; Bulletin of the Faculty of Engineering, Hokkaido University; May 1996; ISSN 0385-602X, No. 177, pp. 41-49; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Three basic modulators of bulk LiNbO3 quasi-phase-matching second-harmonic-generation (QPM-SHG) using Pockels effect are analyzed theoretically. Beam scanning QPM-SHG modulators with asymmetric distribution of refractive index which can be obtained by introducing asymmetry in the spatial distribution of applied electric fields are proposed. It is shown that the deflection angle of the second harmonic beam increases as the gradient of the applied electric field increases. The results derived in this paper are useful for many applications in optical information processing.

Author

Phase Matching; Lithium Niobates; Harmonic Generations; Electric Fields; Electron Beams

19990069590 Nippon Telegraph and Telephone Public Corp., Tokyo, Japan

SC-Type Fixed Optical Attenuator Using Metal-Ion Doped Optical Fiber

Takeuchi, Yoshiaki, Nippon Telegraph and Telephone Public Corp., Japan; Nagase, Ryo, Nippon Telegraph and Telephone Public Corp., Japan; Mitachi, Seiko, Nippon Telegraph and Telephone Public Corp., Japan; NTT Review; Mar. 1997; ISSN 0915-2334; Volume 9, No. 2, pp. 78-83; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Seven kinds of SC-type fixed optical attenuators ranging from 3 to 30 dB have been successfully developed using Co(2+)-ion doped optical fiber. They have high input power endurance. The main wavelength dependence in attenuation have been reduced by controlling the Co(2+)-ion doped area in the fiber core. The fluctuation in attenuation with wavelength and PDL degradation caused by the mode coupling were effectively suppressed in highly attenuative attenuators by using GeO2-doped absorption fibers in the outer part of the cladding. The simple structure allows us to produce these fixed optical attenuators at a lower cost than conventional ones.

Author

Attenuators; Optical Fibers; Ion Optics; Metal Ions; Fabrication

19990069595 International Society for Optical Engineering, Bellingham, WA USA

Laser Optics 1998: Fundamental Problems of Laser Optics, Volume 3685

Rosanov, Nikolay N., Editor; Jun. 26, 1998; 215p; In English, 22-26 Jun. 1998, Saint Petersburg, Russia

Contract(s)/Grant(s): F61775-98-W-E027

Report No.(s): AD-A365220; EOARD-CSP-1028-1; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

The purpose of the symposium was to bring together scientists and engineers in optics and lasers in order to report the most recent results and to simulate new disciplinary activity. One of highlights of the symposium this year was a series of papers on such topics as Laser Dynamics, optical patterns and second order nonlinear interactions. Quantum optics issues were additionally covered and highlighted as a critical area requiring further investigation. The large number of papers presented focused on quantum nucleonics.

DTIC

Conferences; Laser Applications; Laser Outputs

19990069596 International Society for Optical Engineering, Bellingham, WA USA
Laser Optics 1998: Superstrong Laser Fields and Applications, Volume 3683
Andreev, Alexander A., Editor; Jun. 26, 1998; 242p; In English, 22-26 Jun. 1998, Saint Petersburg, Russia
Contract(s)/Grant(s): F61775-98-W-E027
Report No.(s): AD-A365218; EOARD-CSP-98-1028; No Copyright; Avail: CASI; A03, Microfiche; A11, Hardcopy

The purpose of the symposium was to bring together scientists and engineers in optics and lasers in order to report the most recent results and to simulate new disciplinary activity. One of highlights of the symposium this year was a series of papers on such topics as superstrong laser fields and applications and lasers for fusion. The symposia also reflected the large amount of work that has been focused on devices for ultrafast optics.
DTIC
Conferences; Laser Outputs; Optical Equipment

19990069952 NASA Marshall Space Flight Center, Huntsville, AL USA
Imaging Polarimetry of Six X-Ray Selected Blazars
Ghosh, K. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Austin, R. A., NASA Marshall Space Flight Center, USA; Soundararajaperumal, S., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Results of broad band V-filter linear optical polarization measurements of six X-ray selected B L Lac objects (XBLs) are presented. Four of these B L Lac objects (MS0737.9+7441, MS0950.9+4929, MS1458.8+2249 and MS 1534.2+0148) had not been measured before in this band. We have detected strong optical polarization in three B L Lac objects. Analysis of radio through X-ray spectra of these sources confirms that these objects are indeed XBLS. We have also detected several new polarized sources in the fields of these B L Lacs.
Author
Polarimetry; Imaging Techniques; X Rays; Optical Polarization; Linear Polarization; BL Lacertae Objects

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990064349 Princeton Univ., Plasma Physics Lab., NJ USA
Direct calculation of current drive in toroidal geometry
Wright, J. C.; Phillips, C. K.; Bonoli, P. T.; Dec. 31, 1998; 4p; In English
Report No.(s): DE97-050247; PPPL-3208; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The magnitude and radial profiles of noninductive currents driven by fast magnetosonic waves in tokamaks have been calculated directly from the wave- induced quasilinear flux in a toroidal geometry and a Green's function for the current. An expression for the quasilinear flux has been derived which accounts for coupling between modes in the spectrum of waves launched from the antenna. A Fokker-Planck code for the Green's function and a full wave code for the electric field in the quasilinear flux are used to evaluate the current in a specified toroidal geometry.
NTIS
Direct Current; Plasma Physics

19990064353 Sandia National Labs., Albuquerque, NM USA
Z-Pinch Driven Isentropic Compression for Inertial Fusion
Asay, J. R.; Hall, C. A.; Holland, K. G.; Slutz, S. A.; Spielman, R. B.; Feb. 01, 1999; 41p; In English
Report No.(s): DE00-003322; SAND98-2269; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The achievement of high gain with inertial fusion requires the compression of hydrogen isotopes to high density and temperatures. High densities can be achieved most efficiently by isentropic compression. This requires relatively slow pressure pulses on the order of 10-20 nanoseconds; however, the pressure profile must have the appropriate time. We present 1-D numerical simulations that indicate such a pressure profile can be generated by using pulsed power driven z pinches. Although high compression is calculated, the initial temperature is too low for ignition. Ignition could be achieved by heating a small portion of this compressed fuel with a short (-10 ps) high power laser pulse as previously described. Our 1-D calculations indicate that the existing Z-accelerator could provide the driving current (-20 MA) necessary to compress fuel to roughly 1500 times solid density. At this

density the required laser energy is approximately 10 kJ. Multidimensional effects such as the Rayleigh- Taylor were not addressed in this brief numerical study. These effects will undoubtedly lower fuel compression for a given chive current. Therefore it is necessary to perform z-pinch driven compression experiments. Finally, we present preliminary experimental data from the Z-accelerator indicating that current can be efficiently delivered to appropriately small loads (- 5 mm radius) and that VISAR can be used measure high pressure during isentropic compression.
NTIS
Zeta Pinch; Inertial Fusion (Reactor); Magnetohydrodynamic Stability; Isentrope; Plasma Physics

19990064402 NASA Marshall Space Flight Center, Huntsville, AL USA
Current Collection in Plasmas by a Static Bare Tether
Zhang, T. X., Alabama Univ., USA; Hwang, K. S., NASA Marshall Space Flight Center, USA; Wu, S. T., Alabama Univ., USA; Stone, N. H., NASA Marshall Space Flight Center, USA; Sorenson, J., NASA Marshall Space Flight Center, USA; Wright, K. H., NASA Marshall Space Flight Center, USA; 1997; In English, Dec. 1997, San Francisco, CA, USA; Sponsored by American Geophysical Union; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Current collection in plasmas by a static bare tether is studied. Considering the geometry effect, we modify the static Parker-Murphy current collection model to accommodate a cylindrical probe. It is shown that a long cylindrical configuration (length is much greater than diameter) can collect more current than the spherical configuration whose effective surface area and surface potential are identical. However, when the cylinder is not long (length and diameter are same order), it collects less current than the effective sphere. This indicates that Myers et al. might over estimate the PM current when they neglected the geometry effect. Compared to the orbit limit model and the chamber experiment, our predictions are in the range of the adiabatic limits and the upper-bound currents obtained by Rubinstein and Laframboise. It shows that the present results are in agreement with the bare tether chamber test experimental data given by Sorenson, Stone, and Wright. In addition we have applied this model to study the IR drop and the orientation effects which are important in the space condition.
Author
Plasmas (Physics); Tethering; Electric Current

19990064523 Alabama Univ., Huntsville, AL USA
A Laboratory Study of the Charging/Discharging Mechanisms of a Dust Particle Exposed to an Electron Beam
Venturini, C.C., Alabama Univ., USA; Spann, J. F., Alabama Univ., USA; Comfort, R. H., Alabama Univ., USA; 1999; 1p; In English; Interrelation Between Plasma Experiments in Laboratory and Space, 11 Aug. 1999, Kreuth, Germany; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The interaction of micron sized particles or ”dust particles” with different space and planetary environments has become an important area of research. One particular area of interest is how dust particles interact with plasmas. Studies have shown that charged dust particles immersed in plasmas can alter plasma characteristics, while ions and electrons in plasmas can affect a particle’s potential and thereby, its interaction with other particles. The basis for understanding these phenomena is the charging mechanisms of the dust particle, specifically, how the particle’s charge and characteristics are affected when exposed to ions and electrons. For example, when electrons collide with a dust particle, secondary electrons can be produced from the surface of a particle and can affect the surrounding plasma.
Author
Laboratories; Research; Charged Particles; Dust; Electron Beams; Beam Interactions

19990067626 NASA Marshall Space Flight Center, Huntsville, AL USA
Ponderomotive Force and Lower Hybrid Turbulence Effects in Space Plasmas Subjected to Large-Amplitude Low-Frequency Waves
Khazanov, G. V., Alabama Univ., USA; Khazanov, George, NASA Marshall Space Flight Center, USA; Liemohn, M. W., NASA Marshall Space Flight Center, USA; Stone, N. H., NASA Marshall Space Flight Center, USA; Coffey, V. N., NASA Marshall Space Flight Center, USA; [1997]; In English; Sponsored by American Geophysical Union; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In the auroral region, simultaneous occurrences of upward-flowing ions and field-aligned electrons have been observed by the Viking satellite. The occurrence is strongly correlated with large amplitude low frequency fluctuations of the electric field. Large-amplitude shear Alfven waves have also been observed by sounding rockets in the auroral ionosphere. When such LF waves are propagating in a plasma, a ponderomotive force and other types of waves are produced which may lead to significant effects on the plasma. This force is directed toward decreasing density, providing the electromagnetic lift of the background plasma and an increase of collisionless plasma expansion. We find that even for modest wave strengths, the influence on the outflowing oxy-

gen ions can be dramatic, increasing the high-altitude density by orders of magnitude. It is also demonstrated that large-amplitude low-frequency waves (LFW) may generate lower hybrid waves (LHW) in the auroral zone. The excitation of LHW by a LF wave may lead to the appearance of an additional channel of energy transfer from, for example, Alfven or fast magnetosonic waves, to particles. This process then influences the formation of the plasma distribution function at the expense of acceleration in the tail of the distribution during the collapse of the LHW. The ion energization due to the LHW can be comparable with that produced by the ponderomotive force of the LFW. It is shown that the LH turbulence leads to equalization of the ponderomotive acceleration of the different ion species. The mechanism of LHW excitation due to the oxygen ion relative drift in a plasma subjected to low-frequency waves is used for analysis of Viking satellite data for events in the cusp/cleft region. It is found that, in some cases, such a mechanism leads to LHW energy densities and ion distribution functions close to those observed.
Author
Magnetohydrodynamic Waves; Plasma Waves; Polar Regions; Ponderomotive Forces; Space Plasmas; Turbulence Effects; Wave-Particle Interactions

19990067629 NASA Marshall Space Flight Center, Huntsville, AL USA
Magnetospheric Plasmas: A Direct Measurement of the Ionospheric Source
Giles, B. L., NASA Marshall Space Flight Center, USA; Chappell, C. R., NASA Marshall Space Flight Center, USA; Delcourt, D. C., Centre d'Etudes Terrestraire et Planetaire, France; Moore, T. E., NASA Goddard Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Craven, P. D., NASA Marshall Space Flight Center, USA; 1997; In English, 8-12 Dec. 1997, San Francisco, CA, USA; Sponsored by American Geophysical Union; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In a paper of more than a decade ago, the estimated the strength of the ionospheric source and its ability to supply the different plasma regions of the Earth's magnetosphere was reported. The launch of the POLAR spacecraft with the Thermal Ion Dynamics Experiment (TIDE) and the active control of spacecraft potential made possible for the first time the direct measurement of low energy ions moving from the ionosphere into the lobes of the magnetotail. This paper presents data taken during the period of operation of the Plasma Source Instrument (PSI) which maintains the spacecraft potential at about 1.8V positive with respect to the ambient plasma. These data give an in-situ observation of the strength and flow direction of the ionospheric plasmas as it moves outward into the lobes of the tail. A particle trajectory model has been used to trace particles back to the location of the ionospheric source and forward to the entry point of the ions to the plasma sheet. A comparison of measured data with the predictions of the earlier modeling effort will be discussed.
Author
Earth Magnetosphere; Ions; Earth Ionosphere; Geomagnetic Tail; Plasmapause; Geomagnetism

19990068043 NASA Marshall Space Flight Center, Huntsville, AL USA
Global Kinetic Modeling of Banded Electron Structures in the Plasmasphere
Liemohn, M. W., NASA Marshall Space Flight Center, USA; Khazanov, G. V., Alabama Univ., USA; [1997]; In English, 8-12 Dec. 1997, San Francisco, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Significant fluxes of 10 eV to 30 keV electrons have been detected in the plasmasphere, appearing as banded structures in energy with broad spatial extents and slowly evolving over several days. It is thought that these populations are decaying plasma sheet electrons injected into the corotating region of near-Earth space. This capture can occur when the convective electric field drops rapidly and the Alfven boundary suddenly outward, trapping the inner edge of the plasma sheet along closed drift paths. Our bounce-averaged kinetic model of superthermal electron transport is able to simulate this capture and the subsequent drift, diffusion, and decay of the plasma cloud. Results of this simulation will be shown and discussed, from the initial injection during the elevated convection to the final loss of the particles. It is thought that not only Coulomb collisions but also wave-particle interactions play a significant role in altering the plasma cloud. Quasilinear diffusion is currently being incorporated into the model and the importance of this mechanism will be examined. Also, the high anisotropy of the trapped population could be unstable and generate plasma waves. These and other processes will be investigated to determine the final fate of the cloud and to quantify where, how, and when the energy of the plasma cloud is deposited. Comparisons with CRRES observations of these events are shown to verify the model and explain the data.
Author
Electrons; Magnetohydrodynamic Waves; Plasmasphere; Simulation; Wave-Particle Interactions; Dynamic Models

19990068991 Osaka Univ., Dept. of Electrical Engineering, Osaka, Japan
Combined Process of PH3 and N2 Plasmas for GaAs Surface Treatment
Nozu, Satoshi, Osaka Univ., Japan; Sugino, Takashi, Osaka Univ., Japan; Technology Reports of the Osaka University; Oct. 15,

1998; ISSN 0030-6177; Volume 48, No. 2325, pp. 209-217; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

GaAs is treated with PH3 and N2 plasmas. Electron traps induced by these plasma treatments are investigated by isothermal capacitance transient spectroscopy. The EL2 trap (E(sub c)-0.86eV) is detected in the as-grown GaAs. On the other hand, electron traps induced in phosphidized and nitridated GaAs are designated as the T(sub P1) trap (E(sub c)-0.26eV) and the T(sub N1) trap (E(sub c)-0.66eV), respectively. It is found that the Tp, trap is changed to another trap with an energy level as shallow as 0. 16eV below the conduction band edge and a capture cross section as small as 1.8 x 10(exp 21)sq cm by treating with N2 plasma subsequently after PH3 plasma treatment.

Author

Nitrogen; Phosphines; Surface Treatment; Gallium Arsenides; Plasmas (Physics)

19990069001 Hokkaido Univ., Faculty of Engineering, Sapporo, Japan

Evaluation of Plasma Surface Interaction of Boron Film Used as Plasma First Wall: Oxygen Gettering Properties and Hydrogen Retention Properties

Mochizuki, Takahiro, Hokkaido Univ., Japan; Hirohata, Yuko, Hokkaido Univ., Japan; Hino, Tomoaki, Hokkaido Univ., Japan; Yamashina, Toshiro, Hokkaido Univ., Japan; Tsuzuki, Kazuhiro, Hokkaido Univ., Japan; Natsir, Muhamad, Hokkaido Univ., Japan; Inoue, Noriyuki, Hokkaido Univ., Japan; Sagara, Akio, Hokkaido Univ., Japan; Noda, Nobuaki, Hokkaido Univ., Japan; Motojima, Osamu, Hokkaido Univ., Japan; Sogabe, Toshiaki, Hokkaido Univ., Japan; Kuroda, Koji, Hokkaido Univ., Japan; Bulletin of the Faculty of Engineering, Hokkaido University; May 1996; ISSN 0385-602X, No. 177, pp. 1-10; In Japanese; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Boron films are coated on plasma facing material of nuclear fusion device as the getterings of oxygen. On the other hand, hydrogen will be retained into the boron film during the plasma discharge. If this hydrogen is emitted into the plasma, it shall be a cause of plasma energy loss. In this study, we deposited the boron films on a liner made by stainless steel or graphite by using plasma CVD of the mixture gas of diborane (B2H6) and hydrogen (H2). We investigated the properties of oxygen gettering and hydrogen retention of the boron films when the oxygen or hydrogen is discharged by using the liner as the cathode. The oxygen gettering amount of the boron film on the graphite liner was two times larger than that of the boron film on stainless steel. The depth of oxygen gettered in boron film was from 50 to 100 nm. The oxygen were chemically bonded to the boron. The oxygen gettering of the boron film was refleshed by helium glow discharge. The amount of retained hydrogen into the boron film was almost the same to that of the graphite. The hydrogen retained into the film and the graphite were nearly desorbed during heating up to 500 C.

Author

Plasma Heating; Boron; Nuclear Fusion; Surface Reactions; Oxygen Plasma; Energy Transfer; Hydrogen

19990069932 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

Angular Broadening: Effects of Nonzero, Spatially Varying Plasma Frequency Between the Source and Observer

Cairns, Iver H., Iowa Univ., USA; The Astrophysical Journal; Oct. 10, 1998; Volume 506, pp. 456-463; In English

Contract(s)/Grant(s): NAGw-3461; Copyright; Avail: Issuing Activity, Hardcopy

Angular broadening of radiation due to scattering by density irregularities is usually described using geometric optics (GO) or the parabolic wave equation (PWE) with the assumptions that the radiation frequency f greatly exceeds the local plasma frequency f(sub p0) or that f(sub p0)/f is constant along the path. These assumptions are inappropriate for many solar system radio phenomena. Here the PWE and GO formalisms are extended to treat angular broadening in plasmas with nonzero, spatially varying ratios, f(sub p0)(z)/f is less than 1. The new PWE results show that the correlation function, scattered angular spectrum, and other quantities are modified by inclusion of a denominator factor [1 - f(sup 2, sub p0)(z prime)/f prime] inside the path integral over z prime, while the mean-square scattering angle theta(sup2) depends on both f(sub p0)(z)/f at the observer and the foregoing factor inside the path integral. The PWE and GO predictions for theta(sup2) are identical and involve equivalent assumptions. Previous GO and PWE results are recovered in the limits that f(sub p0)(z prime)/f is constant or zero. The new PWE and GO results will permit more accurate calculation of angular broadening for solar system and astrophysical sources. Moreover and importantly, due to the PWE and GO results for theta(sub2) being identical, previous GO analyses of theta(sub2) in solar system contexts are essentially correct, except for the neglect of or minor deficiencies in the treatment of nonzero, spatially varying f(sub p0)/f effects. The identical GO and PWE results for theta(sub2) and the form of the PWE equation for the correlation function raise questions as to whether diffraction is unimportant for angular broadening (under the usual PWE conditions). Future direct comparisons of the PWE predictions with angular spectra calculated using existing GO ray-tracing codes should answer these questions.

Diffraction effects are probably important when the medium and turbulence are not sufficiently homogeneous transverse to the central ray path. The implications are also discussed for studies of the 2-3.5 kHz radiation observed in the outer heliosphere.
Author
Plasma Frequencies; Plasmas (Physics); Scattering; Solar System; Solar Wind; Solar Radio Emission; Irregularities

19990069936 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Measurement of the Plasma Density Using the Intensification of z-Mode Waves at the Electron Plasma Frequency
Cairns, Iver H., Iowa Univ., USA; Physical Review Letters; Jan. 18, 1999; ISSN 0031-9007; Volume 82, No. 3, pp. 564-567; In English; Original contains color illustrations
Contract(s)/Grant(s): NAGw-5051; Copyright; Avail: Issuing Activity, Hardcopy

A new method is proposed for measuring the number density of a plasma using spectral measurements of plasma wave. The method is based on predictions that the ratio electric to magnetic fields and the electric intensity is significantly enhanced in a narrow frequency band without the electron plasma frequency for z-mode waves propagating at small angles to the back-ground magnetic field in cold relatively strongly magnetized plasmas. The method is applied to emissions observed in space over Earth's polar cap, allowing identification of the plasma frequency and the mode consistent with the data available. This method should be useful for other cold, strongly magnetized plasmas in space and in the laboratory.
Author
Plasma Density; Plasmas (Physics); Electron Plasma; Plasma Frequencies; Plasma Waves

19990070325 NASA Marshall Space Flight Center, Huntsville, AL USA
Preliminary Results from a Laboratory Study of Charging Mechanisms in a Dusty Plasma
Venturini, Catherine C., Alabama Univ., USA; Spann, James F., NASA Marshall Space Flight Center, USA; Comfort, Richard H., Alabama Univ., USA; [1999]; 1p; In English, 8 Apr. 1999, Auburn, AL, USA; Sponsored by Auburn Univ., USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

A laboratory investigation has been developed to experimentally study the interaction of micron sized particles with plasmas and electromagnetic radiation. The intent is to investigate under what conditions particles of various compositions and sizes become charged, or discharged, while exposed to an electron beam and ultraviolet radiation. Primary emphasis is on two charging mechanisms: secondary emission of electrons and the photoelectric effect. Preliminary results are presented.
Author
Plasmas (Physics); Dust; Electromagnetic Radiation; Plasma Physics

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SOLID-STATE PHYSICS

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

19990064352 Sandia National Labs., Albuquerque, NM USA
Band Gap of AlGaN Alloys; Applied Physics Letters
Biefeld, R. M.; Crawford, M. H.; Han, J.; Lee, S. R.; Petersen, G. A.; Jan. 29, 1999; 41p; In English
Report No.(s): DE00-003336; SAND99-0274J; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The band gap of AlXGal.XN is measured for the composition range 0s<0.45; the resulting bowing parameter, b = +O.69 eV, is compared to 20 previous works. A correlation is found between the measured band gaps and the methods used for epitaxial growth of the AlXGal-XN: directly nucleated or buffered growths of AlXGal-XN initiated at temperatures T>800 C on sapphire usually lead to stronger apparent bowing (b> +1.3 eV); while growths initiated using low-temperature buffers on sapphire, followed by high-temperature growth, lead to weaker bowing (b<+ 1.3 eV). Extant data suggests that the correct band-gap bowing parameter for AlXGal-XN is b = +O.62 (N.45) eV.
NTIS
Gallium Nitrides; Energy Gaps (Solid State); Aluminum Nitrides

19990064354 Sandia National Labs., Albuquerque, NM USA
Dynamics of Wet Oxidation of High-AL-Content III-V Materials
Ashby, C. I. H.; Jan. 27, 1999; 41p; In English, 30 Nov. - 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-003306; SAND99-0230C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Oxidation of layers of high-Al-content III-V materials by water vapor has become the enabling process for high-efficiency vertical cavity surface emitting lasers (VCSELS) and has potential applications for reducing substrate current leakage in GaAs-on-insulator (GOI) MESFETS. Because of the established importance of wet oxidation in optoelectronic devices and its potential applications in electronic devices, it has become increasingly important to understand the mechanism of wet oxidation and how it might be expected to affect both the fabrication and subsequent operation of devices that have been made using this technique. The mechanism of wet oxidation and the consequence of this mechanism for heterostructure design and ultimate device operation are discussed here.
NTIS
Oxidation; Water Vapor; Aluminum

19990064387 Sandia National Labs., Albuquerque, NM USA
Minimum Surface Formation Energy for Three-Dimensional Intergranular Fracture
Holm, E. A.; McGovney, G. N.; Jan. 20, 1999; 41p; In English, 4 Dec. 1998, Boston, MA, USA; Sponsored by Materials Research Society, USA
Report No.(s): DE00-003290; SAND99-0175C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The minimum expended energy for fracture is the free energy required to form two new surfaces. For intergranular fracture, the minimum surface formation energy is complicated by the rough fracture surface, with area greater than the specimen cross-section. We utilize network optimization algorithms (max-flow/min-cut) to determine the minimum surface formation energies and surfaces for intergranular fracture in 3D polycrystals. For equiaxed grains and uniform boundary strength, the minimum energy fracture area is independent of grain size and is 45% larger than the specimen cross-section, and intergranular fracture will occur when surface energy is less than 1.6 times the grain boundary energy. The 3D fracture area is larger than projected from 2D systems. In systems with microcracked boundaries, the fracture surface deviates to preferentially include microcracked boundaries, creating interlocking grain configurations. Two-dimensional percolation of microcracks occurs at about 80% microcracked boundaries.
NTIS
Surface Energy; Fracturing; Free Energy

19990064502 NASA Marshall Space Flight Center, Huntsville, AL USA
Modeling Studies of PVT Growth of ZnSe: Current Status and Future Course
Ramachandran, N., Universities Space Research Association, USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; [1999]; 1p; In English
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Bulk growth of wide band gap II-VI semiconductors by physical vapor transport (PVT) has been developed and refined over the past several years at NASA Marshall Space Flight Center. Results from a modeling study of PVT crystal growth of ZnSe are reported in this paper. The PVT process is numerically investigated using a two-dimensional formulation of the governing equations and associated boundary conditions. Both the incompressible Boussinesq approximation and a compressible model are tested to determine the influence of gravity on the process and to discern the differences between the two approaches. The influence of a residual gas is included in the models. The results show that both the incompressible and compressible approximations provide comparable results and the presence of a residual gas tends to measurably reduce the mass flux in the system. Detailed flow, thermal and concentration profiles are provided. The simulations show that the Stefan flux dominates the system flow field and the subtle gravitational effects can be gauged by subtracting this flux from the calculated profiles. Shear flows, due to solutal buoyancy, of the order of 50 microns/s for the liorizont,-d growth orientation and 10 microns/s for the vertical orientation are predicted. Whether these flows can fully account for the observed gravity related growth morphological effects and inhomogeneous solute and dopant distributions is a matter of conjecture. A template for future modeling efforts in this area is suggested which incorporates a mathematical approach to the tracking of the growth front based on energy of formation concepts.
Author
Mathematical Models; Research; Vertical Orientation; Zinc Alloys; Selenium Alloys; Semiconductors (Materials); Crystal Growth; Gravitational Effects; Microgravity

19990064600 NASA Marshall Space Flight Center, Huntsville, AL USA
Magnetic Field Suppression of Flow in Semiconductor Melt
Fedoseyev, A. I., Alabama Univ., USA; Kansa, E. J., Embry-Riddle Aeronautical Univ., USA; Marin, C., Alabama Univ., USA; Volz, M. P., NASA Marshall Space Flight Center, USA; Ostrogorsky, A. G., Alabama Univ., USA; 2000; 1p; In English; 38th; Aerospace Sciences, 13 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright;

Avail: Issuing Activity, Hardcopy; Abstract Only

One of the most promising approaches for the reduction of convection during the crystal growth of conductive melts (semiconductor crystals) is the application of magnetic fields. Current technology allows the experimentation with very intense static fields (up to 80 KGauss) for which nearly convection free results are expected from simple scaling analysis in stabilized systems (vertical Bridgman method with axial magnetic field). However, controversial experimental results were obtained. The computational methods are, therefore, a fundamental tool in the understanding of the phenomena accounting during the solidification of semiconductor materials. Moreover, effects like the bending of the isomagnetic lines, different aspect ratios and misalignments between the direction of the gravity and magnetic field vectors can not be analyzed with analytical methods. The earliest numerical results showed controversial conclusions and are not able to explain the experimental results. Although the generated flows are extremely low, the computational task is a complicated because of the thin boundary layers. That is one of the reasons for the discrepancy in the results that numerical studies reported. Modeling of these magnetically damped crystal growth experiments requires advanced numerical methods. We used, for comparison, three different approaches to obtain the solution of the problem of thermal convection flows: (1) Spectral method in spectral superelement implementation, (2) Finite element method with regularization for boundary layers, (3) Multiquadric method, a novel method with global radial basis functions, that is proven to have exponential convergence. The results obtained by these three methods are presented for a wide region of Rayleigh and Hartman numbers. Comparison and discussion of accuracy, efficiency, reliability and agreement with experimental results will be presented as well.

Author

Magnetic Fields; Melts (Crystal Growth); Semiconductors (Materials); Crystal Growth; Doped Crystals; Single Crystals; Bridgman Method

19990064640 Columbia Univ., Radiation Lab., New York, NY USA

Epitaxial Liftoff for Fully Single-Crystal Ferroelectric Thin Films ***Annual Report, 1 Jul. 1998 - 30 Jun. 1999***

Osgood, Richard M., Jr.; Levy, Miguel; Jun. 29, 1999; 5p; In English

Contract(s)/Grant(s): N00173-98-1-G014

Report No.(s): AD-A365343; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the period covered by this report we initiated the application of crystal ion slicing to single crystal potassium tantalate and strontium titanate. Transport of ions in matter (TRIM) simulations and ion implantation at 3.8MeV and various dosages were done and removal of the sacrificial layer tested in a number of etchants. Potassium tantalate films have been fabricated and characterized, Sacrificial layer etching studies in SRTiO3 for (110) crystals were also carried out.

DTIC

Thin Films; Single Crystals; Epitaxy; Strontium Titanates; Tantalum Compounds; Potassium Compounds; Fabrication

19990064641 Naval Postgraduate School, Monterey, CA USA

Numerical Calculation of the Wannier Functions of GaAs/Al(0.25)Ga(0.75)As Superlattice Structure

Yuvanc, Mustafa; Jun. 1999; 51p; In English

Report No.(s): AD-A365370; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper presents the numerical calculation of the Wannier functions (a sub n (Z)) of the GaAs/Al(0.25)Ga(0.75)As superlattice structure. The Wannier functions are linear combinations of the Bloch functions (Psi sub nk (Z)) that can be viewed as a convenient mathematical instrument to get around the lack of orthogonality of the tight binding formulation and are useful tool when the position of an electron has physical importance. However, except for finding a variational principal for the energy levels of one dimensional crystals in terms of the Wannier functions and simple cubic lattice calculations for instructional reasons, models have not been calculated or plotted showing the theory can be expanded to more complex superlattice structures. We develop an algorithm to numerically calculate and plot the Wannier functions of the GaAs/Al(0.25)Ga(0.75)As superlattice structure and hence prove that these functions can be calculated even for complex structures. by using the plots of our numerical modelling, we displayed the peculiar properties of the Wannier functions: (a) Wannier functions are real, (b) They fall off exponentially, and (c) The are either symmetric or anti-symmetric about z=0,

DTIC

Gallium Arsenides; Aluminum Gallium Arsenides; Superlattices; Crystal Lattices

19990066682 Pennsylvania State Univ., Coll. of Engineering, University Park, PA USA

Interfacial Bonding Research for Compliant Substrates, ***30 Jun. 1998 - 1 Jul. 1999***

Miller, David L.; Mayer, Theresa S.; Jun. 23, 1999; 8p; In English

Contract(s)/Grant(s): N00014-97-1-0951

Report No.(s): AD-A364919; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is the second annual progress report. The goal of this project is the improvement of epitaxially grown lattice-mismatched III-V compound semiconductors by development of a practical compliant substrate technology. During the past focused on a GaAs compliant substrate approach using material fabricated by epitaxial growth of an AlAs/GaAs structure with the subsequent oxidation of the AlAs. Although we observed changes in surface morphology and a small reduction in x-ray rocking curve linewidths of layers grown on these substrates, we were unable to confirm any significant defect reduction. During the latter part of the year we shifted our focus back to twist-bonded approach.

DTIC

Bonding; Substrates; Elastic Properties; Oxidation; Semiconductors (Materials); Aluminum Arsenides; Gallium Arsenides

19990066686 Eidgenoessische Technische Hochschule, Lausanne, Switzerland

High-Quality C-Axis Oriented HTSC Films for Microwave Devices ***Final Report, Nov. 1997 - Jan. 1998***

Klemenz, C.; Jun. 08, 1999; 8p; In English

Contract(s)/Grant(s): N68171-96-C-9105

Report No.(s): AD-A364986; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

C-axis oriented HTSC films were grown by LPE on various substrates. The conditions for improving the surface flatness were systematically studied. For the achievement of interstep distances yo approx. 10 micrometers between monosteps of 12 Angstroms, as required for Tunnel devices, following requirements were estimated: undercooling delta-T = 0.17K, misfit / quality LPE films could not be obtained on LSAT substrates, whereas same growth conditions yielded good-quality LPE films on NGO. This might be due to the striations present in LSAT which may influence nucleation and growth behavior. Solid-solutions of substrates and of HTSC allow to reduce misfit problems during growth but still the cooling/oxidation problem and lead to twinning and cracking.

DTIC

Liquid Phase Epitaxy; Microwave Equipment

19990066691 State Univ. of New York, Brook Research Foundation, Stony Brook, NY USA

Electrons, Phonons and their Interactions in Novel Modulation Doped GaAs/AlAs Based Quantum Wells ***Final Report, 1 May 1995 - 31 Jan. 1999***

Petrou, Athos, State Univ. of New York, USA; Jan. 31, 1999; 6p; In English

Contract(s)/Grant(s): DAAH04-95-1-0195

Report No.(s): AD-A365314; ARO-31604.5-EL; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The lowest energy interband transitions in AlGaAs/AlAs quantum wells involve electrons localized in the AlAs x-valleys and holes confined in the AlGaAs layers. These transitions are indirect in both real as well as in kappa-space and are accompanied by strong replicas of the GaAs and AlAs phonons. When a magnetic field is applied perpendicular to the layers a large reduction in the recombination intensity is observed. This reduction is attributed to magnetic field induced localization of the carriers which results in a reduction of the electron-hole wavefunction overlap. We have also studied photoluminescence spectra from type-II, n-type, modulation doped GaAs/AlAs quantum wells due to radiative recombination of electrons localized in the AlAs x-valleys with holes confined in the GaAs layers. In the presence of a magnetic field the emission spectra exhibit features associated with transitions among the AlAs x-valley Landau levels and photo-injected holes. The slopes of these transitions yield an effective mass m* = 0.44 for the electrons.

DTIC

Aluminum Arsenides; Aluminum Gallium Arsenides; Quantum Wells; Photoluminescence; Field Emission; Doped Crystals

19990066694 Arizona State Univ., Dept. of Electrical Engineering, Tempe, AZ USA

Silicon-Based Nanostructures: Experiment and Modeling ***Final Report, 1 Jun. 1995 - 31 May 1999***

Ferry, David K., Arizona State Univ., USA; Jun. 25, 1999; 66p; In English

Contract(s)/Grant(s): N00014-95-1-0918

Report No.(s): AD-A365334; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Under this program, research was carried out in the area of Si-based nanoelectronic devices. The primary device of interest was a single-electron tunneling transistor fabricated in the Si MOS system. As part of the program, extended work on chemically-enhanced vapor etching as a tool for lithography and material processing, and upon the processing of CoSi2 as a viable interconnect, were pursued. Theoretical work addressed both the transport in the Si devices as well as the more general problems in small quantum, confined systems. It was natural to apply these results to GaAs based systems as well. Other portions of the effort entailed high-resolution TEM as a routine tool during our materials and device studies and the development of special visualization tools

for the theoretical program. Sub-contracts were to SRA, Inc., for quantum transport studies of quantum devices, and for process modeling, and to Los Alamos National Laboratory for similar studies and for visualization of processing.
DTIC
Field Effect Transistors; Metal Oxide Semiconductors; Quantum Dots; Electron Tunneling; Fabrication; Silicon

19990067268 Puerto Rico Univ., Dept. of Physics, Rio Piedras, Puerto Rico
Equilibrium and Dynamic Properties of Liquid Crystals Confined in Complex Matrices ***Final Report***
Aliev, F. M., Puerto Rico Univ., Puerto Rico; Mar. 14, 1999; 29p; In English
Contract(s)/Grant(s): F49620-95-1-0520; AF Proj. 2301
Report No.(s): AD-A364987; AFRL-SR-BL-TR-99-0162; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
We have studied both theoretically and experimentally the fundamental problems of light interaction with LC and corresponding forces and torque in LC. We are further developing the method of measurement of laser beams in the near field from the far field patterns that are distorted by propagation of the beam through LC. We have obtained important experimental results on the focusing of various beams into the nonlinear cell retrieval of that information from the nonlinear distortions.
DTIC
Liquid Crystals; Laser Beams; Light Scattering

19990067279 Polish Academy of Sciences, Institute of Physics, Warsaw, Poland
Experimental Study of the Low Supersaturation Nucleation in Crystal Growth by Contactless Physical Vapor Transport
Grasza, K., Polish Academy of Sciences, Poland; Palosz, W., Universities Space Research Association, USA; Trivedi, S. B., Brimrose Corp. of America, USA; [1998]; In English
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche
The process of the development of the nuclei and of subsequent seeding in 'contactless' physical vapor transport is investigated experimentally. Consecutive stages of the Low Supersaturation Nucleation in 'contactless' geometry for growth of CdTe crystals from the vapor are shown. The effects of the temperature field, geometry of the system, and experimental procedures on the process are presented and discussed. The experimental results are found to be consistent with our earlier numerical modeling results.
Author
Data Acquisition; Experimentation; Crystal Growth; Nucleation; Supersaturation

19990067836 Erlangen-Nuernberg Univ., Dept. of Physics, Erlangen, Germany
Analysis of Triangular Arrays of Josephson Tunnel Junctions ***Final Report***
Caputo, P., Erlangen-Nuernberg Univ., Germany; Ustinov, Alexey V., Erlangen-Nuernberg Univ., Germany; May 1999; 15p; In English
Contract(s)/Grant(s): F61775-98-W-E041
Report No.(s): AD-A364967; EOARD-SPC-98-4022; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
High frequency properties of underdamped Josephson junction arrays consisting of two rows of parallel biased cells are studied experimentally. Two row arrays of different geometries are investigated and compared with respect of their microwave power in the W-band. Comparative measurements have shown that, among the studied configurations, the best performance is obtained from an array with square cells and two horizontal junctions. In this array, the measured output power is up to 2 times larger than that in the array with only one horizontal junction, and up to 20 times larger with respect to the array with conventional triangular cells. Experimental data are in good qualitative agreement with previously reported numerical simulations of Yukon and Lin. We confirm that in square cell arrays an enhanced rf voltage can be extracted from the horizontal junctions.
DTIC
Josephson Junctions; Electron Tunneling; Simulation

19990068005 NASA Marshall Space Flight Center, Huntsville, AL USA
Melt Growth of a Nonlinear Optical Crystal Triethylphosphine Sulfide using Modified Bridgman-Stockbarger Technique
Curry, K., Alabama A & M Univ., USA; Aggarwal, M. D., Alabama A & M Univ., USA; Choi, J., Alabama A & M Univ., USA; Wang, W. S., Alabama A & M Univ., USA; Lai, R. B., Alabama A & M Univ., USA; Penn, Benjamin G., NASA Marshall Space Flight Center, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Optical Science, 19 Jul. 1999, Denver, CO, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
Bulk single crystals of triethylphosphine sulfide (C2H5)3P(S), a potential nonlinear optical organic material has been grown from melt using Bridgman- Stockbarger method. Commercially available material triethylphosphine sulfide procured from John-

son Matthey was purified by physical vapor transport using low pressure sublimaton (about 30 mTorr). Modified Bridgman-Stockbarger technique is characterized by the smallest possible quantity of product in the melt for a short period of time. The temperature gradient was chosen to be about 10 C/cm and the ampoule was lowering rate was chosen to be 0.2-0.3 mm/h. For various growth conditions, several single crystal of triethylphosphine sulfide have been grown with sizes 10X10X15mm(exp 3). The second harmonic generation (SHG) efficiency was measured and has been found to be comparable to phase matched potassium dihydrogen phosphate crystals. Further characterization of the grown single crystals is in progress and the results will be presented at the symposium.
Author
Bridgman Method; Crystal Growth; Melts (Crystal Growth); Single Crystals; Sulfides; Optical Materials; Crystallization; Crystallography

19990068006 NASA Marshall Space Flight Center, Huntsville, AL USA
Searching for the Best Protein Crystals: Synchrotron Based Measurements of Protein Crystal Quality
Borgstahl, Gloria, NASA Marshall Space Flight Center, USA; Snell, Edward H., American Crystallographic Association; Bellamy, Henry, NASA Marshall Space Flight Center, USA; Pangborn, Walter, NASA Marshall Space Flight Center, USA; Nelson, Chris, NASA Marshall Space Flight Center, USA; Arvai, Andy, NASA Marshall Space Flight Center, USA; Ohren, Jeff, NASA Marshall Space Flight Center, USA; Pokross, Matt, NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 23 May 1999, Buffalo, NY, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We are developing X-ray diffraction methods to quantitatively evaluate the quality of protein crystals. The ultimate use for these crystal quality will be to optimize crystal growth and freezing conditions to obtain the best diffraction data. We have combined super fine-phi slicing with highly monochromatic, low divergence synchrotron radiation and the ADSC Quantum 4 CCD detector at the Stanford Synchrotron Radiation laboratory beamline 1.5 to accurately measure crystal mosaicity. Comparisons of microgravity versus earth-grown insulin crystals using these methods will be presented.
Author
Crystal Growth; Crystals; Insulin; Microgravity; Proteins; X Ray Diffraction; Crystallization; Crystallography

19990068749 California Univ., Dept. of Chemistry, Berkeley, CA USA
Semiclassical Theory of Electronically Nonadiabatic Processes
Miller, William H., California Univ., USA; Molecular Quantum States at Dissociation; 1998, pp. 62-65; In English
Contract(s)/Grant(s): DE-AC03-76SF-00098; NSF CHE-97-32758; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

The semiclassical (SC) initial value representation (IVR) is currently receiving a great deal of attention as a way of including quantum interference and tunneling effects in molecular dynamics simulations. This is essentially the traditional SC approximation cast in a form that requires one to integrate classical trajectories specified by their initial conditions (rather than by double-ended boundary conditions).
Derived from text
Nonadiabatic Theory; Energy Dissipation; Nonadiabatic Conditions; Heat Transfer; Quantum Theory; Electron Tunneling; Resonant Tunneling

19990069599 North Carolina State Univ., Dept. of Electrical and Computer Engineering, Raleigh, NC USA
Theoretical Studies and Modeling of III-V Nitride Materials and Devices for Optoelectronic Applications ***Final Report, 1 Sep. 1996 - 30 Jun. 1997***
Kim, Ki W.; Mar. 1999; 4p; In English
Contract(s)/Grant(s): DAAH04-96-1-0431
Report No.(s): AD-A365192; NCSU-FAS-5-30684; ARO-34854.1-EL; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

Two main objectives of this research program include: (1) investigation of the fundamental material, transport, and optical properties of III-V nitrides; and (2) simulation and design optimization of GaN-based optoelectronic devices. Study of fundamental physical properties (such as carrier scattering and optical transitions) is based on an envelope function formalism for accurate description of band spectrum in bulk and confined structures. Numerical analyses and optimization of GaN-based devices are approached by solving a set of coupled equations self-consistently. This research initiative has provided valuable insight for the development and optimization of III-V nitride optoelectronic devices, particularly, blue/UV quantum well lasers.
DTIC
Optoelectronic Devices; Numerical Analysis; Design Analysis

19990069615 North Carolina State Univ., Raleigh, NC USA

Selected Energy Epitaxial Deposition and Low Energy Electron Microscopy of AlN, GaN and SiC Thin Films ***Quarterly Report, 1 Jan. - 31 Mar. 1999***

Davis, R. F.; Lamb, H. H.; Tsong, I. S. T.; Mar. 1999; 19p; In English

Contract(s)/Grant(s): N00014-95-I-0122

Report No.(s): AD-A364791; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study of the homoepitaxial growth of GaN(0001) layers was conducted in situ and in real time using the low energy electron microscope. An evaporative cell supplied the Ga flux while the NH3 flux was supplied via a seeded beam supersonic jet source. At growth temperatures of 665 and 677 C, smooth GaN(0001) layers with well defined step structures were grown on MOCVD-GaN(0001) substrates. In general, non-faceted homoepitaxial layers were achieved when the Ga/NH3 flux ratios exceeded 2, starting with a Ga covered substrate surface, in the temperature range 655-710 C. Preliminary kinetics data for homoepitaxial GaN films grown under Ga stable conditions are consistent with an energy barrier for direct dissociative chemisorption of NH3 on GaN(0001) of approximately 0.5 eV.

DTIC

Metalorganic Chemical Vapor Deposition; Thin Films; Silicon Carbides; Gallium Nitrides; Aluminum Nitrides; Electron Microscopy; Epitaxy; Real Time Operation

19990069897 NASA Marshall Space Flight Center, Huntsville, AL USA

Low Temperature Photoluminescence of PVT Grown ZnSe and ZnSeTe

Wang, Ling Jun, Tennessee Univ., USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 20-26 Mar. 1999, Atlanta, GA, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

ZnSe and ZnSeTe single crystals were grown by physical vapor transport (PVT) technique horizontally and vertically. The grown ZnSe and ZnSeTe single crystals were characterized by low temperature photoluminescence at 5 to 10 K using the 3.4 eV emission of an argon laser. The intensity of the sharp near band edge defect lines at 2.799, 2.783 eV and the intrinsic free exciton line at 2.802 eV were mapped on various crystal surfaces with different orientations to the gravitational field. The results show the effects of gravity vector orientation on the defect segregation. Comparison of the photoluminescence spectra of the ZeSe crystal before and after annealing in the Zn vapor shows that the 2.783 eV line of ZnSe crystal is related to the zinc vacancy. The photoluminescence spectra of the ternary ZnSeTe crystal were characterized by a single broad band from 2.2 to 2.4 eV, with a Full Width at Half Maximum (FWHM) of about 100 meV. The temperature dependence of the peak position and intensity were determined from 7 to 150 K.

Author

Photoluminescence; Vapors; Zinc Selenides; Zinc Tellurides; Crystal Growth

19990070323 NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of Interface Shape and Magnetic Field on the Microstructure of Bulk Ge:Ga

Cobb, S. D., NASA Marshall Space Flight Center, USA; Szofran, F. R., NASA Marshall Space Flight Center, USA; Volz, M. P., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; Crystal Growth and Epitaxy, 1-6 Aug. 1999, Tucson, AZ, USA; No Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Thermal and compositional gradients induced during the growth process contribute significantly to the development of defects in the solidified boule. Thermal gradients and the solid-liquid interface shape can be greatly effected by ampoule material. Compositional gradients are strongly influenced by interface curvature and convective flow in the liquid. Results of this investigation illustrate the combined influences of interface shape and convective fluid flow. An applied magnetic field was used to reduce the effects of convective fluid flow in the electrically conductive melt during directional solidification. Several 8 mm diameter boules of Ga-doped Ge were grown at different field strengths, up to 5 Tesla, in four different ampoule materials. Compositional profiles indicate mass transfer conditions ranged from completely mixed to diffusion controlled. The influence of convection in the melt on the developing crystal microstructure and defect density was investigated as a function of field strength and ampoule material. Chemical etching and electron backscattered electron diffraction were used to map the crystal structure of each boule along the center plane. Dislocation etch pit densities were measured for each boule. Results show the influence of magnetic field strength and ampoule material on overall crystal quality.

Author

Shapes; Magnetic Fields; Microstructure; Gallium; Germanium; Liquid-Solid Interfaces

19990070324 NASA Marshall Space Flight Center, Huntsville, AL USA

NASA's Biological Crystal Growth Program on the International Space Station

Kundrot, Craig E., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; IUCR General Assembly and Congress, 7 Aug. 1999, Glasgow, UK; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

NASA's Biological Crystal Growth Program (BCG) on the International Space Station (ISS) will consist of two phases. The first phase is during assembly of the ISS and will accommodate generic payloads that currently fly in the orbiter middeck. The second phase is after assembly of the ISS is complete and BCG payloads will occupy part of the Biotechnology Facility aboard the ISS. During both phases of the program, there will be two types of BCG payloads. One type will emphasize the production of crystals for structure determination back on Earth and will have high capacity for screening crystallization conditions. The second type of payload will be designed to study the crystallization process with the primary aim of developing new methods to further optimize the use of the microgravity environment. Beginning immediately, access to the BCG program for Guest Investigators is simplified. Access to all BCG hardware for Guest Investigators will be coordinated through one office at NASA's Marshall Space Flight Center. Details of how to obtain access to microgravity, the hardware available, and the operational aspects of the program will be described.

Author

Crystal Growth; Payloads; Crystallization

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.

19990066622 NASA Ames Research Center, Moffett Field, CA USA

Basic Governing Equations for the Flight Regimes of Aeroassisted Orbital Transfer Vehicles

Lee, Jong–Hun, NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 3-53; In English; 19th; Thermophysics, 25-28 Jun. 1984, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 84-1729; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The basic governing equations for the low-density, high-enthalpy flow regimes expected in the shock layers over the heat shields of the proposed aeroassisted orbital transfer vehicles are derived by combining and extending existing theories. The conservation equations are derived from gas kinetic principles for a four-component ionized gas consisting of neutral molecules, neutral atoms, singly ionized ions, and electrons, assuming a continuum flow. The differences among translational-rotational, vibrational, and electron temperatures are accounted for, as well as chemical nonequilibrium and electric-charge separation. Expressions for convective and viscous fluxes, transport properties, and the terms representing interactions among various energy modes are explicitly given. The expressions for the rate of electron-vibration energy transfer, which violates the Landau-Teller conditions, are derived by solving the system of master equations accounting for the multiple-level transitions.

Author

Aeroassist; Conservation Equations; Energy Transfer; Heat Shielding; Ionized Gases; Low Density Flow

19990066623 NASA Ames Research Center, Moffett Field, CA USA

Thermal Response of an Aeroassisted Orbital Transfer Vehicle with a Conical Drag Brake

Pitts, W. C., NASA Ames Research Center, USA; Murbach, M. S., Informatics General Corp., USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 361-377; In English; 19th; Thermophysics, 25-28 Jun. 1984, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 84-1712; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

As an aeroassisted orbital transfer vehicle (AOTV) goes through an aerobraking maneuver a significant amount of heat is generated. In this paper, the thermal response of a specific AOTV to this aerobrake heating is examined. The vehicle has a 70-deg, Conical drag-brake heat shield attached to a cylindrical body which contains the payload. The heat shield is made of ceramic fabric its thickness is varied from that of a thin cloth to a 1.5-cm blanket. The fabric thickness, the radiation absorptivity of the vehicle surface materials, and radiation from the wake are all significant parameters in the thermal response to the heating produced by

the braking maneuver. The maximum temperatures occur In the vicinity of the interface between the body and the conical heat shield.
Author
Temperature Effects; Aeroassist; Orbit Transfer Vehicles; Conical Bodies; Drag; Braking

19990066630 NASA Ames Research Center, Moffett Field, CA USA
Thermal Protection Requirements for Near-Earth Aeroassisted Orbital Transfer Vehicle Missions
Menees, Gene P., NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 257-285; In English; 18th; Thermophysics, 1-3 Jun. 1983, Montreal, Canada; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 83-1513; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The thermal protection required for decelerating and maneuvering spacecraft by aerodynamic forces is determined for return missions from geosynchronous to low Earth orbits. The effect of vehicle configuration on surface heating rates and selection of heat shield materials is analyzed. The effects of the current widespread estimates in the structure of atmospheric density are also evaluated. It is shown that nonequilibrium radiation can be a major source of surface heating during atmospheric entry and a significant factor for heat shielding requirements. It is also demonstrated that drag-brake concepts have application to a broad range of orbital transfer missions because of the favorable tradeoffs with aeromaneuvering vehicles in volumetric efficiency, retrothrust plane-change capability, and heat protection requirements. In addition, the results of this study indicate that the aeroassist technique produces acceptable penalties in vehicle payload capacity for drag-brake concepts, because of the system's heat protection requirements, and is highly attractive relative to all-propulsive orbital change maneuvers.
Author
Thermal Protection; Aeroassist; Orbit Transfer Vehicles; Transfer Orbits; Orbital Maneuvers; Nonequilibrium Radiation; Heat Shielding

19990066632 NASA Ames Research Center, Moffett Field, CA USA
Calculation of Nonequilibrium Radiation in the Flight Regimes of Aeroassisted Orbital Transfer Vehicles
Park, Chul, NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 395-418; In English; 22nd; Aerospace Sciences, 9-12 Jan. 1984, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 84-0306; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A computer code has been developed that calculates radiative properties of nonequilibrium air in the low-density regimes expected during the flight of aeroassisted, orbital transfer vehicles. From the given nonequilibrium thermodynamic state variables, the code calculates number densities of internal states and the accompanying emission and absorption characteristics. In addition, the code calculates the number density of the hypothetical gas in radiative equilibrium that produces the same radiation emission as the given nonequilibrium gas. Sample results are shown to demonstrate how the code predicts the non-linear variation of radiation with density at low densities.
Author
Computer Programs; Computation; Nonequilibrium Radiation; Thermodynamics

19990067223 High Energy Accelerator Research Organization, Information Resources Div., Tsukuba, Japan
Beam Lifetime
Hirata, K., High Energy Accelerator Research Organization, Japan; June 1998; 12p; In English, 10-20 May 1998, Montreux, Switzerland
Report No.(s): KEK-Preprint-98-67; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper concerns single-kick lifetime, quantum lifetime, exact estimation of the non-Gaussian beam halo, and their mutual relationships. When a halo is produced by an incoherent stochastic process in an electron storage ring, the quantum lifetime and the single-kick lifetime are identical if the aperture is large enough.
Author
Beams (Radiation); Life (Durability); Halos

19990068751 New York Univ., Dept. of Chemistry, New York, NY USA
Time Dependent Study of Resonances
Zhang, John Z. H., New York Univ., USA; Molecular Quantum States at Dissociation; 1998, pp. 56-58; In English; ISBN 0-9522736-5-9; Copyright; Avail: Issuing Activity, Hardcopy

One of the most important results of quantum scattering theory is the phenomenon of resonance. Resonance plays important roles in bimolecular collision and unimolecular reaction. For example, the product branching ratio and product state distribution in a bimolecular reaction or unimolecular dissociation are often controlled by resonance states. The resonance states are also called metastable species in chemistry and their existence can be detected and lifetimes can be measured experimentally by spectroscopic and other methods. The formation of resonance states or metastable species can arise from a variety of energy transfer processes such as bimolecular collision, photoabsorption, or other energetic processes. The theoretical treatment of resonance is a difficult task partly because resonance states are not as well defined as bound states. Rigorously speaking, resonance states are continuum states that possess some bound state characteristics such as locality.
Derived from text
Quantum Theory; Time Dependence; Resonance Scattering; Wave Functions; Wavelet Analysis; Time Functions; Fourier Transformation

80
SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19990064343 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
NASA Multidisciplinary Design and Analysis Fellowship Program ***Final Report, 1 Dec. 1996 - 31 Jan. 1999***
Schrage, D. P., Georgia Inst. of Tech., USA; Craig, J. I., Georgia Inst. of Tech., USA; Mavris, D. N., Georgia Inst. of Tech., USA; Hale, M. A., Georgia Inst. of Tech., USA; DeLaurentis, D., Georgia Inst. of Tech., USA; July 1999; 26p; In English
Contract(s)/Grant(s): NGT1-52156; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the results of a multi-year training grant for the development and implementation of a Multidisciplinary Design and Analysis (MDA) Fellowship Program at Georgia Tech. The Program funded the creation of graduate MS and PhD degree programs in aerospace systems design, analysis and integration. It also provided prestigious Fellowships with associated Industry Internships for outstanding engineering students. The graduate program has become the foundation for a vigorous and productive research effort and has produced: 20 MS degrees, 7 Ph.D. degrees, and has contributed to 9 ongoing Ph.D. students. The results of the research are documented in 32 publications (23 of which are included on a companion CDROM) and 4 annual student design reports (included on a companion CDROM). The legacy of this critical funding is the Center for Aerospace Systems Analysis at Georgia Tech which is continuing the graduate program, the research, and the industry internships established by this grant.
Author
Multidisciplinary Design Optimization; Design Analysis; Systems Engineering; NASA Programs; Aerospace Systems; Education

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990064534 National Inst. of Standards and Technology, Economic Assessment Office, Gaithersburg, MD USA
Advanced Technology Program Performance of Completed Projects, Report 1
Long, W. F.; Mar. 1999; 152p; In English
Report No.(s): PB99-128175; NIST/SP-950-1; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

Innovations that reduce the costs and improve the outcomes of medical care, improve the clarity of wireless communications, and enhance the quality of manufactured products are among the many significant achievements supported by the Advanced Technology Program (ATP). This review of the first group of completed projects suggests that billions of dollars are likely to flow into the US economy, greatly exceeding the ATP's investment. Thus, the ATP appears to be on track in fulfilling its mission to stimulate economic growth by helping American companies and their research partners overcome significant technical challenges to produce economically valuable new technologies. The details are contained in this report.
NTIS
Wireless Communication; Environmental Engineering; Technology Utilization

19990064616 NASA Goddard Space Flight Center, Greenbelt, MD USA

Continuous Risk Management at NASA

Hammer, Theodore F., NASA Goddard Space Flight Center, USA; Rosenberg, Linda, Unisys Corp., USA; February 1999; 1p; In English; SM Management 1999, Feb. 1999, San Jose, CA, USA

Contract(s)/Grant(s): NAS5-32910; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

NPG 7120.5A, ”NASA Program and Project Management Processes and Requirements” enacted in April, 1998, requires that ”The program or project manager shall apply risk management principles...” The Software Assurance Technology Center (SATC) at NASA GSFC has been tasked with the responsibility for developing and teaching a systems level course for risk management that provides information on how to comply with this edict. The course was developed in conjunction with the Software Engineering Institute at Carnegie Mellon University, then tailored to the NASA systems community. This presentation will briefly discuss the six functions for risk management: (1) Identify the risks in a specific format; (2) Analyze the risk probability, impact/severity, and timeframe; (3) Plan the approach; (4) Track the risk through data compilation and analysis; (5) Control and monitor the risk; (6) Communicate and document the process and decisions. This risk management structure of functions has been taught to projects at all NASA Centers and is being successfully implemented on many projects. This presentation will give project managers the information they need to understand if risk management is to be effectively implemented on their projects at a cost they can afford. Author

Computer Systems Programs; Education; Risk; Probability Theory

19990068420 Royal Aeronautical Society, London, UK

Franchising, Code Sharing and Related Matters: Proceedings

Franchising, Code Sharing and Related Matters: Proceedings; 1998; 46p; In English; Franchising, Code Sharing and Related Matters, 11 Feb. 1998, London, UK; See also 19990068421 through 19990068426; ISBN 1-85768-009-X; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This conference discusses the franchising and code sharing in the airline business. It brought together speakers representing various segments of the airline business: small airlines, major airlines and the government regulators.

CASI

Airline Operations; Conferences; Commercialization; Air Transportation; Regulations

19990068421 Gill Airways, Newcastle-upon-Tyne, UK

Partnerships: Our Path to Success

Hart, Malcolm, Gill Airways, UK; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 1.1 - 1.4; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper sets out how Gill Airways - a medium-sized airline based at Newcastle - has evolved a WIN/WIN philosophy of partnerships with other airlines. The paper explains how such partnerships have earned Gill access to European markets which, notwithstanding deregulation, would not be open to it otherwise because of prohibitive sales and other costs in non-UK markets. The paper covers the range of partnership activities, from route franchises, to code-sharing, to wet leasing and sub-franchising. It also explains the important partnership between Gill Airways and the Royal Mail, which plays a crucial role in enabling Gill Airways to achieve the cost base that makes airline partnership an effective strategy.

Author

Airline Operations; Civil Aviation; Routes; Air Transportation; Operating Costs

19990068422 British Airways, Competition and Industry Affairs, Heathrow, UK

The Role of Code-Sharing and Franchising in British Airways’ Development

Allen, Christopher M., British Airways, UK; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 3.1-3.6; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

For most of its life air transport has been a highly regulated industry with little in the way of competition. The travelling public had learned not to expect to be able to make choices and generally accepted, rather uncritically, whatever it happened to be offered to meet its requirements. More recently competition has been permitted, encouraged even. This has meant that consumers have been faced with choices. But it is not always easy for them to make a real choice. Not only is air-transport something which the average consumer does not buy often enough for there to be any prospect of the choice’s being based on reasonable experience, but in many cases the choice can be between airlines the customer has never even heard of. Corporations and individual travellers choose to deal with a single, preferred supplier where that is possible. In particular they like to be able to complete any single

journey with one airline if they can. This means that for frequent business travellers, whose journeys cover a wide range of destinations, there is attraction in an airline which can meet all their disparate requirements. Equally, for the very many passengers whose journeys may be less frequent but which necessarily involve more than one leg, there is attraction in an airline which can serve the full journey. Franchising and code-sharing play significant roles in the development of British Airways' global network and are expected to continue to do so.
Derived from text
Airline Operations; Commerce; Passengers; Selection; UK; Costs; Air Transportation

19990068424 BDO Franchising and Brand Development, London, UK
Franchising: Realising the Opportunity
Logan, J., BDO Franchising and Brand Development, UK; McHardy, M., BDO Franchising and Brand Development, UK; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 6.1-6.6; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The franchise model is one of the most powerful business tools available to any organization eager to succeed in a highly competitive environment. Franchising is, however, an undeniably emotive topic. Because it has become a familiar and much used word in a seemingly ever increasing range of business situations, preconceptions abound as to what franchising actually means in practice. As a consequence, it is too often dismissed as a business tool where in truth it could provide real commercial benefits - or, alternatively, embraced in a format that is at best suboptimal and, at worst, damaging for the organisation and/or its partner. Contrary to popular belief, there is no one blue-print or formula for franchising. In a successful business to business franchise, both players have a clearly defined and mutually understood commercial purpose for joining forces one founded on the mutual strengths and motivations of both parties and supported by a clear, open understanding of their respective roles and responsibilities throughout the commercial relationship. Neither is the franchise tool confined to brand growth strategies. The key to unlocking the power which franchising offers right across the air transport and, indeed, travel industry lies in understanding its potential and being innovative in how and where it is applied to generate leading edge business solutions. Despite the opportunities created by airline franchise activity, there is a growing recognition that the opportunity for refining and further applying the franchise model in the air transport industry is vast.
Author
Air Transportation; Airline Operations; Commerce; Costs; Economic Analysis; Efficiency

19990068426 Kreis, Kubac, Svoboda and Kirchweger, Brussels, Belgium
Franchising and Code Sharing Under EU Competition Rules
Kreis, Helmut W. R., Kreis, Kubac, Svoboda and Kirchweger, Belgium; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 8.1-8.5; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

FRANCHISING and Code Sharing are well known features for the air transport industry. They represent, however, relatively new phenomena for the European Union's competition law enforcement. With regard to franchising the European Commission adopted in 1986 and 1987 three decisions under Article 85(3) of the Treaty exempting franchise agreements in the cases Yves Rocher and Pronuptia and in the Computerland case from the prohibition of cartels. After having thereby completed its experience in dealing with franchising contracts the European Commission enacted in 1988 a so-called Block Exemption Regulation on the application of Article 85(3) of the Treaty to categories of franchise agreements. Although this Regulation is not part of the package of competition law regulations in transport its applicability to franchise agreements in air transport is not excluded. It also indicates under which circumstances the Commission may intervene against franchise networks in air transport or under which conditions it may grant them individual exemptions. Code Sharing is part of many cooperations between airlines. It helps to build up networks and does not constitute itself a major infringement of EU competition rules. However, code sharing may become a competition law problem where it is combined with other arrangements in cooperation agreements between airlines. A recent and prominent example in this respect are international alliances against which the European Commission has either adopted decisions and imposed conditions like in case Lufthansa/SAS or against which proceedings under Articles 88 and 89 of the Treaty have been initiated like in cases British Airways/American Airlines, the North Atlantic Excellence and the STAR Alliance.
Author
Air Transportation; Airline Operations; Competition; Operating Costs; International Law; Civil Aviation

19990068434 Royal Aeronautical Society, London, UK
Smart Procurement for Weapon Systems: Proceedings
1999; In English; Smart Procurement for Weapon Systems, 4 Mar. 1999, Boscombe Down, UK; See also 19990068435 through

19990068441; ISBN 1-85768-094-4; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This proceedings is a compilation of work on various topics. The papers contained within includes: The challenges of Smart Procurement; Smart teamwork - Systems engineers and operational analysis working together; Smart Procurement from a system engineering perspective; Systems engineering aspects of the UK's BMD programs; The challenge of Smart Procurement - Smart Procurement in practice - The FOAS Project; Multinational Smart Procurement; and Integrated test and evaluation in support of defense capability.

CASI

Conferences; Government Procurement; Weapon Systems; Weapons Development

19990068435 University Coll., London, UK

The Challenges of Smart Procurement

Kirkpatrick, D. L. I., University Coll., UK; Smart Procurement for Weapon Systems: Proceedings; 1999, pp. 1.1 - 1.8; In English; See also 19990068434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper reviews the Smart Procurement Initiatives which form part of the UK's recent Strategic Defence Review. It then assesses the various Initiatives, and identifies the challenges which must be met if the Initiatives are to be successfully implemented.

Author

Government Procurement; Weapon Systems; Weapons Development

19990068436 Defence Evaluation Research Agency, Centre for Defence Analysis, Farnborough, UK

Smart Teamwork: Systems Engineers and Operational Analysts Working Together

Oxenham, D. A., Defence Evaluation Research Agency, UK; Smart Procurement for Weapon Systems: Proceedings; 1999, pp. 2.1 - 2.7; In English; See also 19990068434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The Smart Procurement initiative created as part of the Strategic Defence Review was developed in reaction to forces for change in the environment in which defence capability is deployed and used. It promises to make dramatic changes to the UK's approach to equipment acquisition by making procurement faster, cheaper and better. Its main vehicle for the delivery of this objective will be the "Integrated Project Team". The technical contributions to these teams will come from the skills of scientific research, engineering development, systems design, test and evaluation, and operational analysis. This paper deals with the process of linking these to support decision-making within the Integrated Project Team. In short: "Smart Teamwork". "Value for money" will be a pervasive theme in decisions with the balance between military effectiveness and whole life costs being the vital consideration. This paper discusses how the effectiveness of weapons systems can be determined to ensure that the performance gains from new technology are translatable into military benefits. It will demonstrate the importance of a strong understanding of the linkage between analysis, technology and military doctrine. It concludes that the natural working environment for this is that of a multidisciplinary team working under Systems Engineering principles.

Author

Government Procurement; Weapon Systems; Weapons Development; Military Technology; Defense Program

19990068437 Defence Evaluation Research Agency, Systems Engineering Directorate, Malvern, UK

Smart Procurement from a Systems Engineering Perspective

Bottomley, Peter, Defence Evaluation Research Agency, UK; Smart Procurement for Weapon Systems: Proceedings; 1999, pp. 3.1 - 3.10; In English; See also 19990068434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper reviews what has subsequently happened to make such a 'Through Life Systems Approach' a reality. It indicates where a systems engineering approach is emerging as the underpinning 'coherent process' in the detailed practices and procedures for Smart Procurement and where it is likely and desirable that further applications of systems engineering principles will become evident in the future.

Author (revised)

Government Procurement; Government/Industry Relations; Weapon Systems; Weapons Development

19990068439 Ministry of Defence, Future Offensive Air System Integrated Project Team, Bristol, UK

The Challenge of Smart Procurement. Smart Procurement in Practice: The FOAS Project

Ottewell, J. C., Ministry of Defence, UK; Smith, K. M., Ministry of Defence, UK; Cobb, S., Ministry of Defence, UK; Smart Procurement for Weapon Systems: Proceedings; 1999, pp. 5.1 - 5.6; In English; See also 19990068434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper describes how the Future Offensive Air System (FOAS) Integrated Project Team (IPT) is adapting its business processes to meet the challenge of SMART Procurement. It briefly outlines the concept of an IPT and touches on the particular challenge facing the FOAS IPT Leader. The FOAS IPT approach to Requirements Capture and Management and the reasons it is considered essential to SMART Procurement are described. This leads into the application of Synthetic Environments to FOAS and the novel way in which they are to be employed in the early stages of the project. Both the need for effective use of information technology and the evolutionary way the IPT intend to introduce an enterprise wide Shared Data Environment are outlined. Two sections covering Risk Management and its interaction with the requirements set, follow. The paper concludes that the FOAS IPT is well placed to take advantage of the introduction of SMART Procurement and looks forward, with confidence to the realization of this challenging project.

Author

Government Procurement; Weapons Development; Weapon Systems; Project Management; Requirements; Management Planning; Teams

19990068440 Matra BAe Dynamics, Stevenage, UK

Multinational Smart Procurement

Smith, C. N., Matra BAe Dynamics, UK; Smith, R. F. T., Matra BAe Dynamics, UK; Smart Procurement for Weapon Systems: Proceedings; 1999, pp. 6.1 - 6.13; In English; See also 19990068434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Conducting a multinational Smart Procurement could be the ultimate near term challenge for systems engineering. The diverse nature of the customer and issues of work sharing compound the problems of working productively with the customer. This paper considers the whole life cycle to determine the key issues for smart procurement in a multinational environment. It is based on experience from the recent 8 nation VSHORADS-SHORADS Feasibility Study. The paper discusses how some challenges can be tackled provided both customer and industry are prepared to start thinking now in new ways.

Author (revised)

Government Procurement; Weapon Systems; Weapons Development; Productivity; Production Engineering

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DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

19990064376 NASA Goddard Space Flight Center, Greenbelt, MD USA

Information Systems for Nanosatellite Constellations

Johnson, Michael A., NASA Goddard Space Flight Center, USA; Tompkins, Steve D., NASA Goddard Space Flight Center, USA; Truszkowski, Walter F., NASA Goddard Space Flight Center, USA; 1999; 8p; In English; Space Technology, 28-30 Sep. 1999, Albuquerque, NC, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy

This paper describes strategies we are pursuing to address nanosatellite information systems challenges. These challenges are mainly: severely constrained onboard resources, infrequent communications opportunities, and the number of spacecraft that must be managed in future NASA constellation missions. Among these strategies are designing intrinsically autonomous subsystems that operate reliably with minimal processor load. These and other subsystems and tasks will be incorporated into an agent-based infrastructure. A community of onboard and ground-based agents will manage these spacecraft components in a coordinated manner to accomplish a maximal-science goal.

Author

Information Systems; Information Transfer; Information Flow; Systems Management; Nanosatellites; Satellite Constellations; End-to-End Data Systems

19990064473 Defense Systems Management School, Acquisition Policy Dept., Fort Belvoir, VA USA
Glossary: Defense Acquisition Acronyms and Terms
Nov. 1998; 163p; In English
Report No.(s): AD-A365283; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

This Glossary contains most acronyms, abbreviations, and terms commonly used in the weapon systems acquisition process within the Department of Defense (DoD) and defense industries.
DTIC
Abbreviations; Dictionaries; Terms

19990065303 NASA Langley Research Center, Hampton,VA USA
NASA Patent Abstracts: A Continuing Bibliography, Supplement 55
July 1999; 78p; In English
Report No.(s): NASA/SP-1999-7039/SUPPL55; NAS 1.21:7039/SUPPL55; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.
Derived from text
Bibliographies; Data Bases

19990066652 NASA Marshall Space Flight Center, Huntsville, AL USA
The Process of Science Communications at NASA/Marshall Space Flight Center
Horack, John M., NASA Marshall Space Flight Center, USA; Treise, Deborah, Florida Univ., USA; 1998; 1p; In English; Public Communication of Science and Technology, 17-19 Sep. 1998, Berlin, Germany; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The communication of new scientific knowledge and understanding is an integral component of science research, essential for its continued survival. Like any learning- based activity, science cannot continue without communication between and among peers so that skeptical inquiry and learning can take place. This communication provides necessary organic support to maintain the development of new knowledge and technology. However, communication beyond the peer-community is becoming equally critical for science to survive as an enterprise into the 21st century. Therefore, scientists not only have a 'noble responsibility' to advance and communicate scientific knowledge and understanding to audiences within and beyond the peer-community, but their fulfillment of this responsibility is necessary to maintain the survival of the science enterprise. Despite the critical importance of communication to the viability of science, the skills required to perform effective science communications historically have not been taught as a part of the training of scientist, and the culture of science is often averse to significant communication beyond the peer community. Thus scientists can find themselves ill equipped and uncomfortable with the requirements of their job in the new millennium. At NASA/Marshall Space Flight Center, we have developed and implemented an integrated science communications process, providing an institutional capability to help scientist accurately convey the content and meaning of new scientific knowledge to a wide variety of audiences, adding intrinsic value to the research itself through communication, while still maintaining the integrity of the peer-review process. The process utilizes initial communication through the world-wide web at the site http://science.nasa.gov to strategically leverage other communications vehicles and to reach a wide-variety of audiences. Here we present and discuss the basic design of the science communications process, now in operation for nearly two years. Serving scientists in Earth Science, Microgravity Science, and Space Science. Critical features of the design are illustrated, and essential skills required to operate the process are defined. Measures of success will also be presented.
Author
Communication; Knowledge; Scientists; Design Analysis; Information Transfer

19990066678 ANSER Corp., Arlington, VA USA
Export Rules for the Test and Evaluation Professional
Tagge, Norbert B., ANSER Corp., USA; Maier, Martin T., ANSER Corp., USA; Jan. 1999; 7p; In English
Report No.(s): AD-A364877; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Basic knowledge of the US International Traffic in Arms Regulations (ITAR) is in the Test and Evaluation (T&E) professional's best interests. Compliance with the ITAR on some projects may be necessary and may seem burdensome, even frustrating. But non-compliance is not an option. While not an all-encompassing primer on import/export regulations, this paper serves as a wake up and reminder on key requirements, and highlights some of the current rules.
DTIC
International Trade; Regulations; Weapon Systems

19990067266 Space and Naval Warfare Systems Command, San Diego, CA USA
Hypermedia Potentials for Analysis Support Tools
Lange, D. S., Space and Naval Warfare Systems Command, USA; Feb. 1999; 4p; In English
Report No.(s): AD-A364972; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

The analytical process in many domains is one of associating pieces of preexisting data to form new information. Where the individual data elements are multimedia files, database entries, and computer based models, hypermedia architectures provide natural support for such a process. This paper describes aspects of analysis support that dictate particular requirements in a hypermedia based system. Adaptations of techniques from published hypermedia research were indicated by these requirements. Key among these techniques were anchoring as presented in the Dexter model, perspective filtering and navigation from graph based hypermedia, link typing from rich hypermedia, and the system structure of open hypermedia systems.
DTIC
Data Management; Computerized Simulation; Hypertext; Knowledge Based Systems; Multimedia

19990067267 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Analysis of N-Tier Architecture Applied to Distributed-Database Systems
Valente, Alexandre G., Air Force Inst. of Tech., USA; Jun. 15, 1999; 172p; In English
Report No.(s): AD-A364974; AFIT/GCS/ENG/99J-04; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

N-tier architecture has been more commonly used as a methodology for developing large database applications. This work evaluates the use of this architecture instead of the classical Client/Server architecture in developing corporate applications based on distributed databases. The comparison between architectures is performed using applications that execute transactions similar to those defined in the Transaction Process Council Type C benchmark (TPC-C). The environment used for development and testing was the AFIT Bimodal Cluster (ABC); a heterogeneous cluster of PCs, running Microsoft Windows NT 4.0 OS. The comparative experimental analysis demonstrated that the N-tier architecture allows more efficient bandwidth utilization between client and server machines, with similar performance. Results led to conclusion that the N-tier architecture is better suited than the Client/Server for use in corporate systems interconnected by low bandwidth Wide Area Networks (WANs), such as the Internet.
DTIC
Architecture (Computers); Distributed Processing; Data Bases; Internets

19990067269 Human Resources Research Organization, Alexandria, VA USA
Documentation and Archival of Selected ARI Data Bases, Phase 2 ***Final Report, 2 Apr. 1997 - 30 Aug. 1998***
DiFazio, Ani S.; Young, Winnie Y.; Driessen, Dianne P.; Peck, Donna; Gade, Paul A.; Jun. 1999; 70p; In English
Contract(s)/Grant(s): MDA903-93-D-0032
Report No.(s): AD-A364998; HUMRRO-FR-EADD-98-53; ARI-RN-99-30; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Since 1975, the US Army Research Institute (ARI) has collected a wide array of Manpower Personnel Research (MPR) and Training data in support of its research activities. Until this current effort, there were no formal procedures or guidelines for documenting and archiving these numerous databases. The ability of new users to access and use extant ARI data was heavily dependent on the knowledge of those ARI staff members who worked most closely with the data. With organization turnover and downsizing, critical information needed to access and use data would have been lost over time. This project had two phases. The first Phase developed documentation and archive standards for extant and future ARI data. Phase 2, the focus of this report, applied those standards to specified extant data. The technical approach and procedures used in Phase 2 of this project is the subject of this report.
DTIC
Data Bases; Data Management

19990069604 George Washington Univ., School of Law, Washington, DC USA
The International Legal Limitations On Information Warfare
O'Brien, Gregory J.; May 24, 1998; 85p; In English
Report No.(s): AD-A365127; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

We live in an age that is driven by information. Technological breakthroughs... are changing the face of war and how we prepare for war. Information war has no front line. Potential battlefields are anywhere networked systems allow access to oil and as pipelines, for example, electric power grids, telephone switching networks. In sum, the US homeland may no longer provide a sanctuary from outside attack. A panel of Defense Department experts recently warned the nation about the prospect of an electronic Pearl Harbor, a crippling sneak attack on the nation's defense and civilian information systems in which "cyberterrorists"

and other unknown assailants cripple the nation's, or the world's, computer-networked communications, financial, and national defense systems.
DTIC
Warfare; Information Systems; International Law

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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.

19990064330 Norwegian Defence Research Establishment, Kjeller, Norway
The Quest for Regional Security in the Southern Mediterranean: The Role of European and Arab Security Organisations
Lia, Brynjar, Norwegian Defence Research Establishment, Norway; May 11, 1999; 129p; In English
Contract(s)/Grant(s): FFISYS Proj. 733/410
Report No.(s): FFI/RAPPORT-99/02252; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report surveys the spectrum of security challenges emanating from the Southern Mediterranean region, and the broad range of European security policy responses to these challenges with a particular emphasis on the Euro- Mediterranean initiatives and dialogues, launched during the 1990s. As European security organisations have increasingly begun to see security challenges in the Southern Mediterranean region as a future task of considerable importance, the report examines the scope and results of the Euro-Mediterranean dialogues, including a survey of Arab responses to these initiatives. The role of Arab regional and sub-regional organisations is also viewed. In conclusion, it is argued that the scope for future co-operation and integration is circumscribed by a number of factors, not the least the authoritarian nature of the regimes in the South, and the inability of the Mediterranean projects in fusing a common identity.
Author
Security; Surveys; Organizations

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URBAN TECHNOLOGY AND TRANSPORTATION

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

19990064466 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA'S Changing Role in Technology Development and Transfer
Griner, Carolyn S., NASA Marshall Space Flight Center, USA; Craft, Harry G., Jr., NASA Marshall Space Flight Center, USA; 1997; In English; International Aeronautical Congress, 6-10 Oct. 1997, Turin, Italy
Report No.(s): IAF-97-U.5.02; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

National Aeronautics and Space Administration NASA has historically had to develop new technology to meet its mission objectives. The newly developed technologies have then been transferred to the private sector to assist US industry's worldwide competitiveness and thereby spur the US economy. The renewed emphasis by the US Government on a proactive technology transfer approach has produced a number of contractual vehicles that assist technology transfer to industrial, aerospace and research firms. NASA's focus has also been on leveraging the shrinking space budget to accomplish "more with less." NASA's cooperative agreements and resource sharing agreements are measures taken to achieve this goal, and typify the changing role of government technology development and transfer with industry. Large commercial partnerships with aerospace firms, as typified by the X-33 and X-34 Programs, are evolving. A new emphasis on commercialization in the Small Business Innovative Research and Dual Use programs paves the way for more rapid commercial application of new technologies developed for NASA.
Author
Technology Assessment; Technology Transfer; NASA Programs; Commercialization

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ASTRONOMY

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

19990064340 NASA Goddard Space Flight Center, Greenbelt, MD USA
XTE J1946+274 = GRO J1944+26
Smith, D. A., Massachusetts Inst. of Tech., USA; Takeshima, T., NASA Goddard Space Flight Center, USA; International Astronomical Union Circular; [1998]; In English
Report No.(s): IAUC-7014; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

C. A. Wilson, M. H. Finger, R. S. Wilson, and D. M. Scott, Marshall Space Flight Center, NASA, report for the BATSE team: ”Pulsations from a previously-uncatalogued x-ray pulsar in the Vul-Cyg region have been detected with BATSE in the energy band 20-50 keV from Sept. 8 through Sept. 14. A preliminary location (95-percent confidence) is bounded by R.A. = 19h 34m to 19h 54m and Decl. = +22o.5 to +30o.5 (equinox 2000.0). GRO J1944+26 rose from a 20-50-keV rms pulsed flux of is less than 15 mCrab on Sept. 7 to 27 +/- 3 mCrab on Sept. 13. Observations between Sept. 8 and 14 are consistent with a barycentric pulse frequency of 0.06315331 (6) Hz on Sept. 11.0 UT, with a frequency derivative of 2.2(2) x 10(exp -12) Hz/s. The pulse profile in the band 20-50 keV has a single asymmetric peak.
Author (revised)
X Rays; X Ray Sources; Pulsars; Position (Location); Cygnus Constellation; Radio Astronomy; Radio Bursts

19990064446 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
The Scientific Impact of the GHRS on our Understanding of the Local Interstellar Medium
Linsky, Jeffrey L., Colorado Univ., USA; Wood, Brian E., Colorado Univ., USA; Scientific Impact of the Goddard High Resolution Spectrograph; 1998; Volume 143, pp. 197-212; In English; Sponsored by NASA Goddard Space Flight Center, USA
Contract(s)/Grant(s): GO-5323.01-93A; GO-06067.01-94A; NASA Order S-56460-D; Copyright; Avail: Issuing Activity, Hardcopy

A high-resolution echelle grating and low-noise Digicon detectors make the GHRS an excellent instrument for studying ultraviolet absorption lines formed in the local interstellar medium (LISM). The GHRS has observed interstellar gas absorption along several dozen fines of sight toward stars; many of these stars are located within 100 pc of the Sun and thus sample the LISM properties quite well. We will summarize how the analysis of these beautiful echelle spectra permit us to study four important but closely interrelated topics about the LISM: (1) the dynamics and structure of the warm interstellar clouds, (2) the temperature, density, and other physical properties of the gas, (3) the chemical composition and chemical depletions in the gas phase, and (4) the interaction of the interstellar gas with the ionized hot winds of the Sun and other stars.
Author
Interstellar Matter; Interstellar Gas; Ultraviolet Absorption; Low Noise; Depletion

19990064558 California Inst. of Tech., Pasadena, CA USA
Physical Conditions in Shocked Regions of Regions of Orion from Ground-Based Observation of H2O, *1994-2004*
Cernicharo, J., Consejo Superior de Investigaciones Cientificas, Spain; Pardo, Juan R., California Inst. of Tech., USA; Gonzalez–Alfonso, Eduardo, Consejo Superior de Investigaciones Cientificas, Spain; Serabyn, Eugene, California Inst. of Tech., USA; Phillips, Thomas G., California Inst. of Tech., USA; Benford, Dominic J., California Inst. of Tech., USA; Mehringer, David, California Inst. of Tech., USA; [1998]; 11p; In English; Sponsored in part by the Spanish DGES
Contract(s)/Grant(s): PB96-0883; ESP98-1351E; NSF AST-96-15025; Copyright; Avail: Issuing Activity, Hardcopy

We present observations of the 5(sub 1,5)yields 4(sub 2,2) transition of water vapor at 325.15 GHz taken with the CSO telescope towards Orion IRc2. The emission is more extended than that of other molecular species such as CH3OH. However, it is much less extended than the emission of water vapor at 183.31 GHz reported. A comparison of the line intensities at 325.15 GHz and 183 .31 GHz puts useful constraints on the density and temperature of the emitting regions and allows an estimate of H2O abundance, x(H2O), of approx. = 10(exp -4) in the Plateau and approx. = 10(exp -6) - 10(exp -5) in the Ridge.
Author
Orion Nebula; Observation; Water Vapor; Transition; Atmospheric Chemistry

19990064614 NASA Goddard Space Flight Center, Greenbelt, MD USA
Proceedings of the Workshop on the Spectrophotometric Dating of Stars and Galaxies
Hubeny, Ivan, NASA Goddard Space Flight Center, USA; Heap, Sara, NASA Goddard Space Flight Center, USA; Cornett, Robert, NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 25-29 Apr. 1999, Annapolis, MD, USA; Copyright; Avail:

Issuing Activity, Hardcopy; Abstract Only

In the past decade, we have seen an avalanche of new observational results from space observatories and ground-based observatories. These observations have revealed young globular clusters in the cores of merger galaxies, elliptical galaxies at redshifts up to z=1.5, and starburst galaxies at high redshift. Analyses of the detailed spectra or color- magnitude diagrams of these systems promise to give a new understanding of evolutionary processes and to provide a check on cosmological ages. At the same time, these new spectro-photometric data present new challenges to current methods of spectral analysis and modeling.At the Workshop, we will discuss these new opportunities and challenges on spectro-photometric dating of stars and galaxies.

Author

Data Acquisition; Galaxies; Stars; Cosmology; Galactic Clusters; Globular Clusters; Spectrum Analysis; Stellar Spectrophotometry

19990064647 NASA Marshall Space Flight Center, Huntsville, AL USA

The Study of Neutrons Stars with the Chandra X-Ray Observatory

Weisskopf, Martin C., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; The Neutron Star-Black Hole Connection, 10 Jun. 1999, Crete, Greece; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Dr. Weisskopf will lecture on the use of the Chandra X-Ray Observatory to study neutron stars (and black holes). He will draw on the proposal preparation tool made public by NASA through the Chandra X-Ray Science Center to walk students through the details of the process. Technical examples of studies of several types of neutron star systems (isolated, Be-star, low mass, high-mass) will be used as illustrations and in this way he will tie the physics to the observatory.

Author

Neutron Stars; X Ray Astrophysics Facility; Astrophysics; X Ray Astronomy; X Ray Stars

19990066713 National Optical Astronomy Observatories, Tucson, AZ USA

The Photometry of Undersampled Point Spread Functions

Lauer, Tod R., National Optical Astronomy Observatories, USA; August 1999; 22p; In English

Report No.(s): NOAO-Preprint-851; Copyright; Avail: Issuing Activity, Hardcopy

An undersampled point spread function may interact with the microstructure of a solid-state detector such that the total flux detected can can depend sensitively on where the PSF center falls within a pixel. Such intra-pixel sensitivity variations will not. be corrected by flat field calibration and may limit the accuracy of stellar photometry conducted with undersampled images, as are typical for hubble Space Telescope observations. The total flux in a stellar image can vary by up to 0.03 mag in F555\V WFC images depending on how it is sampled, for example. For NIC3, these variations are especially, strong, up to 0.39 mag, strongly limiting its use for stellar photometry. Intra-pixel sensitivity variations can be corrected for, however, by constructing a well-sampled PSF from a dithered data set. The reconstructed PSF is the convolution of the optical PSF with the pixel response. It can be evaluated at any desired fractional pixel location to generate a table of photometric corrections as a function of relative PSF centroid. A caveat, is that the centroid of an undersample PSF can also be affected by the pixel response function, thus sophisticated centroiding methods, such as cross-correlating the observed PSF with its fully-sampled counterpart, are required to derive the proper photometric correction.

Author

Photometry; Calibrating; Correction; Pixels; Point Spread Functions

19990067632 NASA Goddard Space Flight Center, Greenbelt, MD USA

HST Multi Layer Insulation Failure Review Board Findings

Townsend, Jacqueline, NASA Goddard Space Flight Center, USA; Hansen, Patricia, NASA Goddard Space Flight Center, USA; 1998; In English; 1998 SEE Flight Experiments, 23-25 Jun. 1998, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The mechanical and optical properties of the thermal control materials on the Hubble Space Telescope (HST) have degraded over the nearly seven years the telescope has been in orbit. Astronaut observations and photographs from the Second Servicing Mission (SM2) revealed large cracks in the metallized Teflon fluorinated ethylene propylene (FEP), the outer layer of the multi-layer insulation (MLI), in many locations around the telescope. Also, the absorptance of the bonded metallized Teflon FEP radiator surfaces of the telescope has increased over time. A Failure Review Board was established to determine the damage mechanism and to identify a replacement material. Samples of the top layer of the MLI and radiator material were retrieved during SM2, and a thorough investigation into the degradation followed in order to determine the primary cause of the damage. Mapping of the cracks on HST and the ground testing showed that thermal cycling with deep-layer damage from electron and proton radiation are necessary to cause the observed embrittlement. Further, strong evidence was found indicating that chain scission (reduced

molecular weight) is the dominant form of damage to the metallized Teflon FEP. Given the damage to the outer layer of the multilayer insulation (MLI) that was apparent during the second servicing mission (SM2), the decision was made to replace the outer layer during subsequent servicing missions. The replacement material had to meet the stringent thermal requirements of the spacecraft and maintain structural integrity for at least ten years. Ten candidate materials were exposed to simulated orbital environments and a replacement material was selected. This presentation will summarize the FRB results, in particular, the analysis of the retrieved specimens, the results of the simulated environmental exposures, and the selection of the replacement material. The NASA Space Environments and Effects community needs to hear these results because they reveal that Teflon (FEP) films should not be used in LEO as routinely as they are today.
Author
Cracks; Damage; Embrittlement; Multilayer Insulation; Teflon (Trademark); Damage Assessment; Degradation; Fatigue (Materials); Cleavage

19990067826 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Low-Mass X-Ray Binary X1832-330 in the Globular Cluster NGC 6652: A Serendipitous ASCA Observation
Mukai, Koji, NASA Goddard Space Flight Center, USA; Smale, Alan P., NASA Goddard Space Flight Center, USA; [1999]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Low Mass X-ray Binary (LMXB) X1832-330 in NGC 6652 is one of about 10 bright X-ray sources to have been discovered in Globular Clusters. We report on a serendipitous ASCA observation of this Globular Cluster LMXB, during which a Type I burst was detected and the persistent, non-burst emission of the source was at its brightest level recorded to date. No orbital modulation was detected, which argues against a high inclination for the X1832-330 system. The spectrum of the persistent emission can be fit with a power law plus a partial covering absorber, although other models are not ruled out. Our time-resolved spectral analysis through the burst shows, for the first time, clear evidence for spectral cooling from kT = 2.4 +/- 0.6 keV to kT = 1.0 +/- 0.1 keV during the decay. The measured peak flux during the burst is approximately 10% of the Eddington luminosity for a 1.4 Solar Mass neutron star. These are characteristic of a Type I burst, in the context of the relatively low quiescent luminosity of X1832-330.
Author
X Ray Binaries; Neutron Stars; X Rays; X Ray Astronomy; Globular Clusters

19990067835 NASA Goddard Space Flight Center, Greenbelt, MD USA
Next Generation User Support Tools
Jones, Jeremy E., NASA Goddard Space Flight Center, USA; Nov. 23, 1998; 1p; In English; Spacecraft Ground Control and Data Systems, Feb. 1999, Iguassu Falls, Brazil; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

One of the manually intensive efforts of Hubble Space Telescope (HST) observing is the specification and validation of the detailed proposals for scientists observing with the telescope. In order to meet the operational cost objectives for the Next Generation Space Telescope (NGST), this process needs to be dramatically less time consuming and less costly. We have prototyped a new proposal development system, the Scientist's Expert Assistant (SEA), using a combination of artificial intelligence and user interface techniques to reduce the time and effort involved for both scientists and the telescope operations staff. The Advanced Architectures and Automation Branch of NASA's Goddard Space Flight Center is working with the Space Telescope Science Institute (ST ScI) to explore SEA alternatives. We are testing the usefulness of rule-based expert systems to painlessly guide a scientist to his or her desired observation specification. We are also examining several potential user interface paradigms and exploring data visualization schemes to see which techniques are more intuitive. Our prototypes will be validated using HST's Advanced Camera for Surveys (ACS) instrument (scheduled for installation in 1999) as a live test instrument. Having an operational test-bed will ensure the most realistic feedback possible for the prototyping cycle. In addition, once the NGST instruments are better defined, the SEA will already be a proven platform that simply needs adapting to NGST-specific instruments.
Author
Cameras; Expert Systems; Hubble Space Telescope; Telescopes; Spaceborne Telescopes; Human-Computer Interface; Scientific Visualization

19990068010 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Radiometric Calibration of the NASA Advanced X-Ray Astrophysics Facility
Kellogg, Edwin M., Smithsonian Astrophysical Observatory, USA; 1999; 1p; In English; Hermann von Helmholtz Symposium, 28 Mar. - 1 Apr. 1999, Berlin, Germany
Contract(s)/Grant(s): NAS8-39073; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present the results of absolute calibration of the quantum efficiency of soft x-ray detectors performed at the PTB/BESSY beam lines. The accuracy goal is 1%. We discuss the implementation of that goal. These detectors were used as transfer standards to provide the radiometric calibration of the AXAF X-ray observatory, to be launched in April 1999.
Author
Accuracy; Calibrating; Radiometers; X Ray Astrophysics Facility; X Ray Telescopes; Spaceborne Astronomy; X Ray Astronomy; Astrophysics

19990068011 NASA Marshall Space Flight Center, Huntsville, AL USA
The X-Ray, Optical and Infrared Counterpart to GRB 980703
Vreeswijk, P. M., Amsterdam Univ., Netherlands; Galama, T. J., Amsterdam Univ., Netherlands; Owens, A. N., European Space Research and Technology Centre, Netherlands; Oosterbroek, T., European Space Research and Technology Centre, Netherlands; Geballe, T., Joint Astronomy Centre, USA; Hawarden, T., Joint Astronomy Centre, USA; vanParadijs, J., Amsterdam Univ., Netherlands; Groot, P., Amsterdam Univ., Netherlands; Kouveliotou, C., Universities Space Research Association; Koshut, T., Universities Space Research Association; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We report on our X-ray, optical and infrared follow-up observations of GRB980703. A previously unknown X-ray source in the GRB error box displays a powerlaw decline with index alpha= -1.0,5(exp +0.24 sub -0.29), fairly consistent with the average optical/infrared decay index alpha = -1.61 plus or minus 0.12. We invoke host galaxy extinction to match the observed spectral slope with the slope expected from 'fireball' models. The hypothesis that between 1998 July 4.4 and 8.4 UT no spectral breaks are present in the infrared to X-ray spectral range is in good agreement with the observations. For these two epochs we obtain an extinction of A(sub v) = 1.50 +/- 0.11 (July 4.4) and A(sub v) = 0.85 +/- 0.26 (July 8.4). From the X-ray data we estimate the optical extinction to be A(sub v) = 20.2(+12.3/-7.3), inconsistent with the former value. Optical spectra we took confirm the redshift of z=0.966 found by Djorgovski et al. We compare the afterglow of GRB 980703 with that of GRB 970508 and find that the fraction of the energy in the magnetic field is much lower in the case of GRB 980703.
Author
Afterglows; Infrared Radiation; Spectra; Gamma Ray Bursts; X Ray Astronomy; Infrared Astronomy

19990068019 Tuebingen Univ., Institut fuer Astronomie und Astrophysik, Germany
Low Luminosity States of the Black Hole Candidate GX 339-4, 1, ASCA and Simultaneous Radio/RXTE Observations
Wilms, Joern, Tuebingen Univ., Germany; Nowak, Michael A., Colorado Univ., USA; Dove, James B., Colorado Univ., USA; Fender, Robert P., Amsterdam Univ., Netherlands; DiMatteo, Tiziana, Institute of Astronomy, UK; Oct. 12, 1998; 18p; In English
Contract(s)/Grant(s): NAG5-4731; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We discuss a series of observations of the black hole candidate GX 339-4 in low luminosity, spectrally hard states. We present spectral analysis of three separate archival Advanced Satellite for Cosmology and Astrophysics (ASCA) data sets and eight separate Rossi X-ray Timing Explorer (RXTE) data sets. Three of the RXTE observations were strictly simultaneous with 843 Mega Hertz and 8.3-9.1 Giga Hertz radio observations. All of these observations have (3-9 keV) flux approximately less than 10(exp-9) ergs s(exp-1) CM(exp -2). The ASCA data show evidence for an approximately 6.4 keV Fe line with equivalent width approximately 40 eV, as well as evidence for a soft excess that is well-modeled by a power law plus a multicolor blackbody spectrum with peak temperature approximately equals 150-200 eV. The RXTE data sets also show evidence of an Fe line with equivalent widths approximately equal to 20-1OO eV. Reflection models show a hardening of the RXTE spectra with decreasing X-ray flux; however, these models do not exhibit evidence of a correlation between the photon index of the incident power law flux and the solid angle subtended by the reflector. 'Sphere+disk' Comptonization models and Advection Dominated Accretion Flow (ADAF) models also provide reasonable descriptions of the RXTE data. The former models yield coronal temperatures in the range 20-50 keV and optical depths of r approximately equal to 3. The model fits to the X-ray data, however, do not simultaneously explain the observed radio properties. The most likely source of the radio flux is synchrotron emission from an extended outflow of extent greater than O(10 (exp7) GM/c2).
Author
X Ray Astronomy; Black Holes (Astronomy); X Ray Stars; Binary Stars; Accretion Disks

19990068020 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
Low Luminosity States of the Black Hole Candidate GX 339-4, 2, Timing Analysis
Nowak, Michael A., Colorado Univ., USA; Wilms, Joern, Tuebingen Univ., Germany; Dove, James B., Colorado Univ., USA; 19990101; 14p; In English
Contract(s)/Grant(s): NAG5-3225; NAG5-4731; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Here we present timing analysis of a set of eight Rossi X-ray Timing Explorer (RXTE) observations of the black hole candidate GX 339-4 that were taken during its hard/low state. On long time scales, the RXTE All Sky Monitor data reveal evidence of a 240 day periodicity, comparable to timescales expected from warped, precessing accretion disks. On short timescales all observations save one show evidence of a persistent f(qpo approximately equals 0.3 Hz quasi-periodic oscillations (QPO)). The broad band (10 (exp -3) to 10 (exp2) Hz) power appears to be dominated by two independent processes that can be modeled as very broad Lorentzians with Q approximately less than - 1. The coherence function between soft and hard photon variability shows that if these are truly independent processes, then they are individually coherent, but they are incoherent with one another. This is evidenced by the fact that the coherence function between the hard and soft variability is near unity between 5 x 10 (exp -3) but shows evidence of a dip at f approximately equals 1 Hz. This is the region of overlap between the broad Lorentzian fits to the Power Spectral Density (PSD). Similar to Cyg X-1, the coherence also drops dramatically at frequencies approximately greater than 1O Hz. Also similar to Cyg X-1, the hard photon variability is seen to lag the soft photon variability with the lag time increasing with decreasing Fourier frequency. The magnitude of this time lag appears to be positively correlated with the flux of GX 339-4. We discuss all of these observations in light of current theoretical models of both black hole spectra and temporal variability.
Author

Black Holes (Astronomy); Cygnus Constellation; Periodic Variations; X Ray Binaries; X Ray Stars; Fourier Analysis; Accretion Disks

19990068021 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA

ASCA and Radio/RXTE Observations of GX 339-4 ***Final Report***

Nowak, M. A., Colorado Univ., USA; Wilms, J., Tuebingen Univ., Germany; Dove, J. B., Colorado Univ., USA; Fender, R. P., Amsterdam Univ., Netherlands; Jan. 26, 1999; 8p; In English

Contract(s)/Grant(s): NAG5-4731; NAG5-3225; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have analyzed three separate archival Advanced Satellite for Cosmology and Astrophysics (ASCA) observations and eight separate Rossi X-ray Timing Explorer (RXTE) observations of the black hole candidate GX 339-4 in its low luminosity, spectrally hard state. Three of the RXTE observations were strictly simultaneous with 843 MHz and 8.3- 9.1 GHz radio observations. All data sets show evidence for an approximately 6.4 keV Fe line with equivalent widths approximately 20-100 eV. 'Reflection models' show a hardening of the RXTE spectra with decreasing X-ray flux; however, these models do not exhibit evidence of a correlation between the photon index of the incident power law flux and the solid angle subtended by the reflector. None of the models fit to the X-ray data, however, simultaneously explain the observed radio properties. We argue that the spatial extent of the observed radio emission is at least 0(10(exp 7 GM/c squared). Timing analysis reveals that all observations save one show evidence of a persistent f(qpo approximately equals 0.3 Hz quasi-periodic oscillations(quasi-periodic oscillations)). The broad band (10-3-102 Hz) power appears to be dominated by two independent processes that can be modeled as very broad Lorentzians with Q approximately less than 1. Similar to Cyg X-1, the hard photon variability is seen to lag the soft photon vaxiability with the lag time increasing with decreasing Fourier frequency. The magnitude of this time lag is seen to be positively correlated with the flux of GX 339-4.
Author

X Ray Binaries; X Ray Stars; X Ray Astronomy; Accretion Disks; Radio Astronomy; Black Holes (Astronomy)

19990068739 Amsterdam Univ., Astronomical Inst., Netherlands

On the Nature of XTE J0421+560/CI Cam

Belloni, T., Amsterdam Univ., Netherlands; vandenAncker, M., Amsterdam Univ., Netherlands; Dieters, S., Alabama Univ., USA; Fender, R., Amsterdam Univ., Netherlands; Fox, D. W., Massachusetts Inst. of Tech., USA; Kommers, J. M., Massachusetts Inst. of Tech., USA; Lewin, W. H. G., Massachusetts Inst. of Tech., USA; VanParadijs, J., Amsterdam Univ., Netherlands; 1999; 1p; In English; Sponsored by American Astronomical Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present the results of the analysis of RXTE, BATSE and optical/IR data of the 1998 outburst of the x-ray transient system XTE J0421+650. The x-ray outburst shows a very fast decay initial e-folding time approximately 0.5 days, slowing down to about 2.3 days). The X ray spectrum in the 2-25 keV band is thermal, softening considerably during decay. Intrinsic absorption is observed, also strongly variable. A strong iron line at around 6.7 keV is observed. No fast time variability is observed (is less than 0.1 rms in the 1-4906 Hz band at peak). The analysis of optical/IR data suggest that the secondary is a b[e] star and place the system at a distance of about 2 kpc. At this distance the 2-25 keV luminosity is about 5 x 10(exp 37) erg/seconds. We compare the properties of this system with those of the Be/NS LMC transient A 0538-66 and suggest that CI cam is of a similar nature. The presence of strong radio emission during outburst indicates that the compact object could be a black hole.
Author

Black Holes (Astronomy); X Ray Astronomy; Gamma Ray Astronomy; X Ray Binaries; Accretion Disks; X Ray Stars

19990069626 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Hard X-Ray and Wide Focusing Telescopes ***Annual Report, 31 Jul. 1998 - 30 Jul. 1999***
Gorenstein, Paul, Smithsonian Astrophysical Observatory, USA; July 1999; 8p; In English
Contract(s)/Grant(s): NAG5-5095; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The subject of this program are the development of two new type of X-ray telescopes, the wide field telescope, and the hard X-ray telescope.

Author

Product Development; Design Analysis; X Ray Telescopes; Solid State Devices; Gamma Ray Bursts

19990069910 Space Telescope Science Inst., Baltimore, MD USA
An Atlas of OB Spectra from 1000 to 1200 A
Walborn, Nolan R., Space Telescope Science Inst., USA; Bohlin, Ralph C., Space Telescope Science Inst., USA; Publications of the Astronomical Society of the Pacific; June 1996; Volume 8, pp. 477-487; In English
Contract(s)/Grant(s): NAG8-1076; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Copernicus low-resolution (0.2 A) observations of 16 O stars, 10 B stars (mostly supergiants), and one WN-A star with the highest data quality between 1000 and 1200 A are presented in the form of a classical spectral atlas. The purpose is to survey the systematic spectral-type/luminosity-class dependence of the line features, including those from the stellar winds, in this relatively less-studied wavelength range. Perhaps the most important new contribution is the demonstration of the pronounced luminosity effect in the S IV lambda.lambda 1063, 1073 wind profiles, identical to those previously recognized in Si IV lambda.lambda 1394, 1403 and C III lambda 1176, which share essentially the same ionization potential. The stellar-wind effects in O VI lambda.lambda 1032, 1038; P V lambda.lambda 1118, 1128; Si IV lambda.lambda 1122, 1128; and C III lambda 1176 are also described. Attention is redrawn to the unidentified feature at 1099 A, which is one of the strongest absorption lines in this range of mid-O through early-B spectra. The atlas will facilitate interpretations of recent Hopkins Ultraviolet Telescope and future Far Ultraviolet Spectroscopic Explorer observations in this wavelength range, as well as sharpen the stellar-wind phenomenology for astrophysical analysis.

Author

B Stars; O Stars; Supergiant Stars; Main Sequence Stars; Astrophysics; Early Stars; Late Stars

19990069940 Columbia Univ., Columbia Astrophysics Lab., New York, NY USA
Investigating the Extraordinary X-Ray Variability of the Infrared Quasar IRAS 13349+2439 ***Final Report, 1 Feb. 1998 - 31 Jan. 1999***
Leighly, Karen M., Columbia Univ., USA; Jul. 17, 1999; 6p; In English
Contract(s)/Grant(s): NAG5-6920
Report No.(s): CAL-3119; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We observed the luminous quasar IRAS 13349+2439 using RXTE (X Ray Timing Explorer) in order to search for rapid variability. Unfortunately, the source was in a low state during the observation (PCA count rate approximately 1 - 2 counts/s). It was therefore somewhat weak for RXTE and detailed analysis proved to be difficult.

Author

Infrared Radiation; Infrared Sources (Astronomy); Quasars; Radio Astronomy; X Ray Sources; X Ray Astronomy

19990069941 Columbia Univ., Columbia Astrophysics Lab., New York, NY USA
Variability and Spectral Studies of Luminous Seyfert 1 Galaxy Fairall 9. Search for the Reflection Component is a Quasar: RXTE and ASCA Observation of a Nearby Radio-Quiet Quasar MR 2251-178 ***Final Report, 15 Apr. 1997 - 14 Apr. 1998***
Leighly, Karen M., Columbia Univ., USA; Jul. 17, 1999; 10p; In English
Contract(s)/Grant(s): NAG5-4112
Report No.(s): CAL-3121; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Monitoring observations with interval of 3 days using RXTE (X Ray Timing Explorer) of the luminous Seyfert 1 galaxy Fairall 9 were performed for one year. The purpose of the observations were to study the variability of Fairall 9 and compare the results with those from the radio-loud object 3C 390.3. The data has been received and analysis is underway, using the new background model. An observation of the quasar MR 2251-178 was made in order to determine whether or not it has a reflection component.

Older background models gave an unacceptable subtraction and analysis is underway using the new background model. The observation of NGC 6300 showed that the X-ray spectrum from this Seyfert 2 galaxy appears to be dominated by Compton reflection.
Author
Seyfert Galaxies; Infrared Radiation; Infrared Spectra; X Ray Spectra; Stellar Spectra; X Ray Astronomy; X Ray Sources

90
ASTROPHYSICS

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

19990064367 Eureka Scientific, Inc., Oakland, CA USA
Transient Infall Events in the Disk of AB Aurigae: The Beta Pictoris Phenomenon at 2-4 Mega Years
Grady, C. A., Eureka Scientific, Inc., USA; Perez, Mario R., Space Applications Corp., USA; Bjorkman, K. S., Ritter Observatory, USA; Massa, D., Hughes STX, Inc., USA; Astrophysical Journal; Feb. 01, 1999; Volume 511, pp. 925-931; In English
Contract(s)/Grant(s): NASw-4756; Copyright; Avail: Issuing Activity, Hardcopy

Surveys of Herbig Ae/Be stars have indicated that infalling circumstellar gas similar to that routinely detected toward beta Pic is preferentially observed close to the disk midplane. Recent millimeter interferometry of the historically prototypical Herbig Ae star, AB Aur, indicates that this star is viewed slightly above the disk midplane (i = 76 deg). The wealth of archival spectroscopic data for this star makes it an ideal test of the geometry for infalling or accreting gas in these stars. We present a review of the extant IUE and Hubble Space Telescope GHRS spectral data for AB Aur and find, in contrast to previous studies of this star, which focused on Mg II, that infalling gas is detected at all epochs with covering factors similar to those reported for HD 100546 and that an episode of enhanced infall was serendipitously detected during the 1990 monitoring run.
Author
A Stars; B Stars; Herbig-Haro Objects; Stellar Composition; Stellar Radiation; Stellar Spectra; Emission Spectra; Spectral Emission; Auriga Constellation; Accretion Disks; Stellar Mass Accretion; Stellar Envelopes

19990064399 NASA Marshall Space Flight Center, Huntsville, AL USA
Superluminal Jets and Other Properties of Black Holes Binaries
Harmon, Alan, NASA Marshall Space Flight Center, USA; 1997; In English, 24-27 Jul. 1997, New York, NY, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Discoveries in the past few years of radio jets in Galactic black hole candidates have provided a link between active galactic nuclei (AGNS) and the compact stars in binary systems. The availability of binary systems relatively close by is an opportunity to learn about the jet production mechanism on a timescale a million times shorter than that of an AGN. Evidence is clearly seen of correlated high energy X-ray and gamma ray emission to radio emission from jets, linking the accretion and jet production mechanisms. objects such as GRS 1915+105, GRO J1655-40 and Cyg X-3 show striking properties which distinguish them from other black hole candidates. Our theoretical understanding of these systems is still in the formative stages. I review some of the most recent multiwavelength data and point out questions raised by these observations.
Author
Black Holes (Astronomy); Radio Jets (Astronomy); Radio Emission

19990064414 National Optical Astronomy Observatories, Tucson, AZ USA
A Kinematic Link Between Boxy Bulges, Stellar Bars, and Nuclear Activity in NGC 3079 and NGC 4388
Veilleux, S., Maryland Univ., USA; Bland–Hawthrorn, J., Anglo-Australian Observatory, Australia; Cecil, Gerald, National Optical Astronomy Observatories, USA; August 1999; 42p; In English
Contract(s)/Grant(s): NAG5-26555; NAG5-6547; NSF AST-98-74973; HF-1039.01-92A
Report No.(s): NOAO-Preprint-849; Copyright; Avail: Issuing Activity, Hardcopy

We present direct kinematic evidence for bar streaming in two active galaxies with boxy stellar bulges. The Hawaii Imaging Fabry-Perot Interferometer was used on the Canada-France-Hawaii 3.6-m telescope and the University of Hawaii 2.2-m telescope to derive the two-dimensional velocity field of the line-emitting gas in the disks of the Sc galaxy NGC 3079 and the Sb galaxy NGC 4388. In contrast to previous work based on long-slit data, the detection of the bar potential from the Fabry-Perot data does not rely on the existence of inner Lindblad resonances or strong bar-induced shocks. Simple kinematic models which approximate the intrinsic gas orbits as nonintersecting, inclined elliptical annuli that conserve angular momentum characterize the observed

velocity fields. In NGC 3079, bar streaming motions with moderately eccentric orbits (e = b/a approx. 0.7) aligned along PA = 130 deg. intrinsic to the disk (PA = 97 deg. on the sky) are detected out to R(sub b) = 3.6 kpc. The orbits become increasingly circular beyond that radius (e = 1 at R(sub d) approx. = 6 kpc). The best model for NGC 4388 includes highly eccentric orbits (e approx. 0.3) for R(sub) less than or equal to 1.5 kpc which are aligned along PA = 135 deg. intrinsic to the disk (PA = 100 deg. on the sky). The observed ”spiral arms” are produced by having the orbits become increasingly circular from the ends of the bar to the edge of the disk (R(sub d) approx. = 5 kpc), and the intrinsic bar PA shifting from 135 deg. to 90 deg.. Box-shaped bulges in both NGC 3079 and NGC 4388 are confirmed using new near-infrared images to reduce dust obscuration. Morphological analysis of starlight in these galaxies is combined with the gas kinematics derived from the Fabry-Perot spectra to test evolutionary models of stellar bars that involve transitory boxy bulges, and to quantify the importance of such bars in fueling active nuclei. Our data support the evolutionary bar models, but fail to prove convincingly that the stellar bars in NGC 3079 and NGC 4388 directly trigger or sustain the nuclear activity.
Author
Kinematics; Bulging; Stellar Activity; Imaging Techniques; Velocity Distribution; Astronomical Models; Galactic Bulge; Active Galaxies

19990064415 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Cometary Dust in the Debris Disks of HD 31648 and HD 163296: Two ”Baby” (BETA) Pictoris Stars
Sitko, Michael L., Cincinnati Univ., USA; Grady, Carol A., Eureka Scientific, Inc., USA; Lynch, David K., Aerospace Corp., USA; Russell, Ray W., Aerospace Corp., USA; Hanner, Martha S., Jet Propulsion Lab., California Inst. of Tech., USA; Hanner, Martha S., Jet Propulsion Lab., California Inst. of Tech., USA; Astrophysical Journal; Jan. 01, 1999; Volume 510, pp. 408-412; In English
Contract(s)/Grant(s): NASw-4756; NASA Order S-78611-Z; Copyright; Avail: Issuing Activity, Hardcopy
The debris disks surrounding the pre-main-sequence stars HD 31648 and HD 163296 were observed spectroscopically between 3 and 14 microns. Both stars possess a silicate emission feature at 10 microns that resembles that of the star beta Pictoris and those observed in solar system comets. The structure of the band is consistent with a mixture of olivine and pyroxene material, plus an underlying continuum of unspecified origin. The similarity in both size and structure of the silicate band suggests that the material in these systems had a processing history similar to that in our own solar system prior to the time that the grains were incorporated into comets.
Author
Debris; Dust; Pre-Main Sequence Stars

19990064416 California Inst. of Tech., Caltech Submillimeter Observatory, Pasadena, CA USA
The Molecular Envelope of the Helix Nebula, *1999-2003*
Young, K,, Smithsonian Astrophysical Observatory, USA; Cox, P., Paris Univ., France; Huggins, P. J., New York Univ., USA; Forveille, T., Observatoire de Grenoble, France; Bachiller, R., IGN Observatorio Astronomico Nacional, Spain; Mar. 01, 1999; 12p; In English
Contract(s)/Grant(s): NSF AST-96-17941; NSF AST-96-15025; Copyright; Avail: Issuing Activity, Hardcopy
We present a fully sampled map of the Helix nebula in the 1.3mm CO J=2-1 line, made using the Caltech Submillimeter Observatory. The angular resolution is 31 sec. and the velocity resolution is 1.5km/s. The CO emission is found to extend over a region approx. 1000 sec.x800 sec. and delineates the well-known double ring or ”helix” seen in optical images of teh ionized gas. Our observations provide the first complete view of the global kinematics of the envelope, and reveal the 3-dimensional structure of the gas. The helix is seen to be an expanding, equatorial ring around the ionized nebula, with arcs extending to higher latitudes and exhibiting remarkable point symmetries about the central star. The molecular gas is fragmented into many small condenstions with narrow line widths (approx. 1 km/s). The close relationship found between the structure of the envelope and the ionized nebula underscores the important role of neutral gas in determing the morphology of planetary nebulae. The point symmetries provide evidence for early shaping of the envelope by bipolar outflows of jets.
Author
Molecular Gases; Images; Mapping; Carbon Monoxide; Planetary Nebulae; Angular Resolution

19990064427 Vanguard Research, Inc., Fairfax, VA USA
Studying the Fine Structure and Temporal Variations of the Zodiacal Cloud and Asteroidal Dust Bands Using the 3-Year Near-IR COBE-DIRBE Data *Final Report*
Jayaraman, Sumita, Vanguard Research, Inc., USA; April 1999; 13p; In English
Contract(s)/Grant(s): NASA Order S-85188-Z

Report No.(s): NASA/CR-1999-209246; NAS 1.26:209246; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report presents the results of the data analyses of the DIRBE-COBE data set to study the structure of the zodiacal cloud in the near-infrared wavebands at 1.2, 2.2, and 3.4 microns. The cloud has been divided into two components which have been analyzed and studied separately. The annual variation of the flux in the smooth or low frequency component has been measured in all three bands and the presence of any asymmetries due to the Earth's resonant ring have been studied. The high frequency component which primarily consisted of the asteroidal dust bands. Extensive and careful co-addition was done to extract the central bands in all three wavebands. The ten-degree bands are present in the 1.2 and 2.2 microns but not in the 3.4 micron waveband. Author

Zodiacal Dust; Temporal Distribution; Data Processing; Annual Variations

19990064478 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Cometary Dust in the Debris of HD 31648 and HD163296: Two "Baby" Beta pictoris Stars

Sitko, Michael L., Cincinnati Univ., USA; Grady, Carol A., Eureka Scientific, Inc., USA; Lynch, David K., Aerospace Corp., USA; Russell, Ray W., Aerospace Corp., USA; Hanner, Martha S., Jet Propulsion Lab., California Inst. of Tech., USA; Astrophysical Journal; Jan. 01, 1999; Volume 510, pp. 408-412; In English; Copyright; Avail: Issuing Activity, Hardcopy

The debris disks surrounding the pre-main-sequence stars HD 31648 and HD 163296 were observed spectroscopically between 3 and 14 microns. Both stars possess a silicate emission feature at 10 Am that resembles that of the star P Pictoris and those observed in solar system comets. The structure of the band is consistent with a mixture of olivine and pyroxene material, plus an underlying continuum of unspecified origin. The similarity in both size and structure of the silicate band suggests that the material in these systems had a processing history similar to that in our own solar system prior to the time that the grains were incorporated into comets.

Author

Debris; Stars; Stellar Envelopes; Pre-Main Sequence Stars; Comets; Dust

19990064602 NASA Marshall Space Flight Center, Huntsville, AL USA

Quasi-Periodic Oscillations in Black Hole Candidates as an Indicator of Transition Between Low and High States

Rutledge, Robert E, California Univ., USA; Lewin, Walter H. G., Massachusetts Inst. of Tech., USA; vanderKlis, Michiel, California Univ., USA; vanParadijs, Jan, Amsterdam Univ., Netherlands; Dotani, Tadayasu, Tokyo Univ., Japan; Vaughan, Brian, California Inst. of Tech., USA; Belloni, Tomaso, Amsterdam Univ., Netherlands; Oosterbroek, Tim, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Kouveliotou, Chryssa, Universities Space Research Association, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

By comparing positions on a spectral color-color diagram from 10 black hole candidates (BHCS) observed with Ginga (1354-64, 1826-24, 1630-47, LMC X-1, LMC X-3, GS 2000+25, GS 2023+33, GS 1124-68, Cyg X-1, and GX 339-4) with the observed broad-band noise (0.001- 64 Hz; BBN) and quasi-periodic oscillation (QPO) variability, we find that the so-called "Very High State" is spectrally intermediate to the Soft/High-State and Hard/Low-State. We find a transition point in spectral hardness where the dependence of the BHC QPO centroid frequency (of GS 1124-68 and GX 339-4) on spectral hardness switches from a correlation to an anti-correlation; where the BBN variability switches from High-State to Low-State; and where the spectral hardness of the QPO relative to that of the BBN variability is a maximum. This coincidence of changing behavior in both the QPO and the broad-band variability leads us to hypothesize that the QPO is due to interaction between the physical components which dominate the behaviors of BHCs when they occupy the Hard/Low and Soft/High States. We conclude that these QPO should be observed from BHCs during transition between these two states. Comparison with QPO and BBN behavior observed during the 1996 transition of Cyg X-1 supports this hypothesis. We also report 1-3 Hz QPO observed in GS 2000+25 and Cyg X-1 in the Hard/Low State, and we compare these to the QPO observed in GS 1124-68 and GX 339-4.

Author

Black Holes (Astronomy); Transition Points; Astrophysics; Stellar Oscillations

19990064607 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Accreting Gas and Dust in Pre-Main Sequence Disk Systems

Sitko, M. L., Cincinnati Univ., USA; Grady, C. A., Eureka Scientific, Inc., USA; Lynch, D. K., Aerospace Corp., USA; Russell, R. W., Aerospace Corp., USA; Hanner, M. S., Jet Propulsion Lab., California Inst. of Tech., USA; Formulation and Evolution of Solids in Space; 1999, pp. 513-520; In English; Copyright; Avail: Issuing Activity, Hardcopy

Infrared spectroscopy of pre-main sequence stars with dusty protostellar disks provide information about the evolution of refractory materials in such systems. These systems exhibit varying degrees of strength and structure in the silicate emission band situated at 10 microns wavelength. Band strength is affected by the mean grain size, while band structure is determined by the

chemical composition and degree of crystallinity. In some objects, the silicate band is strong and featureless, similar to that seen in the interstellar medium. In others, the band is often weaker, and exhibits structure consistent with the presence of crystalline olivine. In these latter objects, the band is similar to that of some solar system comets. The strength and structure of the silicate band may be related to the processing history of the system.
Author
Interstellar Matter; Refractory Materials; Accretion Disks; Pre-Main Sequence Stars; Dust; Gases

19990066627 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
Massive Black Holes and the Laser Interferometer Space Antenna (LISA)
Blender, Peter L., Colorado Univ., USA; Hils, Dieter, Colorado Univ., USA; Stebbins, Robin T., Colorado Univ., USA; Eighteenth Texas Symposium on Relativistic Astrophysics and Cosmology; 1998, pp. 536-538; In English; 18th; Relativistic Astrophysics and Cosmology, 15-20 Dec. 1996, Chicago, IL, USA; Sponsored by Department of Energy, USA
Contract(s)/Grant(s): NAGw-4772; NAGw-4865
Report No.(s): LC-98-16902; ISBN 9810234872; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The goals of the USA mission include both astrophysical investigations and fundamental physics tests. The main astrophysical questions concern the space density, growth, mass function, and surroundings of massive black holes. Thus the crucial issue for the USA mission is the likelihood of observing signals from such sources. Four possible sources of this kind are discussed briefly in this paper. It appears plausible, or even likely. that one or more of these types of sources can be detected and studied by LISA.
Author
Black Holes (Astronomy); Interferometers; Lasers

19990066711 California Inst. of Tech., Caltech Submillimeter Observatory, Pasadena, CA USA
Dust Continuum Imaging of the HH 24 Region in L 1630, *1999-2007*
Lis, D. C., California Inst. of Tech., USA; Menten, Karl M., Max-Planck-Inst. fuer Radioastronomie, Germany; Zylka, R., Heidelberg Univ., Germany; [1999]; 18p; In English
Contract(s)/Grant(s): NSF AST-96-15025; Copyright; Avail: Issuing Activity, Hardcopy
We have mapped the 1300 microns and 350 microns continuum emission in the region surrounding the Herbig-Haro objects HH 22 - HH 26 in L1630, which is part of the Orion B molecular cloud complex, using the MPIfR bolometer at the IRAM 30-meter telescope and the SHARC bolometer camera at the CSO. Our observations reveal the presence of a cluster of at least nine protostellar condensations at various evolutionary stages in the region around HH 24 - HH 26. In addition to two previously identified Class 0 protostars, two additional sources with a low 350/1300 microns flux ratio are detected. Although lack of FIR fluxes precludes a definitive determination of their nature, their low 350/1300 microns flux ratio along with the absence of embedded IR and radio continuum sources suggests that they are likely to be in a very early evolutionary stage. In particular, one of these two sources appears quite compact in the 1300 microns image and may be in the short-lived phase of the isothermal collapse. In addition, we have detected three millimeter continuum sources in the vicinity of the HH 22 - HH 23 objects, including a compact source at the origin of the HH 23 optical jet. The bolometric luminosity, submillimeter-to-bolometric luminosity ratio, temperature, and mass of this source are all consistent with those of a Class 0 protostar. However, the compactness of the source suggests that the continuum emission may be dominated by an unresolved disk, as would be expected for a more evolved protostellar source. No evidence is found for the presence of a molecular outflow associated with this source in our CO, C-13O, and HCO(+) data obtained with the CSO.
Author
Cosmic Dust; Imaging Techniques; Observation; Continuums; Herbig-Haro Objects; Molecular Clouds

19990066714 National Optical Astronomy Observatories, Tucson, AZ USA
Ionized Outflows in 3-D Insights from Herbig-Haro Objects and Applications to Nearby AGN
Cecil, Gerald, National Optical Astronomy Observatories, USA; August 1999; 16p; In English
Report No.(s): NOAO-Preprint-850; Copyright; Avail: Issuing Activity, Hardcopy
HST shows that the gas distributions of these objects are complex and clump at the limit of resolution. HST spectra have lumpy emission-line profiles, indicating unresolved sub-structure. The advantages of 3D over slits on gas so distributed are: robust flux estimates of various dynamical systems projected along lines of sight, sensitivity to fainter spectral lines that are physical diagnostics (reddening-gas density, T, excitation mechanisms, abundances), and improved prospects for recovery of unobserved dimensions of phase-space. These advantages al- low more confident modeling for more profound inquiry into underlying dynamics. The main complication is the effort required to link multi- frequency datasets that optimally track the energy flow through

various phases of the ISM. This tedium has limited the number of objects that have been thoroughly analyzed to the a priori most spectacular systems. For HHO'S, proper-motions constrain the ambient B-field, shock velocity, gas abundances, mass-loss rates, source duty-cycle, and tie-ins with molecular flows. If the shock speed, hence ionization fraction, is indeed small then the ionized gas is a significant part of the flow energetics. For AGN'S, nuclear beaming is a source of ionization ambiguity. Establishing the energetics of the outflow is critical to determining how the accretion disk loses its energy. CXO will provide new constraints (especially spectral) on AGN outflows, and STIS UV-spectroscopy is also constraining cloud properties (although limited by extinction). HHO's show some of the things that we will find around AGN'S. I illustrate these points with results from ground-based and HST programs being pursued with collaborators.
Author
Ionized Gases; Three Dimensional Flow; Active Galactic Nuclei; Cloud Physics; Dynamical Systems; Gas Flow; Stellar Spectra

19990067630 NASA Marshall Space Flight Center, Huntsville, AL USA
Evidence from Quasi-Periodic Oscillations for a Millisecond Pulsar in the Low Mass X-Ray Binary 4U 0614+091
Ford, E., Columbia Univ., USA; Kaaret, P., Columbia Univ., USA; Tavani, M., Columbia Univ., USA; Barret, D., Harvard-Smithsonian Center for Astrophysics, USA; Bloser, P., Harvard-Smithsonian Center for Astrophysics, USA; Grindlay, J., Harvard-Smithsonian Center for Astrophysics, USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Paciesas, W. S., Alabama Univ., USA; Zhang, S. N., Universities Space Research Association, USA; [1997]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have detected quasi-periodic oscillations (QPOs) near 1 kHz from the low mass X-ray binary 4U 0614+091 in observations with RXTE. The observations span several months and sample the source over a large range of X-ray luminosity. In every interval QPOs are present above 400 Hz with fractional RMS amplitudes from 3 to 12% over the full PCA band. At high count rates, two high frequency QPOs are detected simultaneously. The difference of their frequency centroids is consistent with a constant value of 323 Hz in all observations. During one interval a third signal is detected at 328 +/- 2 Hz. This suggests the system has a stable 'clock' which is most likely the neutron star with spin period 3.1 msec. Thus, our observations of 4U 0614+091 and those of 4U 1728-34 provide the first evidence for millisecond pulsars within low-mass X-ray binary systems and reveal the 'missing-link' between millisecond radiopulsars and the late stages of binary evolution in low mass X-ray binaries. The constant difference of the high frequency QPOs sug,,ests a beat-frequency interpretation. In this model, the high frequency QPO is associated with the Keplerian frequency of the inner accretion disk and the lower frequency QPO is a 'beat' between the differential rotation frequency of the inner disk and the spinning neutron star. Assuming the high frequency QPO is a Keplerian orbital frequency for the accretion disk, we find a maximum mass of 1.9 solar mass and a maximum radius of 17 km for the neutron star.
Author
Neutron Stars; Oscillations; Pulsars; X Ray Binaries; Accretion Disks

19990067827 NASA Goddard Space Flight Center, Greenbelt, MD USA
Data Processing for the Near Earth Asteroid Rendezvous (NEAR), X-ray and Gamma-ray Spectrometer (XGRS) Ground System
McClanahan, Timothy P., NASA Goddard Space Flight Center, USA; Mikheeva, I., Arizona Univ., USA; Trombka, J. I., NASA Goddard Space Flight Center, USA; Floyd, S. R., NASA Goddard Space Flight Center, USA; Boynton, W. V., Arizona Univ., USA; Bailey, H., Arizona Univ., USA; Bhangoo, J., Arizona Univ., USA; Starr, R., Catholic Univ. of America, USA; Clark, P. E., Catholic Univ. of America, USA; Evans, L. G., Computer Sciences Corp., USA; 1999; 1p; In English; 44th, 19-21 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

An X-ray and Gamma-ray spectrometer (XGRS) is onboard the Near Earth Asteroid Rendezvous (NEAR) spacecraft to determine the elemental composition of the surface of the asteroid 433Eros. The Eros asteroid is highly non-spherical in physical shape and the development of data management and analysis methodologies are in several areas a divergence from traditional remotely sensed geographical information systems techniques. Field of view and asteroid surface geometry must be derived virtually and then combined with real measurements of solar, spectral and instrument calibration information to derive meaningful scientific results. Spatial resolution of planned geochemical maps will be improved from the initial conditions of low statistical significance per integration by repeated surface flyovers and regional spectral accumulation. This paper describes the results of a collaborative effort of design and development of the NEAR XGRS instrument ground system undertaken by participants at the Goddard Space Flight Center, University of Arizona, Cornell University, Applied Physics Laboratory, and Max Plank institute.
Author
Asteroid Missions; Asteroids; Eros Asteroid; Geochemistry; Remote Sensing

19990069228 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Numerical Study of Temporary Gravitational Capture Using the Restricted Three-Body Problem ***Estudo Numerico da Captura Gravitational Temporaria Utilizando o Problema Restrito de Tres Corpos***
Neto, Ernesto Vieira, Instituto Nacional de Pesquisas Espacias, Brazil; 1999; 232p; In Portuguese
Report No.(s): INPE-7033-TDI/663; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Coming from outside the gravitational sphere of influence of a celestial body, a spacecraft may have its relative velocity reduced, to the point of causing it to enter in a temporary orbit around this celestial body. This phenomena is called temporary gravitational capture and can be used to reduce the fuel consumption in a complete transfer between the Earth and the Moon. This work studies the forces acting in this system and, using the method based in the two body energy concept, shows a parametric study about the time of flight and the eccentricity of the primaries in the gravitational capture maneuver. Several others facts related to this problem are also studied in detail.
Author
Three Body Problem; Gravitational Effects; Gravitational Fields; Orbital Maneuvers; Orbital Mechanics; Earth-Moon Trajectories; Transfer Orbits; Lunar Gravitational Effects; Space Navigation

19990069899 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Evolution Properties of Clusters and AXAF Contributions to understanding Clusters
Jones, Christine, Smithsonian Astrophysical Observatory, USA; [1998]; 1p; In English; Cosmological Constraints from x-ray Clusters, 7-19 Dec. 1998, Strasbourg, France
Contract(s)/Grant(s): NAS8-39073; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Our ROSAT survey for distant clusters of galaxies contains the largest solid angle of all ROSAT pointed surveying and thus has sufficient area to test the previously reported cluster evolution. We find significant negative cluster evolution, i.e,, at high redshifts there are fewer luminous clusters than at present. We compare optical cluster properties for the most distant clusters in the ROSAT survey with those measured for nearby clusters. We also present AXAF capabilities and show how AXAF will significantly extend our understanding of cluster properties and their cosmological evolution.
Author
Galactic Clusters; X Ray Astrophysics Facility; Cosmology; Astrophysics

19990070322 NASA Marshall Space Flight Center, Huntsville, AL USA
Coronally Fluoresced Stellar Photospheric X-Ray Spectra
Drake, Jeremy J., NASA Marshall Space Flight Center, USA; Swartz, Douglas A., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 12-15 Apr. 1999, Charleston, Sc, USA; Sponsored by American Astronautical Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Monte Carlo computations of photospheric fluorescent x-ray spectra are described. X-rays emitted from a hot corona incident on an underlying photosphere can undergo either scattering events by Compton scattering or photoabsorption events through the ionization of atoms or weakly ionized species. Through scattering events, photons can be reflected back in a direction towards the stellar surface where they have a finite chance of escape. Photoionization events involving x-ray photons directed toward the photosphere are predominantly inner shell interactions, Observable fluorescent lines can arise as a result of the finite escape probabilities of photons emitted in outward directions by hole transitions in these atoms. For a given stellar composition, fluorescent line strengths are dependent on the height of the fluorescing source above the photosphere and on the angle between the source and the observer. Although the only fluorescent lines likely to be detected in stellar coronae are Fe Ka and perhaps O Ka, these lines could provide powerful and direct spectroscopic diagnostics of coronal geometry.
Author
Fluorescence; Stellar Spectra; X Ray Spectra; Photosphere; Stellar Coronas; Stellar Physics

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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.

19990064366 Lunar and Planetary Inst., Houston, TX USA
Small Mantle Upwellings are Pervasive on Venus and Earth
Herrick, Robert R., Lunar and Planetary Inst., USA; Geophysical Research Letters; Mar. 15, 1999; ISSN 0094-8276; Volume 26,

No. 6, pp. 803-806; In English; Original contains color illustrations
Report No.(s): Paper-1999GL900063; LPI-Contrib-965; Copyright; Avail: Issuing Activity, Hardcopy

Observations of Venus and Africa, an analogous terrestrial plate, indicate that upwellings a few hundred kilometers across are pervasive in the ambient upper mantle of both Venus and Earth. Because of their small size, when they reach the lithosphere the upwellings affect the surface only under special circumstances. On Venus they form volcano-tectonic structures called coronae where the lithosphere has been thinned by rifting. On Earth the small upwellings produce topographic swells where they impinge on a plate stationary with respect to the hot-spot reference frame, as is Africa. The small upwellings' presence throughout the mantle explains both the corona paradox, in which coronae are associated with rifts on Venus but do not appear to drive rifting, and the basin and swell topography of the African plate. The morphology of coronae requires that the small upwellings have some diapiric properties. Their pervasiveness, transient nature, and generally small size make them fundamentally different from traditional Hawaiian-style plumes, and they may be detached diapirs within a mantle convecting in the hard-turbulence regime.
Author
Observation; Coronas; Earth (Planet); Venus (Planet); Geological Faults; Earth Mantle

19990064612 NASA Goddard Space Flight Center, Greenbelt, MD USA
Preliminary Global Topographic Model of Mars Based on MOLA Altimetry, Earth-Based Radar, and Viking, Mariner and MGS Occultations
Smith, David E., NASA Goddard Space Flight Center, USA; Zuber, Maria T., Massachusetts Inst. of Tech., USA; Neumann, Gregory A., Massachusetts Inst. of Tech., USA; 1999; 1p; In English; LSPC Meeting, 15-19 Mar. 1999, Houston, TX, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The recent altimetry data acquired by MOLA over the northern hemisphere of Mars have been combined with the Earth-based radar data obtained between 1971 and 1982, and occultation measurements of the Viking 1 and 2 Orbiters, Mariner 9, and MGS to derive a global model of the shape and topography of Mars. This preliminary model has a horizontal resolution of about 300 km. Vertical accuracy is on average a few hundred meters in the region of the data. Datasets: The altimetry and radar datasets were individually binned in 1.25 degree grids and merged with the occultation data. The Viking and Mariner occultation data in the northern hemisphere were excluded from the combined dataset where MOLA altimetry were available. The laser altimetry provided extensive and almost complete coverage of the northern hemisphere north of latitude 30 while the radar provided longitudinal coverage at several latitude bands between 23N and 23S. South of this region the only data were occultations. The majority of the occultations were obtained from Mariner 9, and the rest from Viking 1 & 2, and MGS. Earlier studies had shown that the Viking and Mariner occultations were on average only accurate to 500 meters. The recent MGS occultations are accurate to a few tens of meters. However, the highest southern latitude reached by the MGS occultations is only about 64S and data near the target region for the Mars 98 lander is limited to a few Viking and Mariner observations of relatively poor quality. In addition to the above datasets the locations of the Viking 1, Viking 2, and Pathfinder landers, obtained from the radio tracking of their signals, were included.
Author
Topography; Models; Mars (Planet); Altimetry; Radio Tracking; Viking Mars Program; Mars Surface

19990067633 NASA Goddard Space Flight Center, Greenbelt, MD USA
Throughput of the Composite Infrared Spectrometer (CIRS) Mid Infrared (MIR) Channel for the Cassini Mission to Saturn
Hagopian, John G., NASA Goddard Space Flight Center, USA; Losch, Patricia, NASA Goddard Space Flight Center, USA; Stewart, Kenneth P., NASA Goddard Space Flight Center, USA; Jennings, Donald, NASA Goddard Space Flight Center, USA; Martino, Anthony J., NASA Goddard Space Flight Center, USA; 1998; In English; Cryogenic Optical Systems and Instruments VIII, 19-24 Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Composite Infrared Spectrometer (CIRS) of the Cassini mission to Saturn has two interferometers covering the far infrared and mid infrared wavelength region. The instrument was aligned at ambient temperature, but operates at 170 Kelvin and has challenging interferometric alignment tolerances. Cryogenic alignment tests of the instrument indicate that it should suffer minimal degradation due to the cooldown from ambient to operational temperature. System level tests performed by the calibration team indicated a lower than expected signal level on the MIR channel, while providing ambiguous optical throughput data. Therefore it became imperative to develop a metric that could be used to determine the instrument performance at both the instrument and system levels, at ambient and cryogenic temperature. Modulation efficiency and throughput measurements were per-

formed and new analytical models developed to evaluate the status of the instrument. Empirical and analytical data were eventually reconciled and deviations from the design values explained.
Author
Infrared Spectrometers; Michelson Interferometers; Calibrating; Cryogenics

19990067634 NASA Goddard Space Flight Center, Greenbelt, MD USA
Acoustic Amplification in the Far Infrared Focal Plane Assembly of the Composite Infrared Spectrometer (CIRS) for the Cassini Mission to Saturn
Hagopian, John G., NASA Goddard Space Flight Center, USA; Crooke, Julie, NASA Goddard Space Flight Center, USA; 1998; In English; Cryogenic Optical Systems and Instruments VIII, 19-24 Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Composite Infrared Spectrometer (CIRS) of the Cassini mission to Saturn has two interferometers covering the far infrared FIR and mid infrared, MIR wavelength region. The FIR is a polarizing Michelson interferometer which presents a collimated output beam to the FIR focal plane. The focal plane consists of a parabolic focus mirror and an analyzer grid, which splits the output beams into transmitted and reflected components. The two polarizations are focussed onto two thermopile detectors; each consisting of a gold black foil welded to the top of two bismuth pyramids. The gold black is 30 microns thick, and the weld area is approximately 2 microns in diameter. The detectors are extremely fragile and the weld can be broken with a miniscule amount of airflow. The detectors consistently passed acoustic testing to qualification levels that simulated the launch environment of the Titan IV launch vehicle. However, they experienced a 50% failure rate when installed in the focal plane assembly during instrument level acoustic tests. A test focal plane was developed with small pressure transducers in the nominal detector locations. These tests indicated over 10 dB of acoustic amplification in the focal plane within the instrument during testing. New techniques were developed to allow testing of the focal plane without over testing the instrument, and modifications were made the focal plane assembly to successfully attenuate the amplification.
Author
Infrared Spectrometers; Michelson Interferometers; Thermopiles; Focal Plane Devices; Acoustic Measurement

19990067635 NASA Goddard Space Flight Center, Greenbelt, MD USA
Shear/Defocus Sensitivity of the Mid Infrared Channel (MIR) of the Composite Infrared Spectrometer (CIRS) for the Cassini Mission to Saturn
Martino, Anthony J., NASA Goddard Space Flight Center, USA; Hagopian, John G., NASA Goddard Space Flight Center, USA; Losch, Patricia, NASA Goddard Space Flight Center, USA; Crooke, Julie, NASA Goddard Space Flight Center, USA; 1998; In English; Cryogenic Optical Systems and Instruments VIII, 19-24 Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Composite Infrared Spectrometer (CIRS) of the Cassini mission to Saturn has two interferometers covering the far infrared and mid infrared wavelength region. The mid infrared wavelength interferometer has a focal plane consisting of a germanium focus lens and HgCdTe array. System level calibration of the CIRS Flight Unit indicated a discrepancy between the expected and actual signal levels. Testing on the CIRS breadboard and Engineering Unit indicated that defocus of the germanium lens could significantly reduce the modulation efficiency of the interferometer in the presence of a moderate degree of wavefront shear. Defocus of the lens in the focal plane was of concern because of the temperature dependence of the index of refraction of germanium and our nominal operation temperature of 170 K. The shear/defocus interaction was extensively investigated and correlated to a newly developed analytical model, It was eventually determined that the CIRS instrument was in focus, had no appreciable wavefront shear and was operating near theoretical limits. The shear/defocus effect is however, of considerable interest, since it has not been described in previous literature on interferometers.
Author
Calibrating; Cassini Mission; Defocusing; Infrared Spectrometers; Sensitivity

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SOLAR PHYSICS

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

19990064338 NASA Marshall Space Flight Center, Huntsville, AL USA
Large-Scale Coronal Heating, Clustering of Coronal Bright Points, and Concentration of Magnetic Flux
Falconer, D. A., NASA Marshall Space Flight Center, USA; Moore, R. L., NASA Marshall Space Flight Center, USA; Porter,

J. G., NASA Marshall Space Flight Center, USA; Hathaway, D. H., NASA Marshall Space Flight Center, USA; 1998; In English; SOHO 7, Sep. 1998, Northeast Habor, ME, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

By combining quiet-region Fe XII coronal images from SOHO/EIT with magnetograms from NSO/Kitt Peak and from SOHO/MDI, we show that on scales larger than a supergranule the population of network coronal bright points and the magnetic flux content of the network are both markedly greater under the bright half of the quiet corona than under the dim half. These results (1) support the view that the heating of the entire corona in quiet regions and coronal holes is driven by fine-scale magnetic activity (microflares, explosive events, spicules) seated low in the magnetic network, and (2) suggest that this large-scale modulation of the magnetic flux and coronal heating is a signature of giant convection cells.
Author
Coronal Holes; Heating; Clusters; Magnetic Flux

19990064463 NASA Marshall Space Flight Center, Huntsville, AL USA
MHD Streamer Structure, Slow Solar Wind, and the Streamer Brightness Boundary
Suess, Steven T., NASA Marshall Space Flight Center, USA; Nerney, S., Ohio Univ., USA; 1999; 1p; In English; European Solar Physics, Sep. 1999, Florence, Italy; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Flow tubes adjacent to closed magnetic field lines on the boundaries of streamers can have extremely large geometric spreading factors. Numerical models in this thin layer are subject to grid definition uncertainties. Therefore, we compute flow tube geometry using the analytic model of streamer structure described by Pneuman. This model has been found to be more widely applicable than commonly believed as a consequence of observations made with SOHO/UVCS and YOKHOH/SXT. We use the model to compute the radial dependence of flow tube geometry (the ”spreading factors”) for several different streamer models. The results are used to analyze the hypothesis that extremely slow flows in these open flow tubes may cause high densities relative to adjacent coronal hole flow. Such high density could mean that the streamer brightness boundary is defined by the open flow tubes adjacent to streamers rather than closed field lines.
Author
Magnetohydrodynamics; Solar Wind; Boundary Layer Flow; Numerical Analysis; Circular Tubes

19990064482 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Matahari dan Lingkungan Antariksa Puslitbang, Jakarta, Indonesia
Effect of Sunspots on 2800 MHZ Flux Intensity ***Pengaruh Bintik Matahari Pada Intensitas Fluks 2800 MHz***
Yatini, Clara Yono, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April 1998; ISSN 0126-9754, No. 55, pp. 36-40; In Malay-Indonesian; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The effect of spots on the star’s surface is different between convective and radiative stars. The mass of convective envelope of our sun is small compared to the total mass. In this case, the energy developed in the core, hence the luminosity are not affected by the presence of sunspot on its surface. The heat flux blocked by sunspot is redistributed through the entire convection zone, and then emitted by the unspotted part of the solar surface. Based on the 2800 MHz flux data during cycle 21 and 22, the 2800 MHz (10.7 cm) energy flux emitted from the sun is connected with the sunspot number.
Author
Emittance; Flux Density; Luminosity; Sunspots

19990064631 NASA Marshall Space Flight Center, Huntsville, AL USA
The Sun in Time
Adams, Mitzi L., NASA Marshall Space Flight Center, USA; Sever, Thomas L., NASA Marshall Space Flight Center, USA; Bero, Elizabeth, NASA Marshall Space Flight Center, USA; 1998; 1p; In English, Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Using a grant from NASA’s Initiative to Develop Education through Astronomy and Space Science (IDEAS) program, we have developed an inter-disciplinary curriculum for middle-school students which targets both history and astronomy. Our curriculum explores the attitudes and techniques of ancient spiritual leaders, specifically those of the Maya and Inca cultures, who observed and tried to control the Sun. We wish students to understand the probable importance of astronomical observations to these ancient peoples. In addition, using the experience of an archaeologist, we show how modern techniques of viewing the Earth through satellite imagery, has allowed the re-discovery of ancient sites where solar observations and attempted manipulation of the universe took place. to contrast ancient observations of the Sun with modern ones, we use the experience of a solar astronomer and bring to the classroom up-to-date information about solar astronomy and the impact of solar activity on the Earth’s environment. In this presentation, we will present fragments of our curriculum as well as results from pre- and post-tests given to partici-

pating groups of students. Finally, we will discuss comments from local middle-school teachers who were asked to evaluate our curriculum.
Author
Sun; Solar Physics; Solar Activity

19990064632 NASA Marshall Space Flight Center, Huntsville, AL USA
The Sun in Time
Adams, Mitzi L., NASA Marshall Space Flight Center, USA; 1998; 1p; In English, 20 Nov. 1998, Birmingham, AL, USA; Sponsored by National Science Teachers Association, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The presentation will include slides and documentation concerning archaeological sites where observations of the Sun may have taken place, as well as a discussion of the role the Sun played in the lives of the ancients. We will complete our discussion by contrasting ancient ideas of the Sun with those of the current era.
Author
Sun; Solar Physics

19990067235 NASA Marshall Space Flight Center, Huntsville, AL USA
The Observed Spectral Evolution of Solar Flare Hard X-Ray Emission
Newton, Elizabeth, NASA Marshall Space Flight Center, USA; Giblin, Timothy, Alabama Univ., USA; 1999; 1p; In English; Sponsored by American Astronomical Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The spectral evolution of flare emission may be characterized using color-color diagrams (CCDs), a technique which has been widely employed by the astrophysics community, but not yet by the solar flare community. CCDs are constructed for a sample of flares observed simultaneously by CGRO/BATSE and Yohkoh/HXT. It is found that flare spectral evolution follows one of only a few patterns, which generally evolve differently than the soft-hard-soft pattern put forth as the norm in previous work. The implications for the nature of flare energy release and acceleration/propagation models are discussed
Author
Solar Flares; Spectral Emission; Emission

19990067273 NASA Marshall Space Flight Center, Huntsville, AL USA
A Survey and Synthesis of Solar Cycle Prediction Techniques
Hathaway, David H., NASA Marshall Space Flight Center, USA; Wilson, Robert M., NASA Marshall Space Flight Center, USA; Reichmann, Edwin J., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A number of techniques for predicting solar activity on a solar cycle time scale are identified, described, and tested with historical data. Some techniques, e.g. regression and curve-fitting, work well as solar activity approaches maximum and provide a complete description of future activity, while others, e.g. geomagnetic precursors, work well near solar minimum but only provide an estimate of the amplitude of the cycle. A synthesis of different techniques is shown to provide a more accurate and useful forecast of solar cycle activity levels. A combination of two uncorrelated geomagnetic precursor techniques provides the most accurate prediction for the amplitude of a solar activity cycle at a time well before activity minimum. This Combined Precursor Method gives a smoothed sunspot number maximum of 154+/-21 at the 95% level of confidence for the next cycle maximum. A mathematical function dependent upon the time of cycle initiation and the cycle amplitude then describes the level of solar activity for the next complete cycle. As the time of cycle maximum approaches a better estimate of the cycle activity is obtained by including the fit between previous activity levels and this function. This Combined Solar Cycle Activity Forecast gives, as of January 1999, a smoothed sunspot maximum of 146+/-20 at the 95% level of confidence for the next cycle maximum. The success of the geomagnetic precursors in predicting future solar activity suggests that solar magnetic phenomena at latitudes above the sunspot activity belts are linked to solar activity which occurs many years later in the lower latitudes.
Author
Solar Cycles; Prediction Analysis Techniques; Solar Activity; Surveys; Solar Activity Effects

19990067628 NASA Marshall Space Flight Center, Huntsville, AL USA
Solar Cycle Predictions Near Sunspot Minimum
Hathaway, David H., NASA Marshall Space Flight Center, USA; 1997; In English, 8-12 Dec. 1997, San Francisco, CA, USA; Sponsored by American Geophysical Union; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Observations of solar magnetic activity and the dynamics of the solar convection zone have produced severe constraints on models of the Sun's magnetic dynamo. These constraints are so severe that, at present, we do not have numerical models that can

accept the current conditions and then march forward in time to predict future activity. Given this state of solar dynamo theory we are forced to examine previous behavior to discover patterns and trends that afford us some measure of predictability. Here we examine the behavior of several indicators of solar activity near solar minimum that are well correlated with the amplitude of the following solar maximum to predict the level of solar activity over cycle 23. Sunspot numbers, areas, and positions are useful for characterizing solar cycle behavior due to the extent of the data (12 cycles or more). These data exhibit several patterns that relate future activity to past behavior. With the Odd-Even effect the odd numbered cycles have been larger than their even numbered predecessors for each of the last six cycle pairs. With the Amplitude-Period effect short period cycles have been followed by large amplitude cycles and long period cycles have been followed by small amplitude cycles for 10 of the last 13 cycles. With the Maximum-Minimum effect the sunspot number at minimum is directly correlated with the sunspot number at maximum for a given cycle. The geomagnetic indices aa and Ap are also related to solar activity by the connections between disturbances in the solar wind and variations in the Earth's magnetic field. Like the Maximum-Minimum effect for sunspots, the size of the aa and Ap indices at minimum are directly related to the amplitude of the following maximum. The number of geomagnetically disturbed days (days with Ap is greater than = 25) over the course of a cycle is another indicator for the size of the next cycle. The aa and Ap indices can each be separated into a component in phase with the current sunspot cycle and an "extended cycle" component that is directly related to the following cycle. Individually each of these indicators provides some measure of predictive ability for the amplitudes of previous cycles. Taken in combination we find that the predictions are much more accurate. Our multi-variate analysis indicates that a maximum sunspot number of 160 +/- 20 should occur near the end of 1999 for cycle 23.
Author
Mathematical Models; Predictions; Solar Activity; Solar Cycles; Sunspot Cycle; Sunspots; Multivariate Statistical Analysis

19990067636 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Photo Album of Earth Scheduling LANDSAT 7 Mission Daily Activities
Potter, William, NASA Goddard Space Flight Center, USA; Gasch, John, Computer Sciences Corp.; Bauer, Cynthia, Bauer, Cynthia; 1998; In English; SpaceOps 1998, 1-5 Jun. 1998, Tokyo, Japan; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

LANDSAT7 is a member of a new generation of Earth observation satellites. LANDSAT7 will carry on the mission of the aging LANDSAT 5 spacecraft by acquiring high resolution, multi-spectral images of the Earth surface for strategic, environmental, commercial, agricultural and civil analysis and research. One of the primary mission goals of LANDSAT7 is to accumulate and seasonally refresh an archive of global images with full coverage of Earth's landmass, less the central portion of Antarctica. This archive will enable further research into seasonal, annual and long-range trending analysis in such diverse research areas as crop yields, deforestation, population growth, and pollution control, to name just a few. A secondary goal of LANDSAT7 is to fulfill imaging requests from our international partners in the mission. LANDSAT7 will transmit raw image data from the spacecraft to 25 ground stations in 20 subscribing countries. Whereas earlier LANDSAT missions were scheduled manually (as are the majority of current low-orbit satellite missions), the task of manually planning and scheduling LANDSAT7 mission activities would be overwhelmingly complex when considering the large volume of image requests, the limited resources available, spacecraft instrument limitations, and the limited ground image processing capacity, not to mention avoidance of foul weather systems. The LANDSAT7 Mission Operation Center (MOC) includes an image scheduler subsystem that is designed to automate the majority of mission planning and scheduling, including selection of the images to be acquired, managing the recording and playback of the images by the spacecraft, scheduling ground station contacts for downlink of images, and generating the spacecraft commands for controlling the imager, recorder, transmitters and antennas. The image scheduler subsystem autonomously generates 90% of the spacecraft commanding with minimal manual intervention. The image scheduler produces a conflict-free schedule for acquiring images of the "best" 250 scenes daily for refreshing the global archive. It then equitably distributes the remaining resources for acquiring up to 430 scenes to satisfy requests by international subscribers. The image scheduler selects candidate scenes based on priority and age of the requests, and predicted cloud cover and sun angle at each scene. It also selects these scenes to avoid instrument constraint violations and maximizes efficiency of resource usage by encouraging acquisition of scenes in clusters. Of particular interest to the mission planners, it produces the resulting schedule in a reasonable time, typically within 15 minutes.
Author
LANDSAT 7; Mission Planning; Scheduling; Remote Control

19990068861 Colorado Univ., Boulder, CO USA
Solar Electromagnetic Radiation Study for Solar Cycle 22: Solar Ultraviolet Irradiance, 120 to 300 NM: Report of Working Groups 2 and 3 of SOLERS 22
Rottman, G. J., Colorado Univ., USA; Cebula, R. P., Hughes STX, Inc., USA; Gillotay, D., Institut d'Aeronomie Spatiale de Belgique, Belgium; Simon, P. A., Institut d'Aeronomie Spatiale de Belgique, Belgium; Solar Physics; 1996, pp. 491-509; In English;

Solar Electromagnetic Radiation Study for Solar Cycle 22: SOLERS22 Workshop, 17-21 Jun. 1996, Sacramento Peak, NM, USA
Contract(s)/Grant(s): NASw-4864; NAS5-97145; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This report summarizes the activities of Working Group 2 and Working Group 3 of the SOLax Electromagnetic Radiation Study for Solar Cycle 22 (SOLERS22) Program. The international (SOLERS22) is Project 1.2 of the Solar-Terrestrial Energy Program (STEP) sponsored by SCOSTEP, a committee of the International Council of Scientific Unions). SOLERS22 is comprised of five Working Groups, each concentrating on a specific wave-length range: WG-1 - visible and infrared, WG-2 - mid-ultraviolet (200 is less than A is less than 300 nm), WG-3 - Far-ultraviolet (lambda greater than 100 and lambda less than 200 nanometers), WG-4 - extreme-ultraviolet (lambda greater than 10 and lambda less than 100 nm), and WG-5 - X-ray (lambda greater than 1 and lambda less than 10 nano meters). The overarching goals of SOLERS22 are to: 1) establish daily solar irradiance values in the specified wavelength ranges, 2) consider the evolving solar structures as the cause of temporal variations, and 3) understand the underlying physical processes driving these changes.
Author
Solar Cycles; Solar Radiation; Ultraviolet Radiation

19990069592 NASA Goddard Space Flight Center, Greenbelt, MD USA
SSBUV and NOAA-11 SBUV/2 Solar Variability Measurements
Deland, Matthew T., Raytheon STX Corp., USA; Cebula, Richard P., Raytheon STX Corp., USA; Hilsenrath, Ernest, NASA Goddard Space Flight Center, USA; Studia geoph. et geod.; 1998; Volume 42, pp. 83-91; In English
Contract(s)/Grant(s): NAS5-31755; NAGw-4864; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Shuttle Solar Backscatter Ultraviolet (SSBUV) and NOAA-II Solar Backscatter Ultraviolet/2 (SBUV/2) instruments measured solar spectral Ultraviolet (UV) irradiance during the maximum and declining phase of solar cycle 22. The SSB UV data accurately represent the absolute solar UV irradiance between 200-405 nanometers, and also show the long-term variations during eight flights between October 1989 and January, 1996. These data have been used to correct long-term sensitivity changes in the NOAA-II SBUV/2 data, which provide a near-daily record of solar UV variations over the 170 to 400 nanometer region between December 1988 and October 1994. The NOAA-II data demonstrate the evolution of short-term solar UV activity during solar cycle 22.
Author
Solar Activity; Solar Cycles; Solar Radiation; Ultraviolet Radiation

19990069912 NASA Marshall Space Flight Center, Huntsville, AL USA
Rendering Three-Dimensional Solar Coronal Structures of Active Region 8227
Gary, G. A., NASA Marshall Space Flight Center, USA; Alexander, D. A., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 30 May - 3 Jun. 1999, Chicago, IL, USA; Sponsored by American Astronomical Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Coronal X-ray and EUV synthesized images are constructed of Active Region 8227 (May-June 1996) and are compared with Yohkoh/SXT, SOHO/EIT, and TRACE observations. Using the rendering technique of Gary (1997) and Alexander, Gary, and Thompson (1998), specific geometric and physical models are used to integrated the plasma emission along the line of sight to obtain a rendered image. The specific instrumental profiles are convolved in the integration process as well as specific heating functions. We analyze coronal X-ray and EUV structures by constructing synthesized image and comparison with observations provide test of specific physical models. We investigate how different pressure distributions within the active region loop system affect the emission characteristics and compare the various results with coronal observations. We investigate how the different heating functions in the active region are reflected in the effect of overall structure of the region. Specific heating rates are tested.
Author
Solar Physics; Solar Corona; Extreme Ultraviolet Radiation; Solar X-Rays

19990069933 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Constraints on Nonlinear and Stochastic Growth Theories for Type 3 Solar Radio Bursts from the Corona to 1 AU
Cairns, Iver H., Iowa Univ., USA; Robinson, P. A., Sydney Univ., Australia; The Astrophysical Journal; Dec. 10, 1998; Volume 509, pp. 471-481; In English
Contract(s)/Grant(s): NAG5-6127; Copyright; Avail: Issuing Activity, Hardcopy

Existing, competing theories for coronal and interplanetary type III solar radio bursts appeal to one or more of modulational instability, electrostatic (ES) decay processes, or stochastic growth physics to preserve the electron beam, limit the levels of Langmuir-like waves driven by the beam, and produce wave spectra capable of coupling nonlinearly to generate the observed radio emission. Theoretical constraints exist on the wavenumbers and relative sizes of the wave bandwidth and nonlinear growth rate

for which Langmuir waves are subject to modulational instability and the parametric and random phase versions of ES decay. A constraint also exists on whether stochastic growth theory (SGT) is appropriate. These constraints are evaluated here using the beam, plasma, and wave properties (1) observed in specific interplanetary type III sources, (2) predicted nominally for the corona, and (3) predicted at heliocentric distances greater than a few solar radii by power-law models based on interplanetary observations. It is found that the Langmuir waves driven directly by the beam have wavenumbers that are almost always too large for modulational instability but are appropriate to ES decay. Even for waves scattered to lower wavenumbers (by ES decay, for instance), the wave bandwidths are predicted to be too large and the nonlinear growth rates too small for modulational instability to occur for the specific interplanetary events studied or the great majority of Langmuir wave packets in type III sources at arbitrary heliocentric distances. Possible exceptions are for very rare, unusually intense, narrowband wave packets, predominantly close to the Sun, and for the front portion of very fast beams traveling through unusually dilute, cold solar wind plasmas. Similar arguments demonstrate that the ES decay should proceed almost always as a random phase process rather than a parametric process, with similar exceptions. These results imply that it is extremely rare for modulational instability or parametric decay to proceed in type III sources at any heliocentric distance: theories for type III bursts based on modulational instability or parametric decay are therefore not viable in general. In contrast, the constraint on SGT can be satisfied and random phase ES decay can proceed at all heliocentric distances under almost all circumstances. (The contrary circumstances involve unusually slow, broad beams moving through unusually hot regions of the Corona.) The analyses presented here strongly justify extending the existing SGT-based model for interplanetary type III bursts (which includes SGT physics, random phase ES decay, and specific electromagnetic emission mechanisms) into a general theory for type III bursts from the corona to beyond 1 AU. This extended theory enjoys strong theoretical support, explains the characteristics of specific interplanetary type III bursts very well, and can account for the detailed dynamic spectra of type III bursts from the lower corona and solar wind.
Author
Stochastic Processes; Type 3 Bursts; Solar Corona; Sun; Solar Wind; Interplanetary Medium

19990070313 NASA Langley Research Center, Hampton,VA USA
Solar Cycle Variation and Application to the Space Radiation Environment
Wilson, John W., NASA Langley Research Center, USA; Kim, Myung–Hee Y., NASA Langley Research Center, USA; Shinn, Judy L., NASA Langley Research Center, USA; Tai, Hsiang, NASA Langley Research Center, USA; Cucinotta, Francis A., NASA Johnson Space Center, USA; Badhwar, Gautam D., NASA Johnson Space Center, USA; Badavi, Francis F., Christopher Newport Univ., USA; Atwell, William, Boeing North American, Inc., USA; September 1999; 36p; In English; Original has color illustrations
Contract(s)/Grant(s): RTOP 199-45-16-12
Report No.(s): NASA/TP-1999-209369; L-17780; NAS 1.60:209369; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The interplanetary plasma and fields are affected by the degree of disturbance that is related to the number and types of sunspots in the solar surface. Sunspot observations were improved with the introduction of the telescope in the seventeenth century, allowing observations which cover many centuries. A single quantity (sunspot number) was defined by Wolf in 1848 that is now known to be well correlated with many space observable quantities and is used herein to represent variations caused in the space radiation environment. The resultant environmental models are intended for future aircraft and space-travel-related exposure estimates.
Author
Extraterrestrial Radiation; Interplanetary Medium; Space Plasmas; Sunspots; Solar Cycles; Cosmic Rays; Solar Activity Effects

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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.

19990064329 Oxford Univ., Dept. of Astrophysics, Oxford, UK
The Emission Line-Radio Correlation for Radio Sources Using the 7C Redshift Survey
Willott, Chris J., Oxford Univ., UK; Rawlings, Steve, Oxford Univ., UK; Blundell, Katherine M., Oxford Univ., UK; Lacy, Mark, Oxford Univ., UK; 1999; In English
Report No.(s): OUAST/99/14; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Physics, Astrophysics, Keble Rd., Oxford, OX1 3RH, England), Hardcopy

We have used narrow emission line data from the new 7C Redshift Survey to investigate correlations between the narrow-line luminosities and the radio proper-ties of radio galaxies and steep-spectrum quasars. The 7C Redshift Survey is a low-frequency (151 MHz) selected sample with a flux-density limit about 25-times fainter than the 3CRR sample. by combining these samples, we can for the first time distinguish whether the correlations present are controlled by 151 MHz radio luminosity L(sub 151) or redshift z. We find unequivocal evidence that the dominant effect is a strong positive correlation between narrow line luminosity L(sub NLR) and L(sub 151), of the form L(sub NLR) proportional to L(sub 151, sup 0.79 +/- 0.04). Correlations of L(sub NLR) with redshift or radio properties, such as linear size or 151 MHz (rest-frame) spectral index, are either much weaker or absent. We use simple assumptions to estimate the total bulk kinetic power Q of the jets in FRII radio sources, and confirm the underlying proportionality between jet power and narrow line luminosity first discussed by Rawlings & Saunders (1991). We make the assumption that the main energy input to the narrow line region is photoionisation by the quasar accretion disc, and relate Q to the disc luminosity, Q(sub phot). We find that 0.05 less than or equal to Q/Q(sub phot) less than or equal to 1 so that the jet power is within about an order of magnitude of the accretion disc luminosity. Values of Q/Q(sub phot) approx. 1 require the volume filling factor of eta the synchrotron-emitting material to be of order unity, and in addition require one or more of the following: (1) an important contribution to the energy budget from protons; (2) a large reservoir of mildly-relativistic electrons; and (3) a substantial departure from the minimum energy condition in the lobe material. The most powerful radio sources are accreting at rates close to the Eddington limit of supermassive black holes (M(sub BH) greater than or equal to 10(exp 90 solar mass), whilst lower power sources are accreting at sub-Eddington rates.
Author
Emission Spectra; Radio Physics; Correlation; Red Shift; Photoionization; Luminosity

19990064348 NASA Marshall Space Flight Center, Huntsville, AL USA
Gamma-Ray Bursts
Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; Science; Aug. 19, 1997; Volume 277, pp. 1257-1258; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Gamma-ray burst (GRB) have been an unsolved mystery in high-energy astrophysics for the last 30 years. Immediately after GRB were discovered, scientists tried to understand the mechanism that causes these events and where they come from. Since than, many theories have been suggested to explain GRB which have durations spanning five orders of magnitude (ranging between a few milliseconds and minutes) and spectrals that peak generally in the range of 0.1 to 1 MeV. Given this numbers, most theorists would think of processes occurring near neutron stars in our galaxy, many of which are known sources of rapidly varying, high-energy photon emission.
Author
Gamma Rays; Bursts; Neutron Stars

19990064428 New Hampshire Univ., Durham, NH USA
CGRO Guest Investigator Program: Cycle 7, Pt. 1, Exploring the Gamma-Ray Sky at 2.2 MeV ***Final Report***
McConnell, Mark L., New Hampshire Univ., USA; Aug. 02, 1999; 13p; In English
Contract(s)/Grant(s): NAG5-6863; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this project was to search for a counterpart to an apparent point source of 2.2 MeV gamma-rays that had been detected using data from the COMPTEL experiment on CGRO. The source detected by COMPTEL was of marginal significance (less than 4(sigma)) and a further, independent, confirmation by OSSE was highly desired. Unfortunately, the planned CGRO observations (with both COMPTEL and OSSE) during cycle 7 were superseded by ToO observations of SN 1998bu.
Author
Gamma Rays; Observation; Radiation Sources

19990064508 NASA Marshall Space Flight Center, Huntsville, AL USA
Observations of Gamma-Ray Bursts
Fishman, Gerald J., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; The Neutron Star-Black Hole Connection, 16 Jun. 1999, Crete, Greece; Sponsored by North Atlantic Treaty Organization, Belgium; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Gamma-ray bursts are now generally believed to originate from cosmological distances and represent the largest known explosions in the Universe. These lectures will describe the temporal and spectral characteristic of gamma-ray bursts, their intensity and sky distribution, and other observed characteristics in the gamma-ray region, primarily from data obtained with the BATSE experiment on the Compton Observatory. A summary of recent discoveries and observations in other wavelength regions

will also be presented, along with their implications for models of the burst emission mechanism. Various possibilities and models for the energy source(s) of gamma-ray bursts will be described.
Author
Gamma Ray Bursts; Spectra; Explosions; Cosmology

19990064628 NASA Marshall Space Flight Center, Huntsville, AL USA
Properties of the Second Outburst of the Bursting Pulsar (GRO J1744-28) as Observed with BATSE
Woods, P., NASA Marshall Space Flight Center, USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; vanParadijs, J., NASA Marshall Space Flight Center, USA; Briggs, M. S., NASA Marshall Space Flight Center, USA; Wilson, C. A., NASA Marshall Space Flight Center, USA; Deal, K. J., NASA Marshall Space Flight Center, USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Lewin, W. H., NASA Marshall Space Flight Center, USA; Kommers, J., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

One year after its discovery, the Bursting Pulsar (GRO J1744-28) went into outburst again, displaying the hard X-ray bursts and pulsations that make this source unique. We report on Burst and Transient Source Experiment (BATSE) observations of both the persistent and burst emission for this second outburst and draw comparisons to the first. The second outburst was smaller than the first in both duration and peak luminosity. The persistent flux, burst peak flux and burst fluence were all reduced in amplitude by a factor approximately 1.7. Despite these differences, the average burst occurrence rate and average burst durations were roughly the same through each outburst. Similar to the first outburst, no spectral evolution was found within bursts and the parameter alpha was very small at the start of the outburst (alpha = 2.1 +/- 1.7 on 1996 December 2). Although no spectral evolution was found within individual bursts, we find evidence for a small (20%) variation of the spectral temperature during the course of the second outburst.
Author
Pulsars; Gamma Ray Bursts; Gamma Ray Astronomy

19990064630 NASA Marshall Space Flight Center, Huntsville, AL USA
Long-Term Variability and Transient Behavior of some Galactic Hard X-Ray Sources as Observed with BATSE
Fishman, Gerald J., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 3rd, 12-19 Sep. 1998, Taormina, Italy; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Burst and Transient Source Experiment (BATSE) experiment on the Compton Observatory has been providing continuous, all-sky monitoring of the hard X-ray sky for over seven years. A wide variety of transient and high-variability phenomena are observed for about sixty Galactic neutron star and black hole systems. A daily sensitivity level of approximately 75 mCrab is attained for sources observed by Earth occultation in un-crowded regions and approximately 20 mCrab for pulsars with known periods. This talk will qualitatively describe the types of variability that are observed from some of the brighter sources, including their duty-cycle and the various time-scales observed. Implications for the INTEGRAL mission will be discussed.
Author
Variability; Galaxies; X Ray Sources; Gamma Ray Bursts; X Ray Astronomy; Stellar Radiation

19990064645 NASA Marshall Space Flight Center, Huntsville, AL USA
An Application of the Direct Coulomb Electron Pair Production Process to the Energy Measurement of the ”VH-Group” in the ”Knee” Region of the ”All-Particle” Energy Spectrum
Derrickson, J. H., NASA Marshall Space Flight Center, USA; Wu, J., Fayetteville State Univ., USA; Christl, M. J., NASA Marshall Space Flight Center, USA; Fountain, W. F., NASA Marshall Space Flight Center, USA; Parnell, T. A., Alabama Univ., USA; 1999; 1p; In English; 26th; International Cosmic Ray, 17-25 Aug. 1999, Salt Lake City, UT, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The ”all-particle” cosmic ray energy spectrum appears to be exhibiting a significant change in the spectral index just above approximately 3000 TeV. This could indicate (1) a change in the propagation of the cosmic rays in the galactic medium, and/or (2) the upper limit of the supernova shock wave acceleration mechanism, and/or (3) a new source of high-energy cosmic rays. Air shower and JACEE data indicate the spectral change is associated with a composition change to a heavier element mixture whereas DICE does not indicate this. A detector concept will be presented that utilizes the energy dependence of the production of direct Coulomb electron-positron pairs by energetic heavy ions. Monte Carlo simulations of a direct electron pair detector consisting of Pb target foils interleaved with planes of 1-mm square scintillating optical fibers will be discussed. The goal is to design

a large area, non-saturating instrument to measure the energy spectrum of the individual cosmic ray elements in the ”VH-group” for energies greater than 10 TeV/nucleon.
Author
Cosmic Ray Showers; Energy Spectra; Radiation Spectra; Electron-Positron Pairs; Pair Production

19990066657 NASA Marshall Space Flight Center, Huntsville, AL USA
A Summary of Biases in the BATSE Burst Trigger
Meegan, Charles A, NASA Marshall Space Flight Center, USA; Pendleton, Geoffrey N., NASA Marshall Space Flight Center, USA; Mallozzi, Robert S., NASA Marshall Space Flight Center, USA; 1999; In English, 12-15 Apr. 1999, Charleston, SC, USA; Sponsored by American Astronautical Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The BATSE threshold for triggering on a gamma-ray burst is generally expressed in units of peak flux between 50 and 300 keV averaged over 1024 milliseconds. The completeness of the sample is affected by several systematic and statistical affects. A study is currently underway to characterize two of these that have not yet been Included Abstract: in the BATSE trigger efficiency calculation. They are: 1) the effects of statistical fluctuations on the measurement of peak flux and, 2) the effect on the trigger threshold of ”slow risers”, In which some of the burst flux is Identified as background. Some other biases that have been identified are in fact Malmquist-type biases which relate to a volume limited, rather than peak flux limited, burst source distribution and which cannot be determined without knowledge of the burst luminosity distribution.
Author
Gamma Ray Bursts; Actuators; Bias; Threshold Gates

19990067625 NASA Marshall Space Flight Center, Huntsville, AL USA
IAUC 6530: GRO J1744-28; C/1995 01
Kouveliotou, Chryssa, Universities Space Research Association, USA; Deal, K. J., Alabama Univ., USA; Richardson, G. A., Alabama Univ., USA; Briggs, M. S., Alabama Univ., USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; vanParadijs, J., Amsterdam Univ., Netherlands; Finger, M. H., Universities Space Research Association, USA; Robinson, C. R., Universities Space Research Association, USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Vaughan, B. A., California Inst. of Tech., USA; 1997; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have recorded a series of outbursts starting on 1996 Dec. 2 that are consistent with the position of GRO J1744-28, the bursting pulsar. The bursts are detected between 20 and 100 keV, and on Dec. 2 they came in variable rates ranging from every 300 to every 500 s, with a preliminary total number estimated between 80 and 1 00 events. After Dec. 3, the burst rate dropped to 15-20 bursts/day, where it has remained. The current average error radius of the burst locations is about 4 deg. The burst fluence is currently about 2 x 10E-7 erg cmE-2. This indicates that the source is in outburst again. Although the source location is currently very close to the sun, we encourage observations in other wavelengths whenever possible. Persistent, hard x-ray emission from GRO J1744-28 (IAUC 6272, 6284, 6285) is currently being detected through both pulsation and earth occultation. Pulsations with a period near 0.467 s became detectable on Dec. 17, rising to a 20- to 40-keV-rms-pulsed flux of 1.3(1) x 10E-9 erg cmE-1 sE-1 (170 mCrab) by 1997 Jan. 3. On Jan. 1.0, the intrinsic pulse frequency was 2.1408983(4) Hz, and the spin-up rate was 2.8(5) x l0E-12 HzsE-1. This assumes the following circular orbit parameters: P = 11.83665(14) days; epoch of longitude 90 deg = JD 2450126.9977(4) TDB; a sin i = 2.6371(5) light-s (determined using data from the 1995 Dec.-l996 Apr. outburst). Earth-occultation monitoring of flux from GRO J1744-28 shows its intensity increasing by a factor of about two during 1996 Dec. 25-1997 Jan. 6. Although source confusion prevents a precise flux estimate, subtracting a 25-percent background for unresolved galactic-center sources yields a persistent flux for Jan. 3-6 in the energy bands 20-30, 30-40, and 40-50 keV of 590, 470, and 290 mcrab, respectively.”
Author
Pulsars; Gamma Ray Astronomy; Gamma Ray Sources (Astronomy); Gamma Ray Bursts

19990068009 NASA Marshall Space Flight Center, Huntsville, AL USA
Observational Review of Gamma-Ray Bursts
Fishman, Gerald J., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Results and Perspectives in Particle Physics, 28 Feb. - 6 Mar. 1999, LaThuile, Italy; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The observed gamma-ray temporal, spectral, intensity and spatial distribution characteristics of GRBs, primarily from data obtained from the Compton Observatory, will be described. The talk will concentrate on recent studies of burst properties, correlations of GRB parameters and other statistical studies that have only recently come to light with the unprecedented sample of over

two thousand GRBs, along with some mention of studies in progress by members of the BATSE team. Recent studies of possible observational biases, un-triggered GRBs and threshold calculations for BATSE will also be described.
Author
Gamma Ray Bursts; Spatial Distribution; Gamma Ray Astronomy; Gamma Ray Spectra

19990068041 NASA Marshall Space Flight Center, Huntsville, AL USA
Anticipating HESSI's View of Spectral Evolution in Flare Hard X-Ray Emission
Newton, Elizabeth K., NASA Marshall Space Flight Center, USA; Miller, James A., Alabama Univ., USA; 1999; 1p; In English; HESSI Workshop, 19 Oct. 199, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The spectral evolution of observed flares' hard X-ray emission is found to conform to certain patterns in color-color diagrams (CCDs). by combining the spectral resolution of BATSE data with the spatial resolution of HXT data, we are able to address the nature of flare energy release and anticipate what kind of observations HESSI may make of the energy release/particle acceleration site in flares. The implications of these observations for theoretical models of acceleration and propagation is considered.
Author
Spectral Resolution; Solar Flares; Emission; Gamma Ray Bursts; Observation

19990068042 NASA Marshall Space Flight Center, Huntsville, AL USA
Gamma-Ray Spectra and Variability of Cygnus Z-1 Observed by BATSE
Ling, J. C., Jet Propulsion Lab., California Inst. of Tech., USA; Wheaton, William A., Jet Propulsion Lab., California Inst. of Tech., USA; Wallyn, P., Jet Propulsion Lab., California Inst. of Tech., USA; Mahoney, W. ., Jet Propulsion Lab., California Inst. of Tech., USA; Paciesas, W. S., Alabama Univ., USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Zhang, S. N., Universities Space Research Association, USA; Hua, X. M., NASA Goddard Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present new BATSE earth occultation observations of the 25 keV-1.8 MeV spectrum and variability of Cygnus X-1 made between August 1993 and May 1994. We observed that the normal soft gamma ray spectrum (gamma2) of Cygnus X-1 has two components: a Comptonized part seen below 300 keV, and a high-energy tail in the 0.3 - 2 MeV range. We interpret it in terms of a two-layer region, consisting of a high-energy core (with an equivalent electron temperature of approximately 210-250 keV) near the event horizon, embedded in an about 50 keV corona. In this scenario, the observed 25-300 keV photons were produced by Compton scattering of soft photons (about 0.5 keV) by the hot electrons in the outer corona. These same hard x rays were further up-scattered by a population of energetic electrons in the inner core, producing the spectral tail above 300 keV. Cygnus X-1 went through an extended sequence of transitions between August 1993 and May 1994, when the 45-140 keV flux first decreased steadily from approximately gamma2 to roughly one-quarter of its intensity over a period of about 140 days. The flux remained at this low level for about 40 days before returning, swiftly (approximately 20 days) to approximately the initial gamma2 level. During the transition, the spectrum evolved to a shape consistent with either a power law with photon index of about 2.6 or a single temperature Compton model with electron temperature kT = 110 +/- 11 keV, and optical depth t = 0.40 +/- 0.06, and then returned essentially to the original gamma2 spectrum at the end of the active period. The overall cooling of the system during the low flux period may be due to an increase in the soft photon population which effectively quenched the hot electrons in these regions through Compton scattering.
Author
Black Holes (Astronomy); Compton Effect; Electron Scattering; Gamma Ray Bursts; Hot Electrons; Photons; X Ray Binaries

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GENERAL

19990069534 Research Inst. for Advanced Computer Science, Moffett Field, CA USA
RIACS *Annual Report, 1 Oct. 1997 - 30 Sep. 1998*
Moore, Robert C., Research Inst. for Advanced Computer Science, USA; 1998; 62p; In English
Contract(s)/Grant(s): NCC2-1006; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Research Institute for Advanced Computer Science (RIACS) was established by the Universities Space Research Association (USRA) at the NASA Ames Research Center (ARC) on June 6, 1983. RIACS is privately operated by USRA, a consortium of universities that serves as a bridge between NASA and the academic community. Under a five-year co-operative agreement with NASA, research at RIACS is focused on areas that are strategically enabling to the Ames Research Center's role as NASA's Center of Excellence for Information Technology. The primary mission of RIACS is charted to carry out research and development

in computer science. This work is devoted in the main to tasks that are strategically enabling with respect to NASA's bold mission in space exploration and aeronautics. There are three foci for this work: (1) Automated Reasoning. (2) Human-Centered Computing. and (3) High Performance Computing and Networking. RIACS has the additional goal of broadening the base of researcher in these areas of importance to the nation's space and aeronautics enterprises. Through its visiting scientist program, RIACS facilitates the participation of university-based researchers, including both faculty and students, in the research activities of NASA and RIACS. RIACS researchers work in close collaboration with NASA computer scientists on projects such as the Remote Agent Experiment on Deep Space One mission, and Super-Resolution Surface Modeling.
Derived from text
Research and Development; Computer Networks; Research Facilities; Space Exploration

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