Scientific and Technical Aerospace Reports

STAR

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January 4, 1999

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

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

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

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

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

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Subject Divisions

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G. Mathematical and Computer Sciences
H. Physics
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Indexes

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

Subject Term Index

Personal Author Index

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Subject Categories of the Division A. Aeronautics

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01 Aeronautics (General)

02 Aerodynamics

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

03 Air Transportation and Safety

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

04 Aircraft Communications and Navigation

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

05 Aircraft Design, Testing and Performance

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

06 Aircraft Instrumentation

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

07 Aircraft Propulsion and Power

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

08 Aircraft Stability and Control

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

09 Research and Support Facilities (Air)

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

Subject Categories of the Division B. Astronautics

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

12 Astronautics (General)

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

13 Astrodynamics

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

14 Ground Support Systems and Facilities (Space)

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

15 Launch Vehicles and Space Vehicles

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

16 Space Transportation

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

17 Space Communications, Spacecraft Communications, Command and Tracking

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

18 Spacecraft Design, Testing and Performance

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

19 Spacecraft Instrumentation

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

20 Spacecraft Propulsion and Power

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

Subject Categories of the Division C. Chemistry and Materials

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23 Chemistry and Materials (General)

24 Composite Materials

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

25 Inorganic and Physical Chemistry

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

26 Metallic Materials

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

27 Nonmetallic Materials

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials.*

28 Propellants and Fuels

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

29 Materials Processing

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

Subject Categories of the Division D. Engineering

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31 Engineering (General)

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

32 Communications and Radar

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

33 Electronics and Electrical Engineering

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

34 Fluid Mechanics and Heat Transfer

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

35 Instrumentation and Photography

Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 Lasers and Masers

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

37 Mechanical Engineering

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

38 Quality Assurance and Reliability

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics

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

Subject Categories of the Division E. Geosciences

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

42 Geosciences (General)

43 Earth Resources and Remote Sensing

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

44 Energy Production and Conversion

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

45 Environment Pollution

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics

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

47 Meteorology and Climatology

Includes weather forecasting and modification.

48 Oceanography

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

Subject Categories of the Division F. Life Sciences

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

51 Life Sciences (General)

52 Aerospace Medicine

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

53 Behavioral Sciences

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

54 Man/System Technology and Life Support

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

55 Space Biology

Includes exobiology; planetary biology; and extraterrestrial life.

Subject Categories of the Division G. Mathematical and Computer Sciences

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

59 Mathematical and Computer Sciences (General)

60 Computer Operations and Hardware

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

61 Computer Programming and Software

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

62 Computer Systems

Includes computer networks and special application computer systems.

63 Cybernetics

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

64 Numerical Analysis

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability

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

66 Systems Analysis

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics

Includes topology and number theory.

Subject Categories of the Division H. Physics

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70 Physics (General)

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

71 Acoustics

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

72 Atomic and Molecular Physics

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics

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

74 Optics

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

75 Plasma Physics

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

76 Solid-State Physics

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

77 Thermodynamics and Statistical Physics

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

Subject Categories of the Division I. Social Sciences

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80 Social Sciences (General)

Includes educational matters.

81 Administration and Management

Includes management planning and research.

82 Documentation and Information Science

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see *61 Computer Programming and Software*.

83 Economics and Cost Analysis

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy

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

85 Urban Technology and Transportation

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

Subject Categories of the Division J. Space Sciences

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88 Space Sciences (General)

89 Astronomy

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

90 Astrophysics

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

91 Lunar and Planetary Exploration

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

92 Solar Physics

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

93 Space Radiation

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

Subject Categories of the Division K. General

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99 General

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

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Typical Report Citation and Abstract

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

Key

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 37, JANUARY 4, 1999

01
AERONAUTICS (GENERAL)

19990004398 Academy of Sciences (USSR), Inst. of Theoretical and Applied Mechanics, Novosibirsk, USSR
International Conference on the Methods of Aerophysical Research: Proceedings, Part 2
Jan. 1998; 231p; In English; Methods of Aerophysical Research, 29 Jun. - 3 Jul. 1998, Novosibirsk, Russia
Contract(s)/Grant(s): F61775-98-WE002
Report No.(s): AD-A354010; CSP-98-1025-Pt-2; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The Final Proceedings for International Conference on Methods of Aerophysical Research (lCMAR'98), 29 June 1998 - 3 July 1998 This is an interdisciplinary conference. Topics include: Problems of Modeling at sub/trans/super/hypersonic velocities: Methods of flow diagnostics; Instrumentation for aerophysical experiments; and Verification of CFD models and methods.
DTIC
Conferences; Aerodynamics; Aerodynamic Characteristics

19990007836 Advisory Group for Aerospace Research and Development, Mission Systems Panel, Neuilly-Sur-Seine, France
System Design Considerations for Unmanned Tactical Aircraft (UTA) ***Les Considerations dans les Projects de Systemes pour les Aeronefs Tactiques et Non Pilotes***
Jul. 1998; 292p; In English; In French; 8th; Mission Systems Panel Symposium, 7-9 Oct. 1997, Athens, Greece; Also announced as 19990007837 through 19990007863; Original contains color illustrations
Report No.(s): AGARD-CP-594; ISBN 92-836-0057-6; Copyright Waived; Avail: CASI; A13, Hardcopy; A03, Microfiche

This volume contains the Technical Evaluation Report, the Keynote Address and the 26 unclassified papers, presented at the Mission Systems Panel 8th Symposium held in Amfithea (Athens) Greece from 7th to 9th October 1997. The papers presented covered the following headings: (1) Applications; (2) Operational Concepts I & II; (3) Advances in UTA Techniques and Technologies (NAV, C(sup 3)I, G&C); and (4) Advances in UTA Techniques and Technologies (Sensors, Processing, Data Fusion).
Author
Conferences; Pilotless Aircraft; Systems Engineering; Aircraft Design; Tacan

19990007842 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
Design Considerations for Future Unihabited Combat Air Vehicles
Chaput, Armand J., Lockheed Martin Tactical Aircraft Systems, USA; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A potential shortfall in U.S. tactical aircraft inventories required to meet future national and international defense contingency requirements early in the next century is projected to materialize some time during the period 2005-2015. The Uninhabited Combat Air Vehicle (UCAV) system concept has potential to help resolve the projected inventory shortfall. Lockheed Martin Tactical Aircraft Systems (LMTAS) studies have identified a number of potential roles and missions in which the UCAV should he both cost and operationally effective. The UCAV concept, however, is unproven and needs system concept technology development, evaluation and demonstration if it is to be considered a viable candidate to meet the projected shortfall. A near-term development program that includes overall system simulation, evaluation and demonstration in combination with configuration specific and advanced technology development (ATD) will ensure that defense planners have a viable alternative ready for decision by the time the projected shortfall materializes.
Author
Pilotless Aircraft; Remotely Piloted Vehicles; Design Analysis; Systems Integration; Systems Analysis; Fighter Aircraft

19990007899 NASA Scientific and Technical Information Facility, Baltimore-Washington International Airport,MD USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 389
Dec. 11, 1998; 80p; In English
Report No.(s): NASA/SP-1998-7037/SUPPL389; NAS 1.21:7037/SUPPL389; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This supplemental issue of Aeronautical Engineering, A Continuing Bibliography with Indexes (NASA/SP-1998-7037) lists reports, articles, and other documents recently announced in the NASA STI Database. The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.
CASI
Aeronautical Engineering; Aerodynamics; Bibliographies; Indexes (Documentation)

19990008041 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
A Study of Uranus' Bow Shock Motions Using Langmuir Waves
Xue, S., Iowa Univ., USA; Cairns, I. H., Iowa Univ., USA; Smith, C. W., Delaware Univ., USA; Gurnett, D. A., Iowa Univ., USA; Journal of Geophysical Research; Apr. 01, 1996; ISSN 0148-0227; Volume 101, No. A4, pp. 7659-7676; In English
Contract(s)/Grant(s): JPL-959193; JPL-959167; NAGw-2040; NAGw-3445; NSF ATM-90-21985
Report No.(s): Paper-95JA03849; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

During the Voyager 2 flyby of Uranus, strong electron plasma oscillations (Langmuir waves) were detected by the plasma wave instrument in the 1.78-kHz channel on January 23-24, 1986, prior to the inbound bow shock crossing. Langmuir waves are excited by energetic electrons streaming away from the bow shock. The goal of this work is to estimate the location and motion of Uranus' bow shock using Langmuir wave data, together with the spacecraft positions and the measured interplanetary magnetic field. The following three remote sensing analyses were performed: the basic remote sensing method, the lag time method, and the trace-back method. Because the interplanetary magnetic field was highly variable, the first analysis encountered difficulties in obtaining a realistic estimation of Uranus' bow shock motion. In the lag time method developed here, time lags due to the solar wind's finite convection speed are taken into account when calculating the shock's standoff distance. In the new trace-back method, limits on the standoff distance are obtained as a function of time by reconstructing electron paths. Most of the results produced by the latter two analyses are consistent with predictions based on the standard theoretical model and the measured solar wind plasma parameters. Differences between our calculations and the theoretical model are discussed.
Author
Observation; Uranus (Planet); Bow Waves; Shock Waves; Plasma Oscillations; Mathematical Models; Electron Plasma

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.

19990004152 Instituto Nacional de Tecnica Aeroespacial, Torrejon de Ardoz, Spain
Computations of DFVLR-F4 Model Using a Viscous Flow Solver for Transonic Wings
Varona, Jose Jimenez, Instituto Nacional de Tecnica Aeroespacial, Spain; Jun. 02, 1998; 65p; In English
Report No.(s): AT/TNO/4510/001/INTA/98; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Some theoretical results of the DFVLR-F4 Model obtained with a viscous flow solver for transonic wings are shown in this document. These calculation have been done under the AEREA F4 Model Test Programme. It is intended the assessment of CFD codes, using the information from the experiments of the DFVLR-F4 model at low and high Reynolds numbers. In the present paper, some comparisons with experimental results obtained at a Reynolds number of 3.0. 10(exp 6) are included. The code utilized is a viscous flow solver, which uses a direct iterative method, coupling an inviscid solver to an integral boundary layer method. The inviscid solver have been widely improved along 1996-97. These modifications have contributed to an improvement of the theoretical results when compared with the experimental ones. The results obtained at present show some lacks of the code in predicting the skin friction coefficient and in the computation of the laminar part of the wing. The absence of body effects leads to some differences in the predicted pitching moment, and in the slope of the lift coefficient. The possibilities of the code to improve the accuracy of the current solutions have been addressed. The boundary layer code has been improved at DLR, in order

to compute the laminar part of the wing, and to include a transition criteria. Additionally, a better numerical solution has been implemented. INTA and DLR are preparing an agreement of cooperation to develop a code which will use the improved flow solver developed at INTA and the improved boundary layer code developed at DLR. Additionally, other possibilities of improvement will be explored. The results obtained at present permit us to be confident in the possibilities of the code, which could give reasonable results at low computing times. The information of the ETW test campaign during December 1997 will help to validate the new results.
Author
Computation; Numerical Analysis; Models; Wings; Transonic Flow

19990007788 ESDU International Ltd., London, UK
Effect of Angle of Attack on the Base Axial Force and Drag of Cylindrical Bodies with Conical Boat-Tails
Dec. 1996; 12p; In English; Included in the Aerodynamics Sub-series.
Report No.(s): ESDU-96033; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham Street, London, N1 6UA, England), Hardcopy, Microfiche

ESDU 96033 presents an empirical method applying to cylindrical bodies with or without conical boat-tails, at angles of attack up to 25 degrees and Mach numbers up to 5. The method requires a value of the base drag at zero angle of angle of attack which may be obtained from ESDU 76033, 78041 and 79022 for subsonic, transonic and supersonic speeds, respectively. There must be at least three diameters of cylindrical section upstream of the boat-tail and the boundary layer must be fully turbulent. The method is accurate to within 0.03 in axial force coefficient based on body maximum cross section. Comparisons of predicted with experimental results are shown. A worked example illustrates the use of the method.
Author
Angle of Attack; Axial Loads; Aerodynamic Drag; Cylindrical Bodies; Conical Nozzles

19990007790 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Modelling of Airfoil-Vortex Interaction and Application to a Helicopter Rotor. Contribution to Blade-Vortex Interaction Noise Prediction ***Modelisation de l'Interaction Profil-Tourbillon et Application au Rotor d'Helicoptere. Contribution a la Prevision du Bruit d'Interaction Pale-Tourbillon***
Rahier, Gilles, Office National d'Etudes et de Recherches Aerospatiales, France; Feb. 1998; ISSN 0078-3780; 218p; In English
Report No.(s): ONERA-PB-1998-1; ESA-TT-1354; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This thesis comes under the scope of work relating to the blade-vortex interaction noise from a helicopter main rotor. It deals with the prediction of blade pressure fluctuations which are the main sources of sound produced by these interactions. Part 1 deals with the study of two-dimensional airfoil-vortex interaction in an inviscid incompressible fluid. The calculations are performed using integral method and take into account vortex deformation during strong interactions. Several ways of modelling the vortex are studied and their influence on the response of the airfoil is analysed. The predictions are compared with other theoretical results and with experiment. The method of calculation is then employed to highlight the role of the main parameters in strong interaction. In part 2, it is applied to a helicopter rotor, after transposing the actual 3D problem into a multi-2D problem. The position and circulation of the vortices are obtained by modelling blade wake roll-up. A law for the evolution of their viscous radius is proposed. The effects of finite wingspan and compressibility are introduced by means of corrections. The approach is validated by comparisons with experiment in the case of a rotor interacting with a prescribed vortex and in that of a rotor interacting with the vortices from its wake. to conclude, the computational capabilities and limitations are summarized and future prospects.
Author
Blade-Vortex Interaction; Airfoils; Computer Systems Performance; Computer Techniques; Noise Prediction; Rotors

19990007832 NASA Langley Research Center, Hampton,VA USA
Tetrahedral Finite-Volume Solutions to the Navier-Stokes Equations on Complex Configurations
Frink, Neal T., NASA Langley Research Center, USA; Pirzadeh, Shahyar Z., NASA Langley Research Center, USA; Dec. 1998; 16p; In English; 10th; Finite Elements in Fluids, 5-8 Jan. 1998, Tucson, AZ, USA
Contract(s)/Grant(s): RTOP 522-31-21-2O
Report No.(s): NASA/TM-1998-208961; L-17783; NAS 1.15:208961; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A review of the algorithmic features and capabilities of the unstructured-grid flow solver USM3Dns is presented. This code, along with the tetrahedral grid generator, VGRIDns, is being extensively used throughout the U.S. for solving the Euler and Navier-Stokes equations on complex aerodynamic problems. Spatial discretization is accomplished by a tetrahedral cell-centered finite-volume formulation using Roe's upwind flux difference splitting. The fluxes are limited by either a Superbee or MinMod

limiter. Solution reconstruction within the tetrahedral cells is accomplished with a simple, but novel, multidimensional analytical formula. Time is advanced by an implicit backward-Euler time-stepping scheme. Flow turbulence effects are modeled by the Spalart-Allmaras one-equation model, which is coupled with a wall function to reduce the number of cells in the near-wall region of the boundary layer. The issues of accuracy and robustness of USM3Dns Navier-Stokes capabilities are addressed for a flat-plate boundary layer, and a full F-16 aircraft with external stores at transonic speed.
Author
Finite Volume Method; Flux Difference Splitting; Mathematical Models; Navier-Stokes Equation; Turbulent Boundary Layer; Computational Fluid Dynamics; Unstructured Grids (Mathematics); Euler Equations of Motion; Turbulent Flow; Applications Programs (Computers); Grid Generation (Mathematics)

19990008037 NASA Langley Research Center, Hampton, VA USA
Global Nonlinear Parametric Modeling with Application to F-16 Aerodynamics
Morelli, Eugene A., NASA Langley Research Center, USA; 1998; 6p; In English; Control, 24-26 Jun. 1998, Philadelphia, PA, USA
Report No.(s): ACC-I-98010-2; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
A global nonlinear parametric modeling technique is described and demonstrated. The technique uses multivariate orthogonal modeling functions generated from the data to determine nonlinear model structure, then expands each retained modeling function into an ordinary multivariate polynomial. The final model form is a finite multivariate power series expansion for the dependent variable in terms of the independent variables. Partial derivatives of the identified models can be used to assemble globally valid linear parameter varying models. The technique is demonstrated by identifying global nonlinear parametric models for nondimensional aerodynamic force and moment coefficients from a subsonic wind tunnel database for the F-16 fighter aircraft. Results show less than 10% difference between wind tunnel aerodynamic data and the nonlinear parameterized model for a simulated doublet maneuver at moderate angle of attack. Analysis indicated that the global nonlinear parametric models adequately captured the multivariate nonlinear aerodynamic functional dependence.
Author
F-16 Aircraft; Orthogonal Functions; Mathematical Models; Multivariate Statistical Analysis; Aerodynamic Coefficients; Aerodynamic Forces

19990008181 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
Numerical Stability and Control Analysis Towards Falling-Leaf Prediction Capabilities of Splitflow for Two Generic High-Performance Aircraft Models
Charlton, Eric F., Lockheed Martin Tactical Aircraft Systems, USA; Sep. 1998; 58p; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 522-22-31-01
Report No.(s): NASA/CR-1998-208730; NAS 1.26:208730; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Aerodynamic analysis are performed using the Lockheed-Martin Tactical Aircraft Systems (LMTAS) Splitflow computational fluid dynamics code to investigate the computational prediction capabilities for vortex-dominated flow fields of two different tailless aircraft models at large angles of attack and sideslip. These computations are performed with the goal of providing useful stability and control data to designers of high performance aircraft. Appropriate metrics for accuracy, time, and ease of use are determined in consultations with both the LMTAS Advanced Design and Stability and Control groups. Results are obtained and compared to wind-tunnel data for all six components of forces and moments. Moment data is combined to form a ”falling leaf” stability analysis. Finally, a handful of viscous simulations were also performed to further investigate nonlinearities and possible viscous effects in the differences between the accumulated inviscid computational and experimental data.
Author
Aerodynamic Characteristics; Aircraft Models; Aircraft Performance; Angle of Attack; Computational Fluid Dynamics; Design Analysis; Fighter Aircraft; Supersonic Aircraft

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.

19990004140 LB and M Associates, Inc., Oklahoma City, OK USA
Analysis of Ditching and Water Survival Training Programs of Major Airframe Manufacturers and Airlines ***Final Report***
Cosper, Donna K., LB and M Associates, Inc., USA; McLean, Garner A., Civil Aeromedical Inst., USA; Jul. 1998; 36p; In English
Contract(s)/Grant(s): DTFA02-94-T-80076; FAA Proj. AM-B-94-PRS-89
Report No.(s): DOT/FAA/AM-98/19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current transport category aircrew training programs related to ditching and water survival are reviewed for content and attention to data. This activity resulted from industry and regulatory inquiries about the state- of-the-art in ditching and water survival operations, especially with regard to the increasing number of aircraft operations, and associated opportunities for emergency water landing events, that the future will bring. The information on water landing events was gathered from published reports related to these issues. For example, Johnson (1984) cited 16 transport category water landings that occurred during the period from 1959 to 1979, and Chen and Muller (1994) reported that 33 water-impact accidents occurred in commuter category aircraft from 1982 until 1989. An additional 21 water-related accidents or near idents occurred in transport a raft from 1980 through 1994. Training materials related to ditching and water survival were provided by six major airframe manufacturers and nine major airlines. The purpose of the study was to examine the information flight attendants, as well as passengers, are provided about ditching and water survival equipment and procedures, to determine if existing training practices are satisfactory. Special emphasis is placed on unplanned water landing events. The resulting analysis identifies deficiencies in both water survival equipment and procedures, and recommends solutions designed to promote more advanced water landing and water survival operations.
Author
Water Landing; Survival; Passengers; Flight Operations; Emergencies; Commuter Aircraft; Commercial Aircraft; Airline Operations

19990004384 Federal Aviation Administration, Washington, DC USA
Notices to Airmen: Domestic/International, September 10, 1998
Sep. 10, 1998; 214p; In English
Report No.(s): PB99-104325; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Table of contents: Airway notams; Airports, facilities, and procedural Notams; General FDC Notams; Part 95 Revisions to minimum en route IFR altitudes and changeover points; International Notices to Airmen; Graphic notices.
NTIS
National Airspace System; Air Navigation; Charts; Runways; Airports

19990004385 Federal Aviation Administration, Washington, DC USA
Notices to Airmen: Domestic/International, May 21, 1998
May 21, 1998; 210p; In English
Report No.(s): PB99-104317; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Table of contents: Airway notams; Airports, facilities, and procedural Notams; General FDC Notams; Part 95 Revisions to minimum en route IFR altitudes and changeover points; International Notices to Airmen; Graphic notices.
NTIS
National Airspace System; Air Navigation; Charts; Runways; Airports; Routes

19990005047 CFD Research Corp., Huntsville, AL USA
Computational Fluid Dynamics Tools for Escape Systems Aerodynamic Analysis, Volume 2 of 2 ***Final Report***
habchi, S. D.; Rock, S. G.; Hufford, G. S.; Parsatharsay, V. J.; Przekwas, A. J.; Feb. 09, 1998; 165p; In English
Contract(s)/Grant(s): N62269-92-C-0248
Report No.(s): AD-A353755; CFDRC-4128/17; NAWCADPAX-97-257-TR; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report documents the findings of a SBIR Phase II study entitled ”CFD Analysis of Drag Reduction on an Ejection Seat During High Speed Ejection”. The main objectives of this study were to develop and validate Computational Fluid Dynamics (CFD) methodologies for comprehensive aerodynamic analysis of ejection seat and occupant in free flight, and develop and adapt

existing CFD technologies for analysis of ejection seat in proximity of aircraft for both steady-state and unsteady seat and aircraft separation using prescribed trajectory.
DTIC
Computational Fluid Dynamics; Escape Systems; Aerodynamic Characteristics; Ejection; Ejection Seats; Free Flight; Design Analysis

19990005048 CFD Research Corp., Huntsville, AL USA
Computational Fluid Dynamics Tools for Escape Systems Aerodynamic Analysis, Volume 1 of 2 ***Final Report***
habchi, S. D.; Rock, S. G.; Hufford, G. S.; Parsatharsay, V. J.; Przekwas, A. J.; Feb. 09, 1998; 129p; In English
Contract(s)/Grant(s): N62269-92-C-0248
Report No.(s): AD-A353756; CFDRC-4128/17; NAWCADPAX-97-257-TR; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report documents the findings of a SBIR Phase II study entitled ”CFD Analysis of Drag Reduction on an Ejection Seat During High Speed Ejection”. The main objectives of this study were to develop and validate Computational Fluid Dynamics (CFD) methodologies for comprehensive aerodynamic analysis of ejection seat and occupant in free flight, and develop and adapt existing CFD technologies for analysis of ejection seat in proximity of aircraft for both steady-state and unsteady seat and aircraft separation using prescribed trajectory.
DTIC
Aerodynamic Characteristics; Computational Fluid Dynamics; Ejection Seats; Ejection; Escape Systems; Design Analysis

19990007921 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Future of Satellite-Aided Search and Rescue
Wallace, Ronald, NASA Goddard Space Flight Center, USA; 1998; 9p; In English; Radio Technical Commission for Maritime Services Assembly, 11-15 May 1998, San Diego, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Satellite technology has been an integral part of maritime search and rescue since the COSPAS-SARSAT system began operation in 1984. This system, credited with more than eighty-six hundred lives saved, has recently been augmented to provide immediate response through geostationary satellites. The other satellite-based distress alerting system, INMARSAT, launched its emergency Standard C service in 1991 and Standard E in 1997. Current plans call for a continuation of service from both of these vital systems at least through the first decade of the next century. We are currently witnessing the construction of a number of new satellite systems that will have the potential for revolutionizing mobile communications. These systems will be capable of emergency communication, and must be given due consideration in any look at the future, This paper reviews existing systems using satellites for distress alerting, describes the plans in place for them, and discusses likely developments.
Author
Inmarsat Satellites; Mobile Communication Systems; Rescue Operations; Synchronous Platforms; SARSAT; COSPAS

19990008228 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board: Aircraft Accident Report. In-Flight Fire/Emergency Landing Federal Express Flight 1406 Douglas DC-10-10, N68055, Newburgh, New York, September 5, 1996
Jan. 01, 1998; 148p; In English
Report No.(s): PB98-910403; NTSB/AAR-98/03; DCA-96-MA-07-9; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report explains the accident involving Federal Express flight 1406, a Douglas DC-10-10, which made an emergency landing at Stewart International Airport on September 5, 1996, after the flightcrew determined that there was smoke in the cabin cargo compartment. Safety issues in the report include flightcrew performance of emergency procedures, undeclared hazardous materials in transportation, dissemination of hazardous materials information, airport emergency response, and adequacy of aircraft interior firefighting methods.
NTIS
Safety; Safety Management; Aircraft Accident Investigation; Aircraft Accidents; Fires; Emergencies; Air Transportation

19990008229 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders: Adopted and Issued during the Month of August, 1998
Aug. 1998; 328p; In English
Report No.(s): PB98-916708; NTSB/IDBOO-98/08; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety Enforcement and Seaman Enforcement Cases for August 1998.
NTIS
Safety Management; Air Transportation

19990008258 European Organization for the Safety of Air Navigation, Experimental Centre, Bretigny-sur-Orge, France
Gears Conflict Resolution Algorithm
Irvine, R., European Organization for the Safety of Air Navigation, France; Nov. 1997; 58p; In English
Report No.(s): PB99-101024; EEC-321; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An algorithm is described which finds a set of flyable, conflict-free trajectories for an aircraft which must fly through an environment containing obstacle aircraft whose trajectories are known. The algorithm makes systematic use of a maneuver generator and a conflict detector. The maneuver generator may embody a variety of aircraft behavior models which might, for example, take into account standard turn behavior and wind predictions. The conflict detector may embody a variety of definitions of what makes a trajectory unacceptable, and might, for example, take into account growing uncertainty in the future positions of aircraft. Correctness of solution trajectories is readily demonstrable. The algorithm is primarily intended for use in free-flight air traffic control simulations but might also be used in operational applications (ground or air-based) should conflict resolution assistance be required. In an automated simulation a solution trajectory can be chosen from the resulting set of conflict-free trajectories in accordance with optimization criteria. The algorithm may be used for prioritized planning of the motion of a number of aircraft. It may also be used to solve motion-planning problems in domains other than air traffic control.
NTIS
Gears; Algorithms; Air Traffic Control; Congestion; Separation; Trajectory Optimization; Flight Paths

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

19990004631 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Analysis of Spaceborne GPS Systems ***Final Report, 12 Sep. 1997 - 11 Mar. 1998***
Cosmo, Mario L., Smithsonian Astrophysical Observatory, USA; Davis, James L., Smithsonian Astrophysical Observatory, USA; Elosegui, Pedro, Smithsonian Astrophysical Observatory, USA; Hill, Michael, Smithsonian Astrophysical Observatory, USA; ScireScapuzzo, Francesca, Smithsonian Astrophysical Observatory, USA; 1998; 18p; In English
Contract(s)/Grant(s): NAG1-1969; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A reasonable amount of literature can be found on the general topic of GPS receiving antennas, but very little has been published on spaceborne GPS receiving antennas. This very new topic seems to be so far more of interest for the industrial world than for the academic community. For satellite applications, microstrip antennas are usually preferred over other types of antennas mainly because of their non-electrical characteristics, such as small size, relatively lightweight, shape, possibility of integration with microwave integrated circuits, and relatively low costs. Careful design of patch antennas could meet all the requirements (electrical and non-electrical) of GPS receiving antenna to be mounted on a tethered satellite.
Derived from text
Global Positioning System; Research; Spaceborne Experiments; Antenna Design; Spacecraft Antennas; Satellite Antennas

19990004640 Civil Aeromedical Inst., Oklahoma City, OK USA
Aircraft Importance and Its Relevance to Situation Awareness ***Final Report***
Gronlund, Scott D., Oklahoma Univ., USA; Ohrt, Daryl D., Oklahoma Univ., USA; Dougherty, Michael R. P., Oklahoma Univ., USA; Perry, Jennifer L., Oklahoma Univ., USA; Manning, Carol A., Civil Aeromedical Inst., USA; May 1998; 16p; In English
Report No.(s): DOT/FAA/AM-98/16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We tested en route air traffic controllers (currently serving as instructors at the FAA Academy) to determine what they remember about the aircraft in their sector. We focused on memory for flight data (especially aircraft altitude and ground speed) and the position of the aircraft on the radar screen. Aircraft importance affected memory for flight data but not the highly accurate recall of the radar position of the aircraft. We hypothesize that controllers use their excellent memory for aircraft position to classify

aircraft as important (potential traffic) or not, and better remember flight data about important aircraft (in particular, their exact altitude). The results have implications for improving techniques to assess situation awareness and interfaces to support it.
Author
Air Traffic Controllers (Personnel); Instructors; Memory

19990005953 Civil Aeromedical Inst., Oklahoma City, OK USA
The Combination of Flight Count and Control Time as a New Metric of Air Traffic Control Activity ***Final Report***
Mills, Scott H., Civil Aeromedical Inst., USA; May 1998; 16p; In English
Report No.(s): DOT/FAA/AM-98/15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The exploration of measures of airspace activity is useful in a number of significant ways, including the establishment of baseline air traffic control (ATC) measures and the development of tools and procedures for airspace management. This report introduces a new metric of ATC activity that combines two existing measures (flight count and the time aircraft are under control). The Aircraft Activity Index (AAI) is sensitive to changes in both flight count and flight length, and therefore is a superior measure for comparing aircraft activity between two epochs of time. The AAI was applied to data from 10 days of System Analysis Recordings obtained from the Seattle Air Route Control Center. The advantages of the AAI were most apparent when different aircraft types consistently had different mean flight lengths. Possible uses of the AAI and other ATC measures for the evaluation of new systems and procedures are discussed.
Author
Air Traffic Control; Systems Analysis; Time Measurement; Airspace

19990007797 Instituto Nacional de Pesquisas Espacias, Dept. Mecanica Espacial e Controle, Sao Jose dos Campos, Brazil
Utilization of the Navigation Solution from the GPS to Determine the Orbit of a Satellite in a Low Orbit ***Utilizacao da Solucao de Navegacao do GPS para Determinacao de Orbita de Satelites a Baixa Altitude***
doNascimento, Jorge Martins, Instituto Nacional de Pesquisas Espacias, Brazil; Kuga, Helio Koiti, Instituto Nacional de Pesquisas Espacias, Brazil; deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 9p; In Portuguese; 14th; Engenharia Mecanica, 8-12 Dec. 1997, Bauru, Brazil
Report No.(s): INPE-6719-PRE/2741; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this work the orbit determination problem of an earth artificial satellite is analyzed. This problem is solved using the GPS (Global Positioning System). It is assumed that the target satellite will carry a GPS receiver. To perform this mission, one needs to perform the following steps: (1) to simulate the m the GPS and the target satellites; (2) to calculate all the distances between the GPS satellites and the target satellite; (3) to determine which GPS satellites are visible; (4) to corrupt those data by adding a random error; (5) to develop a software that is able to get a navigation solution on each point of the orbit; and (6) to develop a new software to get the target satellite state vector (position and velocity) from the navigation solution. This work was motivated by INPE's plans of performing this kind of mission in a near future. It must he emphasized that the goal of this work is not to provide the system maximum accuracy, but a sufficient accuracy to track and control the satellite at a low cost.
Author
Navigation Satellites; Global Positioning System; Orbit Calculation; Artificial Satellites

19990007855 Daimler-Benz Aerospace A.G., Military Aircraft, Ottobrunn, Germany
Reliable Autonomous Precise Integrated Navigation RAPIN for Present and Future Air-Vehicles
Koehler, Thomas, Daimler-Benz Aerospace A.G., Germany; Tumbraegel, Franz, Daimler-Benz Aerospace A.G., Germany; Beyer, Juergen, Honeywell Regelsysteme G.m.b.H., Germany; Jul. 1998; 16p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The operation of unmanned vehicles ranging from strategic missions of autonomous high altitude reconnaissance to tactical missions of reconnaissance and strike/attack impose new requirements to the guidance systems in the area of reliability and safety. This includes all phases of the mission start, cruise, attack/strike and 'Low Level' operation including precision approaches even under bad weather conditions and in a hostile environment. A reliable, continuous and precise navigation system is of paramount importance for the guidance function even more for unmanned air vehicles. The Project RAPIN, the name standing for 'Reliable Autonomous Precise Integrated Navigation', combines the navigational research activities at Daimler-Benz Aerospace AG (Dasa) Military Aircraft teamed with Honeywell Regelsysteme GmbH in that context. RAPIN integrates 'Laser Inertial Navigation System' (LINS), P(Y) code 'Global Positioning System' (GPS) and 'Terrain Referenced Navigation' system (TRN). The data fusion concept is to combine all available information in one MAIN filter gaining the highest accuracy. In order to provide uncontaminated backup solutions in case of sensor failures, a bank of SUB filters is working in parallel. Each SUB filter uses a different subset of sensor signals. It is the objective of this paper to report on the system concept, the design of the prototype, and to describe

the realization process. Subsequently, the paper will present first and preliminary results including flight trials on C-160 Transall ANA/FRA (Autonome Navigationsanlage/Flugregelungsanlage) performed by the ”Wehrtechnische Dienststelle 61”. The possible application of this generic system varies from uninhabited reconnaissance / fighter aircraft over transport aircraft to rescue helicopters.
Author
Autonomous Navigation; Multisensor Fusion; Aircraft Guidance; Systems Integration; Pilotless Aircraft; Flight Management Systems; Air Navigation; Automatic Flight Control

19990007856 Universitaet der Bundeswehr Muenchen, Inst. fuer Systemdynamik und Flugmechanik, Neubiberg, Germany
Landmark Navigation and Autonomous Landing Approach with Obstacle Detection for Aircraft
Fuerst, Simon, Universitaet der Bundeswehr Muenchen, Germany; Werner, Stefan, Universitaet der Bundeswehr Muenchen, Germany; Dickmanns, Dirk, Universitaet der Bundeswehr Muenchen, Germany; Dickmanns, Ernst-Dieter, Universitaet der Bundeswehr Muenchen, Germany; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A machine perception system for aircraft and helicopters using multiple sensor data for state estimation is presented. by combining conventional aircraft sensors like gyros, accelerometers, artificial horizon, aerodynamic measuring devices and GPS with vision data taken by conventional CCD-cameras mounted on a pan and tilt platform, the position of the craft can be determined as well as the relative position to runways and natural landmarks. The vision data of natural landmarks are used to improve position estimates during autonomous missions. A built-in landmark management module decides which landmark should be focused on by the vision system, depending on the distance to the landmark and the aspect conditions. More complex landmarks like runways are modeled with different levels of detail that are activated dependent on range. A supervisor process compares vision data and GPS data to detect mis-tracking of the vision system e.g. due to poor visibility and tries to reinitialize the vision system or to set focus on another landmark available. During landing approach obstacles like trucks and airplanes can be detected on the runway. The system has been tested in real-time within a hardware-in-the-loop simulation. Simulated aircraft measurements corrupted by noise and other characteristic sensor errors have been fed into the machine perception system; the image processing module for relative state estimation was driven by computer generated imagery. Results from real-time simulation runs are given.
Author
Navigation Instruments; State Estimation; Autonomous Navigation; Landmarks; Onboard Data Processing; Multisensor Fusion; Aircraft Landing; Instrument Landing Systems; Computer Vision; Obstacle Avoidance; Flight Simulation

19990008059 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Precise Point Positioning for the Efficient and Robust Analysis of GPS Data From Large Networks
Zumberge, J. F., Jet Propulsion Lab., California Inst. of Tech., USA; Heflin, M. B., Jet Propulsion Lab., California Inst. of Tech., USA; Jefferson, D. C., Jet Propulsion Lab., California Inst. of Tech., USA; Watkins, M. M., Jet Propulsion Lab., California Inst. of Tech., USA; Webb, F. H., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Mar. 10, 1997; ISSN 0148-0227; Volume 102, No. B3, pp. 5005-5017; In English
Report No.(s): Paper-96JB03860; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Networks of dozens to hundreds of permanently operating precision Global Positioning System (GPS) receivers are emerging at spatial scales that range from 10(exp 0) to 10(exp 3) km. to keep the computational burden associated with the analysis of such data economically feasible, one approach is to first determine precise GPS satellite positions and clock corrections from a globally distributed network of GPS receivers. Then, data from the local network are analyzed by estimating receiver specific parameters with receiver-specific data; satellite parameters are held fixed at their values determined in the global solution. This ”precise point positioning” allows analysis of data from hundreds to thousands of sites every day with 40 Mflop computers, with results comparable in quality to the simultaneous analysis of all data. The reference frames for the global and network solutions can be free of distortion imposed by erroneous fiducial constraints on any sites.
Author
Global Positioning System; Data Acquisition; Networks; Receivers

19990008185 Old Dominion Univ., Norfolk, VA USA
Air Traffic Network Project ***Final Report, 1996 - 1997***
1997; 6p; In English
Contract(s)/Grant(s): NAG1-1745
Report No.(s): NASA/CR-1997-207689; NAS 1.26:207689; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The high level requirement of the Air Traffic Network (ATN) project is to provide a mechanism for evaluating the impact of router scheduling modifications on a networks efficiency, without implementing the modifications in the live network.
Author
Networks; Protocol (Computers); Network Synthesis; Telecommunication

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.

19990004075 RAND Corp., Santa Monica, CA USA
The Cutting Edge: A Half Century of U.S. Fighter Aircraft R and D
Lorell, Mark A., RAND Corp., USA; Levaux, Hugh P., RAND Corp., USA; Jan. 1998; 235p; In English
Contract(s)/Grant(s): F49642-96-C-0001
Report No.(s): AD-A354082; RAND-MR-939-AF; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
Past and ongoing RAND research indicates that experience; i.e., the steady buildup and maintenance of expertise over time through constant learning by doing, is critical in the cost effective design and development of successful military aircraft. This proposition is, however, still subject to some debate; given its critical importance for choosing correct policies, more evidence on it would be very valuable. For example, achieving a better understanding of the role of experience in military aircraft R&D is crucial for determining how to maintain a viable U.S. industrial base for the future in an era of declining R&D budgets, few new program starts, and industry contraction. This book, and a companion document that concentrates on bomber R&D, analyze the role of experience in combat aircraft R&D through a systematic review of the historical record from the early 1940s to the present of the major prime contractors in developing new fighter and bomber aircraft, using openly available published sources. This research complements and supports other theoretical and historical research reported elsewhere.
DTIC
Bomber Aircraft; Fighter Aircraft; Research and Development; Research Management; Federal Budgets

19990004106 Old Dominion Univ., Coll. of Engineering and Technology, Norfolk, VA USA
Analysis and Design of Fuselage Structures Including Residual Strength Prediction Methodology ***Final Report***
Knight, Norman F., Old Dominion Univ., USA; 1998; 135p; In English
Contract(s)/Grant(s): NAG1-1588
Report No.(s): NASA/CR-1998-208267; NAS 1.26:208267; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
The goal of this research project is to develop and assess methodologies for the design and analysis of fuselage structures accounting for residual strength. Two primary objectives are included in this research activity: development of structural analysis methodology for predicting residual strength of fuselage shell-type structures; and the development of accurate, efficient analysis, design and optimization tool for fuselage shell structures. Assessment of these tools for robustness, efficient, and usage in a fuselage shell design environment will be integrated with these two primary research objectives.
Derived from text
Prediction Analysis Techniques; Fuselages; Structural Analysis

19990004162 Army Aeromedical Research Lab., Fort Rucker, AL USA
Design Issues for Helmet-Mounted Display Systems for Rotary-Wing Aviation ***Final Report***
Rash, Clarence E., Army Aeromedical Research Lab., USA; McLean, William E., Army Aeromedical Research Lab., USA; Mora, John C., Army Aeromedical Research Lab., USA; Ledford, Melissa H., Army Aeromedical Research Lab., USA; Mozo, Ben T., Army Aeromedical Research Lab., USA; Jul. 1998; 186p; In English
Contract(s)/Grant(s): Proj 30162787A879
Report No.(s): AD-A352464; USAARL-RN-98-32; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
Since the 1970s, the trend in Army aviation has been to rely on helmet-mounted displays (HMDs) to provide the aircrew with pilotage imagery, flight information, and fire control imagery and symbology. This paper is intended to serve as both a checklist and a guide for designers of future integrated helmet and display systems for rotary-wing aircraft. In this paper: 1) salient performance parameters of such systems are identified; 2) recommendations for values of these parameters are suggested, based on past research and the opinions of subject matter experts; 3) an analysis of potential health and safety hazards is provided; 4) a human

factors engineering assessment (HFEA) is provided; and 5)lessons learned from previously fielded U.S. Army HMD systems are summarized. However, this paper is not a cookbook for building an integrated helmet and display system.
DTIC
Helmet Mounted Displays; Rotary Wing Aircraft; Rotary Wings; Safety; Human Factors Engineering; Helmets

19990004383 Galaxy Scientific Corp., Egg Harbor Township, NJ USA
Health Hazards of Combustion Products from Aircraft Composite Materials ***Final Report***
Gandhi, S., Galaxy Scientific Corp., USA; Lyon, R. E., Galaxy Scientific Corp., USA; Sep. 1998; 36p; In English
Report No.(s): PB99-104499; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Concerns about the potential health hazards of burning fiber-reinforced polymer composites in aircraft fires parallel the rising usage of these materials for commercial aircraft primary and secondary structures. An overview of the nature and the potential hazards associated with airborne carbon fibers released during flaming combustion of aircraft composites is presented. The current data derived from animal studies are insufficient to determine the acute toxicity of carbon fibers from burning composites.
NTIS
Combustion Products; Hazards; Health; Fiber Composites; Reinforcing Fibers

19990005098 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
Large Area Composite Inspection System ***Final Report, Oct. 1992 - Jun. 1998***
Drake, Thomas E., Lockheed Martin Tactical Aircraft Systems, USA; Jun. 1998; 164p; In English
Contract(s)/Grant(s): F33615-92-C-5981; AF Proj. 3153
Report No.(s): AD-A353169; FZM-8250-19; AFRL-ML-WP-TR-1998-4128; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Large Area Composite Inspection System (LACIS) successfully proved that Laser Ultrasonic Testing (UT) will meet the future needs of both Air Logistics Centers (ALC's) and aerospace contractors. Many significant advances in laser ultrasonic technology were demonstrated with the prototype system. Highlights of the program accomplishments are: large area complex composite structures were tested with Laser UT for the first time; rapid and accurate optical scanning was achieved; improved defect detection and signal-to-noise ratio was accomplished; and, advanced data analysis capabilities were demonstrated. Laser UT reduced the capital investment and lowers the labor cost of testing composite structures. The LACIS program conclusively demonstrated the superiority of Laser UT for testing large complex aerospace composite materials. Laser UT will be an important manufacturing and in-service method for Quality Assurance of next generation of advanced aircraft.
DTIC
Composite Structures; Inspection; Lasers; Ultrasonic Tests; Logistics; Composite Materials; Aerospace Systems

19990007837 Lockheed Martin Corp., Palmdale, CA USA
Design Guidelines and Considerations for the UTA
Nicolai, Leland M., Lockheed Martin Corp., USA; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Unmanned Tactical Aircraft is viewed by many as the centerpiece for affordable tactical air warfare in the year 2020 due to its potential for a revolutionary reduction in LCC and the fact that it embodies most of the Aerospace 2020 technology initiatives. Most of the technology for making the UTA effective as a weapon system is here today, but the technology for realizing its potential cost reduction remains to be developed.
Author
Pilotless Aircraft; Design Analysis; Cost Reduction

19990007840 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Highly Maneuverable Lethal Vehicle (HMLV) Concept
Palfalvy, George M., Naval Air Warfare Center, USA; Andes, David K., Naval Air Warfare Center, USA; Siegel, David, Office of Naval Research, USA; Jul. 1998; 6p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The paper presents interim results of a technology feasibility study of an unoccupied, armed, reusable, semi-autonomous air weapon system- the Highly Maneuverable Lethal Vehicle (HMLV). The HMLV concept that is currently being studied nominally has the following characteristics: (1) Acceleration capability greater than that of any manned aircraft; (2) Sensors, sensor processing, automatic target recognition algorithms and reasoning/decision-making algorithms to allow it to operate almost completely autonomously; (3) A variable-bandwidth, jam-resistant data-link to communicate images to an offboard controller; (4) Light-

weight, inexpensive, but precision guided and highly lethal, weaponry to prosecute air and surface targets; and (5) Airborne refueling capability. The study's goal is to examine applicable technologies and determine where they are lacking so that research funding can be properly focused. Interim results indicate that: (1) High-g airframes can he built (range and loiter capability for these airframes may be an issue); (2) Turbojet engines that can withstand the high-g environment can be built; (3) Sensor and signal-processing research is progressing at a rate that will produce sufficient capability in the near future; (4) The high-g capability of the HMLV, combined with a simple infrared countermeasure, will allow it to evade most threat missiles; and (5) Advances in computational algorithms, including ATR, will be required.
Author
Highly Maneuverable Aircraft; Pilotless Aircraft; Feasibility Analysis

19990007844 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
System Integrity Considerations for Unmanned Tactical Aircraft
Scheithauer, D., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Wunderlich, G., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In general, unmanned aerial vehicles (UAVS) and Cruise Missiles (CM) have demonstrated their operational value in the limited conflicts of the last years. This experience and technological advances promise similar successful results for more sophisticated Unmanned Tactical Aircraft (UTA) covering a wider range of airborne mission roles. Throughout this publication the term UTA will be used in favor of the term uninhabited combat aerial vehicle (UCAV). In this paper UTA concepts are evaluated with respect to system integrity. In a first step mission scenarios are analyzed with respect to the hostile threats an UTA will encounter. These external threats together with internal threats affecting reliability and system safety are the reference for the evaluation of the required integrity levels. On the basis of a generic system architecture essential and non-essential functions are considered. The assessment led to the result that UTA will be quite complex. This will have a major impact on the life cycle costs according to the experience with manned aircraft programs. However, compared with manned aircraft weapon systems UTA life cycle costs will be lower due to fewer operating costs.
Author
Cruise Missiles; Pilotless Aircraft; Systems Engineering; Weapon Systems; Design Analysis; Threat Evaluation

19990007846 Wright Lab., Aeromechanics Integration Branch, Wright-Patterson AFB, OH USA
Unconstrained Maneuver Air Vehicle: A Configuration Development
Shenk, Barth W., Wright Lab., USA; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Maneuverability-based sizing of a notional, unmanned air vehicle is presented with spin tunnel test results of a resultant configuration. Sustained load factor and roll acceleration were traded against wing loading, thrust-to-weight ratio and aspect ratio for a notional air-to-air combat mission. Prospective turn and roll performance goals were developed for an unmanned fighter, and physical limitations of thrust matching between cruise and maneuver power requirements was studied. The resulting configuration characteristics indicate that optimization of this class of vehicle requires development of inertial optimization methods and structural design methodologies for instantaneous, dynamic loads.
Author
Highly Maneuverable Aircraft; Structural Design; Pilotless Aircraft; Optimization; Aircraft Configurations; Spin Tests; Aircraft Design

19990007848 Papachristofilou (I.), Thessaloniki, Greece
System Layout of an Unmanned High Altitude Aircraft for Certification and Flight in Civil Airspace
Papachristofilou, I., Papachristofilou (I.), Greece; Kaempf, P., Daimler-Benz Aerospace A.G., Germany; Wagner, O., Technische Univ., Germany; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Several unmanned air vehicles (UAVs) are currently in operation or under development, and predictions for the future indicate an expansion in the tasks that will be covered by UAVs. With missions conceivable both in the civil as well as military sectors, UAVs are expected to be procured and operated in increasing numbers in the immediate future. However, besides the technical challenges associated with unmanned flight, the issues of certification and rules of operation of unmanned aircraft in non-restricted airspace need to be addressed. Flights of unmanned aircraft are currently taking place within reserved airspace with only few exceptions where UAVs have been allowed to enter open airspace under special precautions. The potential of unmanned aircraft can only be exploited if such restrictions are lifted and they are certified to operate along manned aircraft. to reach such a

point, formulation of explicit certification requirements on the system design of the aircraft is required, as well as a series of flight tests to validate the concept of safe use of unmanned aircraft in non-restricted airspace. Although such regulations do not exist at the moment, airworthiness and air traffic control authorities have already started examining the issues involved and are expected to issue guidelines covering unmanned flight in the near future. Based on information available from the above mentioned authorities, the main characteristics of those regulations can be described at the present time. Moreover, the implications on the system design of unmanned aircraft can be highlighted, showing the parameters that are to influence future designs. In our view the least complicated route to the operation of unmanned aircraft in civil airspace can be explored with a subsonic high altitude reconnaissance platform. Here the relocation of the pilot to a ground station offers the highest benefits, creating a strong rationale for the development of such a craft. At the same time, only a limited number of additional subsystems are necessary to facilitate flight in open airspace, which will be demonstrated by means of a recently concluded conceptual design of an unmanned high altitude aircraft.
Author
Pilotless Aircraft; Aircraft Design; Systems Engineering; Airspace; Control Systems Design

19990007849 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Hypersonic Drone for Reconnaissance Missions in Depth ***Drone Hypersonique pour des Missions de Reconnaissance en Profondeur***
Serre, L., Office National d'Etudes et de Recherches Aerospatiales, France; Jul. 1998; 10p; In French; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The concept of using a hypersonic drone aircraft operating at very high altitude is analyzed. One example of an operational flight is obtaining an important class of information which is difficult to obtain by other means. Of equal importance, the mounting of sensors is strongly connected with the size of the vehicle, and must, by this standard, be considered in the preliminary project for finalizing the main options.
Transl. by CASI
Drone Aircraft; Hypersonic Aircraft; Reconnaissance

19990008025 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
Response and Failure of Composite Plates with a Bolt-Filled Hole ***Interim Report***
Yan, U. M., Stanford Univ., USA; Sun, H. T., Stanford Univ., USA; Wei, W. D., Stanford Univ., USA; Chang, F. K., Stanford Univ., USA; Jun. 1998; 90p; In English
Report No.(s): PB99-104465; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This progress report summarizes the activities that have been performed under the sponsorship of the Federal Aviation Administration (FAA) under contract no. DEPT/95-G-012-0001 from May 1, 1996 to June 1, 1997. This program is considered to be a part of a special joint project between the FAA and the Boeing Company on the design of composite bolted joints. The major effort of the joint project is to develop the most advanced computer code for the analysis and design of bolted composite joints for the Boeing Company and the FAA. The major focus of the FAA program is on net-tension failure of composites containing a circular cutout with or without a mechanically tightened bolt, while the Boeing program focuses on the bearing damage of bolted joints in both double and single lap joints. This report describes the activities under FAA funding. Both experimental and analytical work have been conducted.
NTIS
Failure; Composite Structures; Plates (Structural Members); Bolts

19990008132 Research Inst. of National Defence, Div. of Defence Analysis, Stockholm, Sweden
Outlook for the Russian Aircraft Industry 1997-2007 ***Utsikter foer den Tyska Flyplansindustrin 1997-2007***
Kogan, Evgeni, Research Inst. of National Defence, Sweden; Apr. 1998; 48p; In English
Report No.(s): PB99-102311; FOA-R-98-00755-170-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The study addresses one of the most important areas in the development of the Russian military industrial complex, the Civil and Military Aircraft Industry. to give the reader a better understanding of how the industry takes the leap from a state-owned, domestically-oriented manufacturing to a transformed and slimmed production under harsh market-oriented circumstances, a historical perspective is provided. Dr Kogan then examines the status and plans for the most important actors, the MIG MAPO, Suchoi, the Financial Industrial Group RAC and the Transnational FIG Ilyshion. The helicopter design bureau Mil is also included due to its importance domestically as well as in exports. The author scrutinizes the cooperation within CIS and with foreign firms,

especially French ones. Because of the its importance to transport aircraft production in CIS, the Ukrainian Antonov complex is also focused on.
NTIS
Aircraft Industry; Civil Aviation; Aircraft Production

19990008188 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Analytical Predictions of Fatigue Crack Growth in the Lower Plate of the F-111 Wing Pivot Fitting Fuel Flow Hole Number 58
Murtagh, B. J., Defence Science and Technology Organisation, Australia; Walker, K. F., Defence Science and Technology Organisation, Australia; Feb. 1998; 16p; In English
Report No.(s): DSTO-TN-0135; DODA-AR-010-459; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report details a comparison of fatigue growth predictions for a fatigue crack in the lower plate of the F-111 Wing Pivot Fitting, adjacent to Fuel Flow Hole No 58. This is a known fatigue critical location and is designated as DI 86. Fatigue analysis using conventional fracture mechanics techniques and empirical retardation models performed by the manufacturer, Lockheed Martin Tactical Aircraft Systems (then General Dynamics), predicted a fatigue life of approximately 57,000 flight hours. An equivalent analysis was conducted using the analytical crack closure code, FASTRAN II, and this resulted in a life prediction of about 25,000 flight hours. Spectrum differences provide a partial explanation. A FASTRAN II analysis using a spectrum based on an in-flight strain measurement system known as AFDAS produced a shorter life again. Further work is underway to quantify the difference in the predictions due to spectrum differences, and that due to analysis techniques.
Author
Crack Propagation; Strain Measurement; F-111 Aircraft; Fracture Mechanics; Crack Closure

06
AIRCRAFT INSTRUMENTATION

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

19990004346 NASA Goddard Space Flight Center, Greenbelt, MD USA
MIDEX Advanced Modular and Distributed Spacecraft Avionics Architecture
Ruffa, John A., NASA Goddard Space Flight Center, USA; Castell, Karen, NASA Goddard Space Flight Center, USA; Flatley, Thomas, NASA Goddard Space Flight Center, USA; Lin, Michael, NASA Goddard Space Flight Center, USA; 1998; 11p; In English; Aerospace Conference, 21-28 Mar. 1998, Snowmass, CO, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

MIDEX (Medium Class Explorer) is the newest line in NASA's Explorer spacecraft development program. As part of the MIDEX charter, the MIDEX spacecraft development team has developed a new modular, distributed, and scaleable spacecraft architecture that pioneers new spaceflight technologies and implementation approaches, all designed to reduce overall spacecraft cost while increasing overall functional capability. This resultant "plug and play" system dramatically decreases the complexity and duration of spacecraft integration and test, providing a basic framework that supports spacecraft modularity and scalability for missions of varying size and complexity. Together, these subsystems form a modular, flexible avionics suite that can be modified and expanded to support low-end and very high-end mission requirements with a minimum of redesign, as well as allowing a smooth, continuous infusion of new technologies as they are developed without redesigning the system. This overall approach has the net benefit of allowing a greater portion of the overall mission budget to be allocated to mission science instead of a spacecraft bus. The MIDEX scaleable architecture is currently being manufactured and tested for use on the Microwave Anisotropy Probe (MAP), an inhouse program at GSFC.
Author
Avionics; Spacecraft Design; Mission Planning; Anisotropy; Explorer Satellites

19990007847 Boeing Co., Anaheim, CA USA
Sensor Alternatives for Future Unmanned Tactical Aircraft
Fleeman, E. L., Boeing Co., USA; Jul. 1998; 16p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper addresses the enabling technologies of the sensor suite for the next generation Unmanned Tactical Aircraft (UTA). An assessment is made of target sensors, communication sensors, and navigation sensors that are used in the UTA intelligence, surveillance, reconnaissance, communication, and target designation missions. Emphasis is given to the classes of UTAs that operate at stand-off altitudes and ranges outside the effectiveness envelope of typical threat air defenses and jammers. Primary environmental factors that are addressed in the paper are world-wide cloud cover and rain rate. The effects of cloud cover and rain rate on sensor performance are evaluated for synthetic aperture radar (SAR), passive millimeter wave (mmW), and electro-optical (EO) sensors. The synergy of radar frequency (RF) sensors to improve the sensor suite performance in cloud cover and rain rate is addressed. The paper also addresses the enabling technologies that are required for real time, low false alarm rate (FAR), automatic target recognition (ATR) and precision targeting. A target sensor suite is postulated that is based on multi-spectral, multi-dimension discriminants of the target. An X-band or Ku-band SAR is considered to be the best overall target sensor for UTA applications. A priority ranking of other target sensors is ultra wide band (UWB) low frequency SAR, forward looking infrared (FLIR), laser infrared detection and ranging (LIDAR), visible, and passive mmW. The Year 2007 sensor suite would cover the multi-spectral range of VHF frequency to visible wavelength and the multi-dimensional parameters of contrast, two-dimensional shape, three-dimensional shape, temporal, and polarization signatures of the target.
Author
Pilotless Aircraft; Sensors; Target Acquisition; Target Recognition; Synthetic Aperture Radar; Radar Targets; Real Time Operation

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.

19990008190 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Resonance Testing of the Gnome Combustor Liner
Dunlop, James, Defence Science and Technology Organisation, Australia; Jun. 1997; 31p; In English
Report No.(s): DSTO-TN-0093; DODA-AR-010-266; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report details the results of a series of experimental tests conducted on a combustor liner of the Rolls-Royce Gnome engine. These tests were undertaken as part of an investigation into the cause of cracking of the combustor liner's splitter vane. A modal analysis of the splitter vane was undertaken and mode shape results are presented over a wide range of natural frequencies. A comparison of strains generated by these modes in the areas of cracking shows that two modes in particular are a possible cause of the cracking. The effects on the splitter vane, of an interference fit between it and the engine rear frame splitter ring, are also quantified both statically and dynamically.
Author
Linings; Resonant Frequencies; Gas Turbine Engines; Vibration Mode

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.

19990004130 NASA Langley Research Center, Hampton, VA USA
BACT Simulation User Guide (Version 7.0)
Waszak, Martin R., NASA Langley Research Center, USA; Nov. 1997; 20p; In English

Contract(s)/Grant(s): RTOP 522-33-11-01
Report No.(s): NASA/TM-97-206252; L-17678; NAS 1.15:206252; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents the structure and operation of a simulation model of the Benchmark Active Control Technology (BACT) Wind-Tunnel Model. The BACT system was designed, built, and tested at NASA Langley Research Center as part of the Benchmark Models Program and was developed to perform wind-tunnel experiments to obtain benchmark quality data to validate computational fluid dynamics and computational aeroelasticity codes, to verify the accuracy of current aeroservoelasticity design and analysis tools, and to provide an active controls testbed for evaluating new and innovative control algorithms for flutter suppression and gust load alleviation. The BACT system has been especially valuable as a control system testbed.
Author
Active Control; Wind Tunnel Models; Test Stands; User Manuals (Computer Programs)

19990007852 Alenia Difesa, Avionic Systems and Equipment Div., Turin, Italy
Autopilot Synthesis for Unmanned Tactical Air Vehicles (UTAV)
Faggion, P., Alenia Difesa, Italy; Zolla, L., Alenia Difesa, Italy; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents an overview on the AutoPilot design philosophy for a medium class, jet powered Unmanned Tactical Air Vehicle (U.T.A.V,) and the development of its Rig + Advanced Integrated Data Acquisition & Simulation System (Rig + AIDASS). After a short description of the Mirach 150 U.T.A.V. system, the synthesis methodology of the primary control laws for the steering and navigational modes are presented (Autopilot and Flight Management System). The process aims at verifying accordance between requirements and performances of the global system (Autopilot+Airframe). The performances of the system are shown: dynamic responses in front of altitude, groundspeed and heading demands and their maintenance in presence of atmospheric turbulence (MIL-F-8785/C). The study is developed in FORTRAN 77 language.
Author
Flight Management Systems; Automatic Pilots; Pilotless Aircraft; Data Acquisition; Control Theory; Air Navigation; Systems Integration

19990007854 Bombardier, Inc., Defence Systems Div., Mirabel, Quebec Canada
Autonomous Navigation and Control Functions of the CL-327 VTOL UAV
Pelletier, M., Bombardier, Inc., Canada; Sakamoto, A., Bombardier, Inc., Canada; Tessier, C., Bombardier, Inc., Canada; Saintonge, G., Bombardier, Inc., Canada; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The CL-327 vertical take-off and landing (VTOL) unmanned air vehicle has a payload carrying capability of 100 kg and an on-station endurance of 4.75 hours at 100 km (based on 50 kg payload). Although similar to that of the CL-227, the pitch, roll, yaw and height autopilots have been modified and improved to account for the capabilities and dynamics of the CL-327. The advanced guidance, navigation and control functions include GPS/DGPS-aided flight, waypoint guidance, automatic (vertical) take-off and landing as well as autonomous flight without the intervention from the surface element. Because of these and other advanced features, the CL-327 is the world's most advanced VTOL UAV in production today.
Author
Vertical Takeoff Aircraft; Pilotless Aircraft; Autonomous Navigation; Aircraft Control; Automatic Flight Control; Design Analysis; Aircraft Design

19990008008 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Maneuver Controller Design for an F-111C Flight Dynamics Model
Gibbens, Peter W., Defence Science and Technology Organisation, Australia; May 1998; 128p; In English
Report No.(s): DSTO-RR-0129; DODA-AR-010-504; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Australia), Hardcopy, Microfiche

A maneuver controller program has been developed to fly an F-111C dynamic flight model through any number of prescribed maneuvers. A selection of discrete maneuvers is available which can be used as building blocks to represent most of those likely to be encountered in flight. Generalised maneuvers can also be flown by providing reference flight trajectories generated by an external source. The dynamic model and maneuver controller have been developed to allow the realistic modelling of maneuvers required by mission analyses, weapons delivery studies and systems assessments.
Author
Dynamic Models; Controllers; Design; Aerodynamics

19990008135 Research Inst. of National Defence, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden
Control Stick Steered Aircraft Simulation Model ***Styrspaksstyrd Flygplanssimuleringsmodell***
Wissman, H., Research Inst. of National Defence, Sweden; Apr. 1998; 64p; In Swedish; Original contains color illustrations
Report No.(s): PB99-102394; FOA-R-98-00760-616-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

When 'the duel between missile and aircraft' is evaluated, it is important to be able to describe and study the influence of different technical/tactical counter measures that a pilot can perform in order to decrease the probability of being shot down. This paper, a master thesis at LiTH, outlines one approach that can be used to model an aircraft, in order to describe realistic, interactive maneuvers from a control stick (joystick) connected to the computer, that is controlling the movements of the flying aircraft. The paper describes an implemented simulation model of an aircraft that is controlled by an ordinary, commercial control stick (joystick). A graphical interface, developed earlier, is used to display data and show views of the aircraft and its environment. Further, the paper also includes a description of the applied flight dynamics.
NTIS
Control Sticks; Aircraft Models; Aerodynamics; Flight Simulation; Flight Control

19990008184 NASA Langley Research Center, Hampton, VA USA
High-Alpha Research Vehicle Lateral-Directional Control Law Description, Analyses, and Simulation Results
Davidson, John B., NASA Langley Research Center, USA; Murphy, Patrick C., NASA Langley Research Center, USA; Lallman, Frederick J., NASA Langley Research Center, USA; Hoffler, Keith D., Vigyan Research Associates, Inc., USA; Bacon, Barton J., NASA Langley Research Center, USA; Oct. 1998; 70p; In English
Contract(s)/Grant(s): RTOP 522-21-61-01
Report No.(s): NASA/TP-1998-208465; NAS 1.60:208465; L-17673; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains a description of a lateral-directional control law designed for the NASA High-Alpha Research Vehicle (HARV). The HARV is a F/A-18 aircraft modified to include a research flight computer, spin chute, and thrust-vectoring in the pitch and yaw axes. Two separate design tools, CRAFT and Pseudo Controls, were integrated to synthesize the lateral-directional control law. This report contains a description of the lateral-directional control law, analyses, and nonlinear simulation (batch and piloted) results. Linear analysis results include closed-loop eigenvalues, stability margins, robustness to changes in various plant parameters, and servo-elastic frequency responses. Step time responses from nonlinear batch simulation are presented and compared to design guidelines. Piloted simulation task scenarios, task guidelines, and pilot subjective ratings for the various maneuvers are discussed. Linear analysis shows that the control law meets the stability margin guidelines and is robust to stability and control parameter changes. Nonlinear batch simulation analysis shows the control law exhibits good performance and meets most of the design guidelines over the entire range of angle-of-attack. This control law (designated NASA-1A) was flight tested during the Summer of 1994 at NASA Dryden Flight Research Center.
Author
Angle of Attack; Control Theory; Directional Control; Feedback Control; Flight Control; Lateral Control; Research Vehicles; Servomechanisms; Thrust Vector Control; F-18 Aircraft

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).

19990004169 Applied Research Associates, Inc., Vicksburg, MS USA
Preliminary Analytical Model for Flexible Pavement ***Final Report***
Bryant, Larry M., Applied Research Associates, Inc., USA; Jul. 1998; 65p; In English
Contract(s)/Grant(s): DNA001-93-C-0147
Report No.(s): AD-A352986; WES/CR/GL-98-4; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the first step in development of a preliminary analytical model for flexible pavement analysis for the Airfields and Pavements Division (APD), Geotechnical Laboratory, US Army Engineer Waterways Experiment Station. This first step may be generally described as development of a linear elastic finite element model that reasonably compares with the empirical and/or layered elastic solutions in current use. This report does not attempt to document a literature survey related to pavement analysis nor does it discuss the background of previous pavement analysis methods or finite element methods beyond that neces-

sary for understanding of the problem at hand. Further, this study attempts to determine the optional usage of the specific tools at hand, i.e., PATRAN (1993) and ABAQUS (1992), in development of the improved analytical model. It does not attempt to generalize to other finite element modeling tools or the broad finite element method. This report includes and builds upon previous work done by the author in this area.
DTIC
Pavements; Computer Programs; Geotechnical Engineering

19990005999 National Inst. of Standards and Technology, Process Measurements Div., Gaithersburg, MD USA
NIST Measurement Services: NIST Calibration Services for Gas Flow Meters. Piston Prover and Bell Prover Gas Flow Facilities
Wright, J. D., National Inst. of Standards and Technology, USA; Mattingly, G. E., National Inst. of Standards and Technology, USA; Aug. 1998; 54p; In English
Report No.(s): PB99-107260; NIST/SP-250-49; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document provides a description of the small and medium range gas flow calibration facilities at the National Institute of Standards and Technology (NIST) Fluid Flow Group, as reported in NIST Special Publication 250 for Test Nos. 18010C-18040C and 18050S, Flow Rate Measurements. The Fluid Flow Group can perform gas meter calibrations and special tests at flows between 3.7 x 10(exp -5) cu m/min and 1.4 m(3)/min (0.001 standard cubic feet per minute (SCFM) and 51 scfm, reference temperature and pressure are 293.15 K and 101325 Pa) using positive displacement techniques. The flow rate of gas passing through the meter under test is determined from pressure, temperature, volume, and transit time measurements of a displaced volume of gas. Two types of displacement devices are used mercury-sealed piston provers and bell gasometers, or bell provers. This report describes the techniques used for calibrating meters and presents the uncertainty analysis associated with such calibrations.
NTIS
Calibrating; Services; Gas Flow; Gas Meters; Flowmeters

19990007757 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Performance Tests of the Original Transonic Wind Tunnel Compressor and Circuit
Link, Yoel Y., Defence Science and Technology Organisation, Australia; Quick, Howard A., Defence Science and Technology Organisation, Australia; May 1998; 84p; In English; Original contains color illustrations
Report No.(s): DSTO-TN-0150; DODA-AR-010-527; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Australia), Hardcopy, Microfiche

A detailed test programme of the AMRL Transonic Wind Tunnel was conducted. The objective of the test programme was to determine the pressure distributions around the tunnel circuit with larger nozzle exit areas. The existing high speed contraction, test section, model support mechanism, and downstream diffuser were removed for the tests. A variable nozzle and collector were designed and installed in place of the removed components to determine the effects of increasing the nozzle exit area. Three nozzle configurations were investigated, with a 38.3%, 44.4% and 58.1% increase in area relative to the existing test section area. Measurements were made of static pressure around the tunnel circuit, total pressure upstream and downstream from the compressor, and temperatures at various locations. Noise measurements were also made outside the tunnel complex and at four locations around the boundary of the site to determine the noise level of the wind tunnel.
Author
Performance Tests; Transonic Wind Tunnels; Compressors; Circuits; Pressure Distribution

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19990006016 Air Force Systems Command, Space Warfare Center, Falcon AFB, CO USA
SWC Space Tactics Bulletin, Volume 5
Jan. 1998; 42p; In English
Report No.(s): AD-A353077; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Space Tactics Bulletin is an official, nondirective SWC publication. Its purpose is to update warfighting staffs and units on SWC efforts to effectively employ space assets in support of operations, and provide a forum for information exchange to improve space tactics and procedures. The views and opinions expressed herein, unless otherwise specifically indicated, are those

of the individual author. They do not purport to express the views of the SWC Commander, the Department of the Air Force or any other department or agency of the USA Government.
DTIC
Tactics; Military Technology; Documents; Information Transfer

19990008058 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Cassini/Huygens Science Instruments, Spacecraft, and Mission
Jaffe, Leonard D., Jet Propulsion Lab., California Inst. of Tech., USA; Herrell, Linda M., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Spacecraft and Rockets; Jul. 1997; Volume 34, No. 4, pp. 509-521; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Cassini spacecraft will take 18 scientific instruments to Saturn. After launch and a seven-year cruise, Cassini will arrive at Saturn and separate into a Saturn orbiter and an atmospheric probe, called Huygens, which will descend to the surface of Titan. The orbiter will orbit the planet for four years, making close flybys of five satellites, including multiple flybys of Titan. Communication with Earth is at X-band; the maximum downlink rate from Saturn is 166 x 10(exp 3) bps. Orbiter instruments are body mounted; the spacecraft must be turned to point some of them toward objects of interest. The orbiter carries 12 instruments. Optical instruments provide imagery and spectrometry. Radar supplies imaging, altimetry, and radiometry. Radio links contribute information about intervening material and gravity fields. Other instruments measure electromagnetic fields and the properties of plasma, energetic particles, and dust particles. The probe is spin stabilized. It returns data via an S-band link to the orbiter. The probe's six instruments include sensors to determine atmospheric physical properties and composition. Radiometric and optical sensors will produce data on thermal balance and obtain images of Titan's atmosphere and surface. Doppler measurements between probe and orbiter will provide wind profiles. Surface sensors will measure impact acceleration, thermal and electrical properties, and, if the surface is liquid, density and refractive index. This design will enable Cassini to determine the composition; the physical, morphological, and geological nature; and the physical and chemical processes of the atmospheres, surfaces, and magnetosphere of the Saturnian system. This paper briefly describes the Cassini mission and spacecraft and, in somewhat more detail, the scientific instruments.
Author
Cassini Mission; Dust; Electrical Properties; Electromagnetic Fields; Environmental Monitoring; Geology; Gravitational Fields; Imaging Techniques; Impact Acceleration

13
ASTRODYNAMICS

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

19990004168 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Yawsonde Technology for the Jet Propulsion Laboratory (JPL) Free Flying Magnetometer (FFM) Program ***Final Report***
Hepner, David J.; Hollis, Michael J.; Mitchell, Charles E.; Jul. 1998; 31p; In English
Contract(s)/Grant(s): Proj 1L1-62618-A-H8-0
Report No.(s): AD-A352980; ARL-TR-1610; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The preliminary application of yawsonde technology to the Jet Propulsion Laboratory's (JPL) free flying magnetometer (FFM) program has been completed. An optical sensor design has been completed specifically to meet the volumetric constraints of the JPL FFM vehicle. Two sensor prototypes were fabricated, and one was extensively tested at the US Army Research Laboratory. A review of yawsonde technology encompassing the optical sensors, installation within a flight vehicle, calibration, launch window simulation, flight testing, and data reduction is covered. The prospective sensor application is combined with projected solar ephemeris data and trajectory data to provide assurance of adequate coverage for projected flight tests. A data reduction methodology is developed wherein the sensors' orientation provides a means to determine solar aspect angle and solar roll rate of the vehicle.
DTIC
Magnetometers; Free Flight

19990007782 Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

Bi-Impulsive Transfers Between Elliptic Noncoplanar Orbits with Minimum Fuel Consumption ***Transferencias Bi-impulsivas Entre Orbitas Elipticas Nao Coplanares com Consumo Minimo de Combustivel***

Schulz, Walkiria, Instituto de Pesquisas Espaciais, Brazil; Mar. 1997; 110p; In Portuguese

Report No.(s): INPE-6385-TDI/604; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In this work the problem of a spacecraft bi-impulsive transfer between two given non coplanar elliptical orbits, with minimum fuel consumption is solved for two different cases: (i) considering the spacecraft movement on a keplerian force field; and (ii) considering a non keplerian force field (the perturbing forces include Earth gravity harmonics and atmospheric drag). In the last one the problem is solved by the Two Point Boundary Value Problem (TPBVP) formulation. It was developed a new algorithm and a software, that uses the analytical expressions developed in this algorithm, to get an initial guess to solve the TPBVP. The software developed to generate orbital transfers on a keplerian force field will be used by the INPE staff on space missions like the satellite China-Brazil Earth Resources Satellite (CBERS). Several simulations were performed to observe the spacecraft orbital behavior by different kind of perturbations and constraints, on a fuel consumption optimization point of view.

Derived from text

Field Theory (Physics); Gravitation; Perturbation; Planar Structures; Algorithms; Harmonics

19990007794 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Optimal Rendezvous Maneuvers for Space Vehicles

deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; Journal of the Brazilian Society of Mechanical Sciences; 1998; ISSN 0100-7386; Volume 18, No. 3, pp. 297-301; In English

Report No.(s): INPE-6736-PRE/2758; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper considers the problem of optimal rendezvous maneuvers between two space vehicles. The rendezvous is a space maneuver where a spacecraft, called the chaser, has to be transferred from its initial orbit to a final orbit where it has to reach and follow a second spacecraft, called the target. In the present research those two spacecrafts arc supposed to be in Keplerian orbits around the Earth. Those two orbits can be coplanar or fully three-dimensional. The control available to perform this maneuver is the application of two impulses (instantaneous change in the velocity of the spacecraft) to the chaser vehicle.

Author

Astrodynamics; Orbital Maneuvers; Rendezvous; Planar Structures

19990008168 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Time-of-Flight Analyses for the Gravitational Capture Maneuver

Neto, Ernesto Vieira, Instituto Nacional de Pesquisas Espacias, Brazil; deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; Journal of Guidance, Control and Dynamics; Jan. 1998; Volume 21, No. 1, pp. 122-126; In English; Sponsored in part by Federal Agency for Post-Graduate Education

Contract(s)/Grant(s): FAPES-95/9290-1; CNPq-300221/95-9

Report No.(s): INPE-6737-PRE/2759; Copyright; Avail: Issuing Activity (Instituto Nacional de Pesquisas Espaciais, Caixa Postal 515, 12201-970 - Sao Jose dos Campos - SP - Brasil), Hardcopy, Microfiche

Several aspects of the time of flight involved in the problem of gravitational capture in the regularized, restricted three-body problem are studied. A gravitational capture occurs when a massless particle changes its two-body energy around one celestial body from positive to negative without the use of nongravitational forces. The importance of several parameters involved in 2 capture in the Earth-moon system is studied. In particular, the time required for the capture is studied under different initial conditions. This Information is very Important for mission designers for two reasons: (1) the time for gravitational capture has an impact in the duration of any mission that uses this technique; and (2) the gravitational capture is a very sensitive phenomenon and, if the time involved is too large, perturbations from different sources may influence the mission too much. The results show the existence of regions where the time for the capture is reduced by a factor close to 10 with an adequate choice of initial conditions, without the reduction of the energy savings. In addition, the results are used to solve a family of optimization problems, such as the problem of finding trajectories that can perform a gravitational capture in a minimum time with a fixed savings or with maximum savings with an upper time limit.

Author

Earth-Moon System; Three Body Problem; Energy Conservation; Celestial Bodies

19990008192 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Traveling Between the Lagrangian Points and the Earth
deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; Acta Astronautica; 1998; ISSN 0094-5765; Volume 39, No. 7, pp. 483-486; In English
Report No.(s): INPE-6735-PRE/2757; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper is concerned with minimum energy trajectories to transfer a spacecraft between the five Lagrangian points and Earth. The planar circular restricted three-body problem in two dimensions is used as the model for the Earth-Moon system, and Lemaitre regularization is used to avoid singularities.
Author
Lagrangian Function; Earth (Planet); Three Body Problem

19990008193 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Effects of the Third Dimension in a Close Approach Maneuver
deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; deFelipe, Gislaine, Taubate Univ., Brazil; 1998; 11p; In English; 47th; Astronautical, 7-11 Oct. 1996, Beijing, China; Sponsored by International Astronautical Federation, France
Report No.(s): INPE-6727-PRE/2749; IAF-96-A.1.05; Copyright; Avail: Issuing Activity (Instituto Nacional de Pesquisas Espaciais, Caixa Postal 515, 12201-970 - Sao Jose dos Campos - SP - Brasil), Hardcopy, Microfiche

The Swing-By maneuver uses a close approach with a celestial body to modify the velocity, energy and angular momentum of a spacecraft. In the present paper the swing-by maneuvers are studied and classified under the model given by the three-dimensional restricted three- body problem. Several simulations are made to show the effects of the third dimension in this maneuver. to show the results, the orbit of the spacecraft is classified in four groups: elliptic direct, elliptic retrograde, hyperbolic direct and hyperbolic retrograde. Then, the modification in the orbit of the spacecraft due to the close approach is shown in plots that specify from which group of orbits the spacecraft is coming and to which group it is going. Several families of orbits are found and shown in details.
Author
Spacecraft Maneuvers; Angular Momentum; Three Body Problem; Orbits

19990008369 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Bi-Impulsive Orbital Transfers with Time Limit ***Transferencias Orbitais Bi-Impulsivas com Limite de Tempo***
Rocco, Evandro Marconi, Instituto Nacional de Pesquisas Espacias, Brazil; deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; deOliveiraeSouza, Marcelo Lopes, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 18p; In Portuguese; 14th; Engenharia Mecanica, 8-12 Dec. 1997, Bauru, Brazil
Report No.(s): INPE-6724-PRE/2746; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this work we consider the problem of two-impulse orbital transfer between coplanar elliptical orbits with minimum fuel consumption but with a time limit for this transfer. This time limit imposes a new characteristic to the problem that rules out the majority of transfer methods. Then we used the equations presented by D. F. Lawden, modified and solved those equations to develop a software for orbital maneuvers. This software will be used in the next missions developed by INPE. The original method developed by Lawden considers only the case where the points of beginning and the end of maneuver are known. The software developed here extends this method to the case where only one point is known and to the case where the two points are free. The four possible cases were tested with success.
Author
Impulses; Elliptical Orbits; Orbital Maneuvers; Transfer Orbits

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

19990007798 Thermoscience Inst., Moffett Field, CA USA
CFD Modelling of Bore Erosion in Two-Stage Light Gas Guns
Bogdanoff, D. W., Thermoscience Inst., USA; Aug. 1998; 38p; In English
Contract(s)/Grant(s): RTOP 242-80-01

Report No.(s): NASA/TM-1998-112236; A-9811886; NAS 1.15:112236; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A well-validated quasi-one-dimensional computational fluid dynamics (CFD) code for the analysis of the internal ballistics of two-stage light gas guns is modified to explicitly calculate the ablation of steel from the gun bore and the incorporation of the ablated wall material into the hydrogen working cas. The modified code is used to model 45 shots made with the NASA Ames 0.5 inch light gas gun over an extremely wide variety of gun operating conditions. Good agreement is found between the experimental and theoretical piston velocities (maximum errors of +/-2% to +/-6%) and maximum powder pressures (maximum errors of +/-10% with good igniters). Overall, the agreement between the experimental and numerically calculated gun erosion values (within a factor of 2) was judged to be reasonably good, considering the complexity of the processes modelled. Experimental muzzle velocities agree very well (maximum errors of 0.5-0.7 km/sec) with theoretical muzzle velocities calculated with loading of the hydrogen gas with the ablated barrel wall material. Comparison of results for pump tube volumes of 100%, 60% and 40% of an initial benchmark value show that, at the higher muzzle velocities, operation at 40% pump tube volume produces much lower hydrogen loading and gun erosion and substantially lower maximum pressures in the gun. Large muzzle velocity gains (2.4-5.4 km/sec) are predicted upon driving the gun harder (that is, upon using, higher powder loads and/or lower hydrogen fill pressures) when hydrogen loading is neglected; much smaller muzzle velocity gains (1.1-2.2 km/sec) are predicted when hydrogen loading is taken into account. These smaller predicted velocity gains agree well with those achieved in practice. CFD snapshots of the hydrogen mass fraction, density and pressure of the in-bore medium are presented for a very erosive shot.
Author

Computational Fluid Dynamics; Solar Radiation; Powder (Particles); Backscattering; Gas Pressure; Igniters

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.

19990005995 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
Cost and Economics for Advanced Launch Vehicles ***Final Report, 15 Oct. 1997 - 14 Oct. 1998***
Whitfield, Jeff, Georgia Inst. of Tech., USA; 1998; 68p; In English
Contract(s)/Grant(s): NAG8-1417; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Market sensitivity and weight-based cost estimating relationships are key drivers in determining the financial viability of advanced space launch vehicle designs. Due to decreasing space transportation budgets and increasing foreign competition, it has become essential for financial assessments of prospective launch vehicles to be performed during the conceptual design phase. As part of this financial assessment, it is imperative to understand the relationship between market volatility, the uncertainty of weight estimates, and the economic viability of an advanced space launch vehicle program. This paper reports the results of a study that evaluated the economic risk inherent in market variability and the uncertainty of developing weight estimates for an advanced space launch vehicle program. The purpose of this study was to determine the sensitivity of a business case for advanced space flight design with respect to the changing nature of market conditions and the complexity of determining accurate weight estimations during the conceptual design phase. The expected uncertainty associated with these two factors drives the economic risk of the overall program. The study incorporates Monte Carlo simulation techniques to determine the probability of attaining specific levels of economic performance when the market and weight parameters are allowed to vary. This structured approach toward uncertainties allows for the assessment of risks associated with a launch vehicle program's economic performance. This results in the determination of the value of the additional risk placed on the project by these two factors.
Author

Cost Estimates; Economics; Spacecraft Launching; Market Research; Launch Vehicles; Weight (Mass)

19990008131 Stockholm Univ., Meteorology Dept., Sweden
Aerodynamics of Rocket-Borne In situ Measurements in the Transition Regime
Gumbel, J., Stockholm Univ., Sweden; Dec. 04, 1997; ISSN 0280-4441; 70p; In English
Report No.(s): PB99-100786; REPT-AP-33; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A quantification of aerodynamic perturbations is crucial to the analysis of rocket-borne in situ measurements in the middle and upper atmosphere. In the important altitude range 80-120 km, this quantification is complicated by the gradual shift of the flow conditions from continuum flow via the transition regime to free molecular flow. The 'Direct Simulation Monte Carlo' method by G. A. Bird provides a tool to access the aerodynamics in this region by tracing the behavior of the gas on a molecular basis.

After a brief presentation of the underlying gas kinetics and the simulation algorithms, the model is applied to a number of questions relevant for in situ composition measurements. For representative payload geometries, density, temperature and velocity fields are investigated as a function of altitude and flow speed. In addition, studies of individual molecular trajectories help to clarify details of the payload/gas interactions. Strongly altitude-dependent flow conditions are found in the range 85-105 km.
NTIS
Aerodynamics; Rocket-Borne Instruments; Aerodynamic Forces; Flow Distribution; In Situ Measurement

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

19990008346 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Measurements of Thermophysical Properties of Molten Silicon by a High-Temperature Electrostatic Levitator
Rhim, W. K., Jet Propulsion Lab., California Inst. of Tech., USA; Chung, S. K., Jet Propulsion Lab., California Inst. of Tech., USA; Rulison, A. J., Jet Propulsion Lab., California Inst. of Tech., USA; Spjut, R. E., Harvey Mudd Coll., USA; International Journal of Thermophysics; Mar. 1997; ISSN 0195-928X; Volume 18, No. 2, pp. 459-469; In English; 4th; Thermophysical Properties, 5-8 Sep. 1995, Tokyo, Japan; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Several thermophysical properties of molten silicon measured by the high-temperature electrostatic levitator at JPL are presented. They are density, constant-pressure specific heat capacity, hemispherical total emissivity, and surface tension. Over the temperature range investigated (1350 less than T(sub m) less than 1825 K), the measured liquid density (in g/cc) can be expressed by a quadratic function, pi(P) = p(sub m) - 1.69 x 10(exp -4)(T - T(sub m)) - 1.75 x 10(exp -7)((T - T(sub m))(exp 2) with T(sub m) and p(sub m) being 1687 K and 2.56 g/cc, respectively. The hemispherical total emissivity of molten silicon at the melting temperature was determined to be 0.18, and the constant-pressure specific heat was evaluated as a function of temperature. The surface tension (in 10(exp -3) N/m) of molten silicon over a similar temperature range can be expressed by sigma(T) = 875 - 0.22(T - T(sub m)).
Author
Thermophysical Properties; Heat Measurement; Silicon; Melting

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.

19990004144 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA
Simulation-Based Analysis of Reentry Dynamics for the Sharp Atmospheric Entry Vehicle ***Final Report, Jan. 1997 - May 1998***
Tillier, Clemens Emmanuel, Stanford Univ., USA; May 1998; 120p; In English
Contract(s)/Grant(s): NCC2-5197
Report No.(s): NASA/CR-1998-208334; NAS 1.26:208334; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis describes the analysis of the reentry dynamics of a high-performance lifting atmospheric entry vehicle through numerical simulation tools. The vehicle, named SHARP, is currently being developed by the Thermal Protection Materials and Systems branch of NASA Ames Research Center, Moffett Field, California. The goal of this project is to provide insight into trajectory tradeoffs and vehicle dynamics using simulation tools that are powerful, flexible, user-friendly and inexpensive. Implemented Using MATLAB and SIMULINK, these tools are developed with an eye towards further use in the conceptual design of the SHARP vehicle's trajectory and flight control systems. A trajectory simulator is used to quantify the entry capabilities of the vehicle subject to various operational constraints. Using an aerodynamic database computed by NASA and a model of the earth, the simulator generates the vehicle trajectory in three-dimensional space based on aerodynamic angle inputs. Requirements for entry along the SHARP aerothermal performance constraint are evaluated for different control strategies. Effect of vehicle mass on entry parameters is investigated, and the cross range capability of the vehicle is evaluated. Trajectory results are presented and interpreted. A six degree of freedom simulator builds on the trajectory simulator and provides attitude simulation for future entry

controls development. A Newtonian aerodynamic model including control surfaces and a mass model are developed. A visualization tool for interpreting simulation results is described. Control surfaces are roughly sized. A simple controller is developed to fly the vehicle along its aerothermal performance constraint using aerodynamic flaps for control. This end-to-end demonstration proves the suitability of the 6-DOF simulator for future flight control system development. Finally, issues surrounding real-time simulation with hardware in the loop are discussed.
Author
Aerodynamic Characteristics; Computerized Simulation; Lifting Bodies; Trajectory Control; Atmospheric Entry; Thermal Protection; Flight Control

19990004338 NASA Marshall Space Flight Center, Huntsville, AL USA
Propulsive Small Expendable Deployer System (ProSEDS) Space Experiment
Johnson, Les, NASA Marshall Space Flight Center, USA; Gilchrist, Brian, Michigan Univ., USA; Estes, Robert D., Smithsonian Astrophysical Observatory, USA; Lorenzini, Enrico, Smithsonian Astrophysical Observatory, USA; Ballance, Judy, NASA Marshall Space Flight Center, USA; 1998; 6p; In English; Joint Propulsion Conference, 13-16 Jul. 1998, Cleveland, OH, USA; Sponsored by Department of the Army, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Propulsive Small Expendable Deployer System (ProSEDS) space experiment will demonstrate the use of an electrodynamic tether propulsion system. The flight experiment is a precursor to the more ambitious electrodynamic tether upper stage demonstration mission which will be capable of orbit raising, lowering and inclination changes-all using electrodynamic thrust. ProSEDS which is planned to fly in 2000, will use the flight proven Small Expendable Deployer System (SEDS) to deploy a tether (5km bare wire plus 15 km spectra) from a Delta II upper stage to achieve approximately 0.4N drag thrust, thus demonstrating deorbit thrust. The experiment will use a predominantly 'bare' tether for current collection in lieu of endmass collector and insulated tether approach used on previous missions. ProSEDS will utilize tether-generated current to provide limited spacecraft power. In addition to the use of this technology to provide orbit transfer of payloads and upper stages from LEO to higher orbits it may also be an attractive option for future missions to Jupiter and any other planetary body with a magnetosphere.
Author
Deployment; Propulsion System Configurations; Tethering; Electrodynamics; Low Earth Orbits; Accumulators; Spaceborne Experiments

19990004343 NASA Goddard Space Flight Center, Greenbelt, MD USA
Composite Bus Structure for the SMEX/WIRE Satellite
Rosanova, Giulio G., NASA Goddard Space Flight Center, USA; 1998; 10p; In English; 12th; Small Satellites, 31 Aug. - 3 Sep. 1998, Logan, UT, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): SSC98-IV-4; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In an effort to reduce the weight and optimize the structural design of the Small Explorer (SMEX) Wide-Field Infrared Explorer (WIRE) spacecraft, it has become desirable to change the material and construction from mechanically fastened aluminum structure to a fully bonded fiber-reinforced composite (FRC) structure. GSFC has developed the WIRE spacecraft structural bus design concept, including the instrument and launch vehicle requirements. The WIRE Satellite is the fifth of a series of SMEX satellites to be launched once per year. GSFC has chosen Composite Optics Inc. (COI) as the prime contractor for the development and procurement of the WIRE composite structure. The detailed design of the fully bonded FRC structure is based on COI's Short Notice Accelerated Production SATellite ("SNAPSAT") approach. SNAPSAT is a state of the art design and manufacturing technology for advanced composite materials which utilizes flat-stock detail parts bonded together to produce a final structural assembly. The structural design approach adopted for the WIRE structure provides a very viable alternative to both traditional aluminum construction as well as high tech. molded type composite structures. This approach to composite structure design is much less costly than molded or honeycomb sandwich type composite construction, but may cost slightly more than conventional aluminum construction on the subsystem level. However on the overall program level the weight saving achieved is very cost effective, since the primary objective is to allocate more mass for science payloads.
Author
Composite Structures; Explorer Satellites; Fiber Composites; Structural Design; Weight Reduction; Bonded Joints; Cost Effectiveness

19990007918 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Design and Simulation of Autonomous Attitude Control of Satellites Using Fuzzy Logic ***Projeto e Simulacao do Controle de Atitude Autonomo de Satelites Usando Logica Nebulosa***

Guerra, Rodrigo, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 192p; In Portuguese

Report No.(s): INPE-6714-TDI/630; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Increasing satellite autonomy is a continuing goal for improving its performance and reducing its operational costs. in this work, a new control algorithm based on fuzzy logic is presented, whose aim is to autonomously control a spin stabilized satellite with magnetic coils. Several simulations have been carried on to test the performance of the fuzzy logic controller under realistic conditions, such as: the occultation of the solar sensor during the orbital motion; and the use of a simple algorithm to determine the angular velocities of the body. In these simulations, the dynamic response of the fuzzy logic controller was observed and its performance was compared qualitatively and quantitatively with the conventional one. The First Brazilian Scientific Satellite - SACI1, under current development by the National Institute for Space Research - R,;PE, is one of several possible missions that can take benefit from this approach. The simulations have shown that the fuzzy logic controller reached the control specifications established to the SACI1, leading the system to the nominal operational conditions, being at the same time simple and robust.
Author

Design Analysis; Simulation; Attitude Control; Automatic Control; Satellite Design; Autonomy

19990008128 Norwegian Defence Research Establishment, Kjeller, Norway

Military Use of Images from Commersial Optical Photo Satellites ***Miltaer Bruk av Bilder fra Kommersielle Optiske Fotosatellitter***

Bjerke, Pal, Norwegian Defence Research Establishment, Norway; Sep. 04, 1998; 33p; In Norwegian; Original contains color illustrations

Contract(s)/Grant(s): FFIE Proj. 721/170

Report No.(s): FFI/Rapport-98/04501; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Military use of satellite images started around 1960 with dedicated military photo satellites. Soon the technology was transferred to the civil marked, with the LANDSAT-program as the first to deliver images in 1972 for the international scientific remote-sensing community. Not until the French SPOT-satellite was sent in orbit with an imaging-capability of 10 meter resolution in 1986, there was serious interest in satellite images as a mean for gathering military information. After the restriction on image resolution was lowered to 1 meter in 1994, several operators have announced photo satellites to come with resolution in the range from 1-3 meters. The better image resolution combined with a more effective (faster) delivery of images on the Internet, gives new opportunities for their military use. Even though the satellite images do not have the same resolution as possible from airphotos, both mapping and surveillance will be useful applications. In times of conflict, however, certain restrictions are supposed to appear on delivery of the images.
Author

Military Spacecraft; Satellite Imagery; Technology Transfer; Photography; Image Resolution

19990008156 Space Technology Labs., Inc., Los Angeles, CA USA

1958 NASA/USAF Space Probes (ABLE-1), Volume 2, Payload and Experiments ***Final Report***

Jun. 1959; 212p; In English

Contract(s)/Grant(s): AF-04(647)-205

Report No.(s): NASA-MEMO-5-25-59W/VOL2; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The three NASA/USAF lunar probes of August 17, October 13, and November 8, 1958 are described. Details of the program, the vehicles, the payloads, the firings, the tracking, and the results are presented. Principal result was the first experimental verification of a confined radiation zone of the type postulated by Van Allen and others.
Author

Lunar Probes; Payloads; Space Probes

19990008194 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Effect of Visibility Constraints in Artificial Satellites Maneuvers ***Efeito de Vinculos de Visibilidade em Manobras de Satelites Artificiais***

Schulz, Walkiria, Instituto Nacional de Pesquisas Espacias, Brazil; deAlmeidaPrado, Antonio Fernando Bertachini, Instituto Nacional de Pesquisas Espacias, Brazil; Kuga, Helio Koiti, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 9p; In English; 14th; Engenharia Mecanica, 8-12 Dec. 1997, Bauru, Brazil

Report No.(s): INPE-6718-PRE/2740; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this work the effect of visibility constraints due to the use of only one ground station control of a spacecraft during a bi-impulsive transfer between two given non coplanar elliptical orbits is analyzed from the point of view of fuel consumption. This kind of constraint requires special orbital places to apply impulsive maneuvers, where the ground station is able to track the satellite. The increment of the fuel consumption imposed by this kind of constraint is evaluated by subdividing of the true anomalies intervals at the initial and final orbits. This research takes part on the orbital maneuvers program for the China-Brazil Earth Resources Satellite (CBERS) and should be extended for any kind of bi-impulsive orbital transfer.
Author
Artificial Satellites; Orbital Maneuvers; Transfer Orbits; Fuel Consumption; Elliptical Orbits

19
SPACECRAFT INSTRUMENTATION

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

19990008186 Colorado Univ., Boulder, CO USA
Pioneer Venus Orbiter Ultraviolet Spectrometer: Operations and Data Analysis ***Final Report***
Stewart, A. I. F., Colorado Univ., USA; Nov. 24, 1997; 6p; In English
Contract(s)/Grant(s): NAG2-504
Report No.(s): NASA/CR-1997-207818; NAS 1.26:207818; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The Pioneer Venus spacecraft orbited Venus 5,055 times between 4th December 1978 and 6th October 1992, before entering Venus' atmosphere and burning up on the latter date. On 255 of these orbits, science operations were suspended because of superior conjunction (Venus' proximity to the Sun as seen from Earth). of the remaining 4800 orbits, about 85% yielded good-quality OUVS science data; 15% were lost to various problems, including loss of uplink (commands) to and downlink (data) from the spacecraft, errors in commanding OUVS, and one or other of the two instrument anomalies mentioned below.
Author
Pioneer Venus 1 Spacecraft; Pioneer Venus Spacecraft; Ultraviolet Spectrometers; Downlinking

20
SPACECRAFT PROPULSION AND POWER

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

19990004159 NASA Marshall Space Flight Center, Huntsville, AL USA
Low Cost Propulsion Technology Testing at the Stennis Space Center: Propulsion Test Article and the Horizontal Test Facility
Fisher, Mark F., NASA Marshall Space Flight Center, USA; King, Richard F., NASA Stennis Space Center, USA; Chenevert, Donald J., NASA Stennis Space Center, USA; 1998; In English; 34th; Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 98-3367; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The need for low cost access to space has initiated the development of low cost liquid rocket engine and propulsion system hardware at the Marshall Space Flight Center. This hardware will be tested at the Stennis Space Center's B-2 test stand. This stand has been reactivated for the testing of the Marshall designed Fastrac engine and the Propulsion Test Article. The RP-1 and LOX engine is a turbopump fed gas generator rocket with an ablative nozzle which has a thrust of 60,000 lbf. The Propulsion Test Article (PTA) is a test bed for low cost propulsion system hardware including a composite RP-I tank, flight feedlines and pressurization system, stacked in a booster configuration. The PTA is located near the center line of the B-2 test stand, firing vertically into the water cooled flame deflector. A new second position on the B-2 test stand has been designed and built for the horizontal testing of the Fastrac engine in direct support of the X-34 launch vehicle. The design and integration of these test facilities as well as the coordination which was required between the two Centers is described and lessons learned are provided. The construction of the horizontal test position is discussed in detail. The activation of these facilities is examined and the major test milestones are described.
Author
Propulsion; Low Cost; Engine Tests; Gas Generators; Liquid Propellant Rocket Engines; Turbine Pumps

19990004339 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA
X-33 Linear Aerospike Engine
Vinson, John, Lockheed Martin Corp., USA; Aerospace America; 1998; 5p; In English
Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In July of 1999 two linear aerospike rocket engines will power the first flight of NASA's X-33 advanced technology demonstrator. A successful X-33 flight test program will validate the aerospike nozzle concept, a key technical feature of Lockheed Martin's VentureStar(trademark) reusable launch vehicle. The aerospike received serious consideration for NASA's current space shuttle, but was eventually rejected in 1969 in favor of high chamber pressure bell engines, in part because of perceived technical risk. The aerospike engine (discussed below) has several performance advantages over conventional bell engines. However, these performance advantages are difficult to validate by ground test. The space shuttle, a multibillion dollar program intended to provide all of NASA's future space lift could not afford the gamble of choosing a potentially superior though unproven aerospike engine over a conventional bell engine. The X-33 demonstrator provides an opportunity to prove the aerospike's performance advantage in flight before commiting to an operational vehicle.
Derived from text
X-33 Reusable Launch Vehicle; Aerospike Engines; Flight Tests; Ground Tests; Rocket Engines

19990007761 Boeing North American, Inc., Reusable Space Systems, Downey, CA USA
Propulsion system advances that enable a reusable Liquid Fly Back Booster (LFBB)
Keith, E. L., Boeing North American, Inc., USA; Rothschild, W. J., Boeing North American, Inc., USA; 1998; 8p; In English, 16-17 Jul. 1998, Cleveland, OH, USA; Sponsored by NASA, USA
Contract(s)/Grant(s): NAS8-97272; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper provides an overview of the booster propulsion system for the Liquid Fly Back Booster (LFBB). This includes, system requirements, design approach, concept of operations, reliability, safety and cost assumptions. The paper summarizes the findings of the Boeing propulsion team that has been studying the LFBB feasibility as a booster replacement for the Space Shuttle. This paper will discuss recent advances including a new generation of kerosene and oxygen rich pre-burner staged combustion cycle main rocket engines. The engine reliability and safety is expected to be much higher than current standards by adding extra operating margins into the design and normally operating the engines at 75% of engine rated power. This allows for engine out capability. The new generation of main engines operates at significantly higher chamber pressure than the prior generation of gas generator cycle engines. The oxygen rich pre-burner engine cycle, unlike the fuel rich gas generator cycle, results in internally self-cleaning firings which facilitates reusability. Maintenance is further enhanced with integrated health monitoring to improve safety and turn-around efficiency. The maintainability of the LFBB LOX/kerosene engines is being improved by designing the vehicle/engine interfaces for easy access to key engine components.
Author
Rocket Engines; Propulsion; Liquid Oxygen; Engine Parts; Reusable Rocket Engines; Reusable Launch Vehicles; Post Boost Propulsion System; Aerodynamic Characteristics; Aerospace Engineering

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CHEMISTRY AND MATERIALS (GENERAL)

19990004071 General Electric Co., Corporate Research and Development, Schenectady, NY USA
Polycomponent Functionally Graded Materials for Thermal Barrier Systems ***Final Report, 15 Mar. 1995 - 14 Mar. 1998***
Jackson, Melvin R., General Electric Co., USA; Ritter, A. M., General Electric Co., USA; Gigliotti, M. F., General Electric Co., USA; Dobbs, J., General Electric Co., USA; Zhao, J. C., General Electric Co., USA; Aug. 1998; 80p; In English
Contract(s)/Grant(s): F49620-95-C-0028; AF Proj. 2306
Report No.(s): AD-A354114; AFRL-SR-BL-TR-98-0663; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Functionally graded materials (FGMs) offer benefits for thermal barrier coating (TBC) systems for aircraft and power generation gas turbines. A preferred FGM, including the insulating ceramic outer surface and a graded inner structure on a superalloy substrate, will act both to minimize stresses due to the temperature difference between the outer surface of the FGM and the underlying substrate, and also to protect the substrate from environmental attack. Most bond coats in use are not functionally graded; they are monolithic, or, are made of discrete layers of different combinations of materials. Currently, deficiencies in bond coat performance directly impact and reduce the performance and life of TBC systems. This research is directed toward improving the durability and performance of thermal barrier systems via improved understanding of the interrelationships between the thermophysical, chemical and mechanical properties. Durability also may be improved by decreasing ceramic thickness. If nanocrys-

talline ceramics are shown to offer improved insulating performance, this will allow decreased ceramic thickness for performance equivalent to current ceramic layers. The overall objective of the research was to develop fundamental understandings of the physical and mechanical properties of polycomponent (three or more constituent) FGM systems as a function of phase constituents, phase volume, and microstructure. The use of three or more components in an FGM system permits the decoupling of previously dependent physical properties. For example, in a binary metal oxide-metal graded system, thermal conductivity and thermal expansion are not independent of one another, because both are functions of the volume fraction metal oxide.
DTIC
Composite Materials; Thermophysical Properties; Thermal Control Coatings; Substrates; Metal Oxides; Heat Resistant Alloys

19990004143 ESDU International Ltd., London, UK
Thermal Conductivity of Liquid Aliphatic Amines
Jun. 1997; 36p; In English; Supersedes ESDU-78022. Included in the Physical Data, Chemical Engineering Sub-series
Report No.(s): ESDU-97010; ESDU-78022; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, England), Hardcopy, Microfiche

ES DU 97010 gives data for 17 primary, 5 secondary and 5 tertiary amines and one alkenyl amine. Experimental results drawn from the literature for each compound were fitted with a four-term polynomial equation in reduced temperature. The coefficients were also faired with changing molecular structure to ensure the best correlation not only for the individual compounds but also as members of their chemical series. The coefficient correlations also allowed values to be predicted for compounds for which no measured data exist. The equations were used to tabulate thermal conductivity values from the melting point to about 0.9 critical temperature in SI units at 10 K and 10 degree Celsius intervals. The likely uncertainties at various temperatures are assessed and are indicated in the tables. The critical point, coefficients and sources of the data are given for each compound. The effect of pressure is briefly considered.
Author
Polynomials; Thermal Conductivity; Molecular Structure; Amines; Liquid Flow

19990005963 Pennsylvania State Univ., Dept. of Civil and Environmental Engineering, University Park, PA USA
Ultra-Violet Light/Ozone Treatment of a Sequentially Loaded and Regenerated Granular Activated Carbon Biofilter
Dusenbury, James S.; Aug. 1997; 175p; In English
Report No.(s): AD-A353328; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The research described herein has evaluated a UV/ozone in-situ regeneration treatment of sequentially loaded and regenerated GAC biofilters used for removing methyl isobutyl ketone (MIBK) from waste-air streams. Exploration has been conducted in the three primary areas of: (a) GAC biofiltration including ultra-violet light (UV)/ozone treatment of sequentially loaded and regenerated GAC biofilters, (b) biofilter biofilm kinetics, and (c) UV/ozone treatment of virgin and loaded GAC. The GAC biofilter was alternately exposed to a simulated waste air stream laden with MIBK for 24 hours, followed by exposure to a regeneration air stream for 24 hours. The second bed was regenerated with either humid air or humid air which had passed through the UV reactor to produce ozone and associated oxidants. Sequentially loaded and regenerated bench-scale reactors have been constructed to operate in a manner analogous to a commercially available air pollution control system manufactured by Terr-aqua Environmental Systems (TAES).
DTIC
Ozone; Activated Carbon; Ultraviolet Radiation; Filters; Granular Materials; Luminaires

19990005965 Process Technologies, Inc., Boise, ID USA
Photolytic Destruction Technology Demonstration - NAS North Island, Site 9 ***Final Report, Oct. 1997 - Feb. 1998***
Aug. 1998; 163p; In English
Contract(s)/Grant(s): N47408-97-C-0215
Report No.(s): AD-A353747; CR 98.15-ENV; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Photolytic Destruction Technology was chosen for demonstration, as part of the Navy Environmental Leadership Program (NELP), at Naval Air Station (NAS) North Island's Site 9 soil vapor extraction (SVE) system. The demonstration was conducted, under contract N47408-97-C-0215 through Naval Facilities Engineering Service Center's Broad Agency Announcement (BAA) program, to Process Technologies Incorporated (PTI), beginning October 7, 1997 and ending February 12, 1998, for 128 days. The literature search, demonstration oversight, and evaluation were funded by the Pollution Abatement Ashore Program managed by Naval Facilities Engineering Command and sponsored by the Environmental Protection, Safety and Occupational Health Division (N45) of the Chief of Naval Operations. The system was installed to treat a slip stream containing volatile organic compounds (VOCs) from the operating SVE system already installed at the site. The goal of this demonstration was to obtain the

necessary cost and performance data, including the lessons learned, on the system comprising of a concentrator, condenser, and photolytic destruction unit (PDU), for comparison with other treatment technologies. The system was demonstrated on air stream contaminated with halogenated and non-halogenated VOCs such as l,2-dichloroethene, trichloroethene, tetrachloroethene, toluene, and octane. The test results indicated that the system was effective in removing VOCs in thc SVE off-gas to below the maximum allowable emissions of 25 parts per million by volume. The average total DRE achieved for VOCs was 95.44% whereas the PDU alone demonstrated an overall DRE of 97%. The estimated unit cost to treat SVE off-gas at NAS North Island's Site 9, for a 3,000 standard cubic feet per minute PTI system, is $3.77 per pound of VOC treated.
DTIC
Destruction; Photolysis; Environment Protection

19990005988 ESDU International Ltd., London, UK
Vapour Pressures and Critical Points of Liquids: Aliphatic and Alicyclic Amines, 1, Primary Amines
Jun. 1997; 98p; In English; Supersedes ESDU-76025. Included in the Physical Data Chemical Engineering Sub-series
Report No.(s): ESDU-97012; ESDU-76025; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, England), Hardcopy, Microfiche

ESDU 97012 presents vapour pressure data for 39 aliphatic amines to C 1 8, 1 alkenylamine and 6 cycloalkylamines obtained by a critical evaluation of experimental results in the literature. The limited data available were extrapolated using a correlation developed relating the behaviour of the coefficients of the Wagner equation to the behaviour of the ideal gas and liquid heat capacities. The Wagner equation was fitted to the data from the melting point to close to the critical point (except for some compounds for which it was cut off around 0.9 critical) and the coefficients are given for each compound. Two tables of vapour pressure calculated using the equation are given: one in SI units at 5 K intervals and one in bars at 5 degree C intervals. A table also gives saturation temperatures at various specified pressures and indicates the possible uncertainty in the calculated values. Values of acentric factor, normal melting and boiling points, and the slope of the saturation temperature versus vapour pressure curve at the normal boiling point are also given together with a list of the sources of data for each compound. Density data for the compounds are given in ESDU 97013 and the choice of critical point values gave the best correlation for both properties.
Author
Amines; Vapor Pressure; Critical Point; Liquids; Melting Points; Ideal Gas

19990005989 ESDU International Ltd., London, UK
Orthobaric Densities and Molar Volumes of Liquids: Aliphatic and Alicyclic Amines, 1, Primary Amines
Jun. 1997; 90p; In English; Included in the Physical Data Chemical Engineering Sub-series
Report No.(s): ESDU-97013; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, England), Hardcopy, Microfiche

ESDU 97013 tabulates from near the melting point to the critical point density in kg/cu m at 5 degree C intervals and molar volumes in cu cm/mol at 5 K intervals for 38 aliphatic amines to C 18, one alkenylamine and three cycloamines. Another table gives at specified Celsius temperatures the density, molar volume and their derivatives with respect to temperature. The critical density was calculated using the Rackett and Riedel equations, which were in close agreement, and critical temperature and pressure were adjusted to give the best correlation of experimental results extracted from the literature for both the density data given here and the vapour pressure data given for these compounds in ESDU 97012. The equation used to fit the density data related reduced density to a polynomial in reduced temperature. The coefficients in the equation are given for each compound together with estimates of the accuracy of the predictions using them and a list of sources of data used. Values at the critical point are also given together with normal boiling and melting points.
Author
Amines; Critical Temperature; Critical Point; Vapor Pressure; Melting Points

19990005990 ESDU International Ltd., London, UK
Vapour Pressures and Critical Points of Liquids: Aliphatic and Alicyclic Amines, 2, Secondary and Tertiary Amines
Sep. 1997; 102p; In English; Included in the Physical Data Chemical Engineering Sub-series
Report No.(s): ESDU-97014; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, England), Hardcopy, Microfiche

ESDU 97014 presents vapour pressure data for 32 secondary alkylamines to C18 and 16 tertiary alkylamines obtained by a critical evaluation of experimental results in the literature. The limited data available were extrapolated using a correlation developed relating the behaviour of the coefficients of the Wagner equation to the behaviour of the ideal gas and liquid heat capacities. The Wagner equation was fitted to the data from the melting point to close to the critical point (except for some compounds for

which it was cut off around 0.9 critical) and the coefficients are given for each compound. Two tables of vapour pressure calculated using the equation are given: one in SI units at 5 K intervals and one in bars at 5 C intervals. A table also gives saturation temperatures at various specified pressures and indicates the possible uncertainty in the calculated values. Values of acentric factor, normal melting and boiling points, and the slope of the saturation temperature versus vapour pressure curve at the normal boiling point are also given together with a list of the sources of data for each compound. Density data for the compounds are given in ESDU 97015 and the choice of critical point values gave the best correlation for both properties.
Author
Amines; Vapor Pressure; Liquids; Melting Points; Ideal Gas; Critical Point

19990006002 Science Applications International Corp., Reston, VA USA
Environmental Profile for Propylene Carbonate
Jun. 1998; 56p; In English
Contract(s)/Grant(s): EPA-68-C6-0027
Report No.(s): PB99-101412; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Section 2.0 provides background information on Propylene carbonate (PC) and presents several case studies focusing on its use in depainting operations. Key human health and environmental impact categories are identified in Section 3.0 Section 4.0 discusses sources of information, physical and chemical properties, environmental rate and transport, and the toxicology of PC. Section 5.0 identifies the populations at risk of exposure and summarizes the available data on potential impacts to natural resources and ecosystems. Current environmental regulations are reviewed in Section 6.0, and a summary is provided in Section 7.0.
NTIS
Alternatives; Propylene; Carbonates; Toxicology; Health; Exposure; Environmental Surveys; Chemical Properties; Removal

19990008235 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA
Evaluation of Joint Sealants of Concrete Pavements ***Interim Report, Sep. 1995 - Aug. 1996***
Gurjar, Ashok H., Texas A&M Univ., USA; Tang, Tianxi, Texas A&M Univ., USA; Zollinger, Dan G., Texas A&M Univ., USA; Mar. 1997; 154p; In English
Contract(s)/Grant(s): FHWA-0-187
Report No.(s): PB99-109654; FHWA/TX-98-187-27; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
This report document investigation of concrete pavement joint sealants which began with project 1371 'Evaluation of Joint Sealants.' The purpose of the continued investigation is to propose specification and test protocol for joint sealants in concrete pavements based on characterization of selected material properties. The report documents the procedure for estimation of the service life of a sealant joint sealant material and its application to specification development.
NTIS
Concretes; Pavements; Protocol (Computers); Sealers

19990008396 Environmental Protection Agency, Emission Standards Div., Research Triangle Park, NC USA
National Volatile Organic Compound Emission Standards for Architectural Coatings: Background for Promulgated Standards ***Final Report***
Aug. 1998; 480p; In English
Report No.(s): PB99-104671; EPA/453/R-98/006B; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche
The U.S. Environmental Protection Agency (EPA) received a total of 243 letters commenting on the proposed standards and the background information document (BID) for the proposed standards. The EPA held a public hearing on July 30, 1996 in Durham, North Carolina, at which 19 commenters presented oral comments. In addition, the EPA held a public meeting on August 13, 1996 in Rosemont, Illinois, in which 77 persons participated. At this public meeting, 18 manufacturers provided company profiles. Some commenters provided more than one comment letter or commented at the public hearing or meeting.
NTIS
Paints; Pollution Control; Organic Compounds; Environment Protection; Air Pollution; Volatility

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COMPOSITE MATERIALS

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

19990004100 California Univ., Dept. of Mechanical and Environmental Engineering, Santa Barbara, CA USA
Structural Qualification of Composite Airframes
Kedward, Keith T., California Univ., USA; McCarty, John E., California Univ., USA; 1997; 81p; In English
Contract(s)/Grant(s): NAG1-1376; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The development of fundamental approaches for predicting failure and elongation characteristics of fibrous composites are summarized in this document. The research described includes a statistical formulation for individual fiber breakage and fragmentation and clustered fiber breakage, termed macrodefects wherein the aligned composite may represent a structural component such as a reinforcing bar element, a rebar. Experimental work conducted in support of the future exploitation of aligned composite rebar elements is also described. This work discusses the experimental challenges associated with rebar tensile test evaluation and describes initial numerical analyses performed in support of the experimental program.
Author
Composite Structures; Airframe Materials; Tensile Tests; Fiber Composites

19990004341 Clark-Atlanta Univ., GA USA
Constitutive Modeling and Testing of Polymer Matrix Composites Incorporating Physical Aging at Elevated Temperatures, *1 Jun. 1995 - 31 May 1998*
Veazie, David R., Clark-Atlanta Univ., USA; 1998; 17p; In English
Contract(s)/Grant(s): NAG1-1727; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advanced polymer matrix composites (PMC's) are desirable for structural materials in diverse applications such as aircraft, civil infrastructure and biomedical implants because of their improved strength-to-weight and stiffness-to-weight ratios. For example, the next generation military and commercial aircraft requires applications for high strength, low weight structural components subjected to elevated temperatures. A possible disadvantage of polymer-based composites is that the physical and mechanical properties of the matrix often change significantly over time due to the exposure of elevated temperatures and environmental factors. For design, long term exposure (i.e. aging) of PMC's must be accounted for through constitutive models in order to accurately assess the effects of aging on performance, crack initiation and remaining life. One particular aspect of this aging process, physical aging, is considered in this research.
Author
Structural Design; Polymer Matrix Composites; Mechanical Properties; High Strength; Crack Initiation; Composite Structures; Composite Materials; Commercial Aircraft; Aging (Materials)

19990004342 NASA Lewis Research Center, Cleveland, OH USA
Probabilistic Modeling of Ceramic Matrix Composite Strength
Shan, Ashwin R., Sest, Inc., USA; Murthy, Pappu L. N., NASA Lewis Research Center, USA; Mital, Subodh K., Toledo Univ., USA; Bhatt, Ramakrishna T., Army Research Lab., USA; Sep. 1998; 16p; In English; 39th; Structures, Structural Dynamics, and Materials Conference and Exhibit, 20-23 Apr. 1998, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 523-21-13
Report No.(s): NASA/TM-1998-208492; NAS 1.15:208492; E-11281; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Uncertainties associated with the primitive random variables such as manufacturing process (processing temperature, fiber volume ratio, void volume ratio), constituent properties (fiber, matrix and interface), and geometric parameters (ply thickness, interphase thickness) have been simulated to quantify the scatter in the first matrix cracking strength (FMCS) and the ultimate tensile strength of SCS-6/RBSN (SiC fiber (SCS-6) reinforced reaction-bonded silicon nitride composite) ceramic matrix composite laminate at room temperature. Cumulative probability distribution function for the FMCS and ultimate tensile strength at room temperature (RT) of (0)(sub 8), (0(sub 2)/90(sub 2), and (+/-45(sub 2))(sub S) laminates have been simulated and the sensitivity of primitive variables to the respective strengths have been quantified. Computationally predicted scatter of the strengths for a uniaxial laminate have been compared with those from limited experimental data. Also the experimental procedure used in the tests has been described briefly. Results show a very good agreement between the computational simulation and the experimental data. Dominating failure modes in (0)(sub 8), (0/90)(sub s) and (+/-45)(sub S) laminates have been identified. Results indi-

cate that the first matrix cracking strength for the (0)(sub S), and (0/90)(sub S) laminates is sensitive to the thermal properties, modulus and strengths of both the fiber and matrix whereas the ultimate tensile strength is sensitive to the fiber strength and the fiber volume ratio. In the case of a (+/-45)(sub S), laminate, both the FMCS and the ultimate tensile strengths have a small scatter range and are sensitive to the fiber tensile strength as well as the fiber volume ratio.
Author
Ceramic Matrix Composites; Fiber Composites; Fiber Strength; Fiber-Matrix Interfaces; Fracture Strength; Matrix Materials; Silicon Nitrides; Temperature Ratio; Tensile Strength; Thermodynamic Properties

19990005101 PolyComp Technologies, Inc., Del Mar, CA USA
Thermo-Oxidative Stability of Polyimide Composite for Aerospace Applications ***Final Report, 1 Mar. 1995 - 28 Feb. 1998***
Leung, Chuk L., PolyComp Technologies, Inc., USA; Aug. 1998; 39p; In English
Contract(s)/Grant(s): F49620-95-C-0022; AF Proj. 2306
Report No.(s): AD-A352964; PC-OSR-03; AFRL-SR-BL-TR-98-0611; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Polyimides are increasingly being used in high-temperature structural composites for airframe and engine applications. A basic understanding of the structure-property relationship of polyimides will enable the intelligent selection and formulation of thermally stable matrices. Our approach aims at developing a understanding of the influence of polymer chemistry on composite stability by conducting novel polymer modifications and formulations to provide different polymer structures to minimize thermo-oxidative degradation of polyimides. We showed that the molecular weights of the prepolymers strongly influence the network structures of the polyimide, and the entrapment of unreacted prepolymer molecules in the polymer network will decrease the thermal stability. We also demonstrated that the network structures of bismaleimides can be modified by inserting bulky substituents around the amic linkages. However, thermo-oxidative stability is not improved because of the tendency for the substituents to undergo scission.
DTIC
Thermal Stability; Polymer Chemistry; Aerospace Engineering; Composite Materials; Oxidation; Polyimide Resins; Composite Structures; Bismaleimide

19990005978 Ohio Aerospace Inst., Cleveland, OH USA
Development and Characterization of SiC)/ MoSi2-Si3N4(p) Hybrid Composites ***Final Report***
Hebsur, Mohan G., Ohio Aerospace Inst., USA; Oct. 1998; 26p; In English
Contract(s)/Grant(s): NCC3-637; RTOP 505-63-5F
Report No.(s): NASA/CR-1998-208519; NAS 1.26:208519; E-11273-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Intermetallic compound MoSi2 has long been known as a high temperature material that has excellent oxidation resistance and electrical/thermal conductivity. Also its low cost, high melting point (2023 C), relatively low density (6.2 g/cu cm versus 9 g/cu cm for current engine materials), and ease of machining, make it an attractive structural material. However, the use of MoSi2 has been hindered due to its poor toughness at low temperatures, poor creep resistance at high temperatures, and accelerated oxidation (also known as 'pest' oxidation) at temperatures between approximately 450 and 550 C. Continuous fiber reinforcing is very effective means of improving both toughness and strength. Unfortunately, MoSi2 has a relatively high coefficient of thermal expansion (CTE) compared to potential reinforcing fibers such as SiC. The large CTE mismatch between the fiber and the matrix resulted in severe matrix cracking during thermal cycling. Addition of about 30 to 50 vol % of Si3N4 particulate to MoSi2 improved resistance to low temperature accelerated oxidation by forming a Si2ON2 protective scale and thereby eliminating catastrophic 'pest failure'. The Si3N4 addition also improved the high temperature creep strength by nearly five orders of magnitude, doubled the room temperature toughness and significantly lowered the CTE of the MoSi2 and eliminated matrix cracking in SCS-6 reinforced composites even after thermal cycling. The SCS-6 fiber reinforcement improved the room temperature fracture toughness by seven times and impact resistance by five times. The composite exhibited excellent strength and toughness improvement up to 1400 C. More recently, tape casting was adopted as the preferred processing of MoSi2-base composites for improved fiber spacing, ability to use small diameter fibers, and for lower cost. Good strength and toughness values were also obtained with fine diameter Hi-Nicalon tow fibers. This hybrid composite remains competitive with ceramic matrix composites as a replacement for Ni-base superalloys in aircraft engine applications.
Author
Silicon Carbides; Silicon Nitrides; Thermal Cycling Tests; Hybrid Composites; Creep Strength; Ceramic Matrix Composites; Heat Resistant Alloys; Molybdenum Compounds; Silicides

19990007759 NASA Lewis Research Center, Cleveland, OH USA

The Evolution of Interfacial Sliding Stresses During Cyclic Push-in Testing of C- and BN-Coated Hi-Nicalon Fiber-Reinforced CMCs

Eldridge, J. I., NASA Lewis Research Center, USA; Bansal, N. P., NASA Lewis Research Center, USA; Bhatt, R. T., NASA Lewis Research Center, USA; Jan. 1998; 8p; In English; Ceramic Engineering and Science Proceedings Conference, Jan. 1998, Cocoa Beach, FL, USA; Sponsored by American Ceramic Society, USA

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

Interfacial debond cracks and fiber/matrix sliding stresses in ceramic matrix composites (CMCs) can evolve under cyclic fatigue conditions as well as with changes in the environment, strongly affecting the crack growth behavior, and therefore, the useful service lifetime of the composite. In this study, room temperature cyclic fiber push-in testing was applied to monitor the evolution of frictional sliding stresses and fiber sliding distances with continued cycling in both C- and BN-coated Hi-Nicalon SiC fiber-reinforced CMCs. A SiC matrix composite reinforced with C-coated Hi-Nical on fibers as well as barium strontium aluminosilicate (BSAS) matrix composites reinforced with BN-coated (four different deposition processes compared) Hi-Nicalon fibers were examined. For failure at a C interface, test results indicated progressive increases in fiber sliding distances during cycling in room air but not in nitrogen. These results suggest the presence of moisture will promote crack growth when interfacial failure occurs at a C interface. While short-term testing environmental effects were not apparent for failure at the BN interfaces, long-term exposure of partially debonded BN-coated fibers to humid air resulted in large increases in fiber sliding distances and decreases in interfacial sliding stresses for all the BN coatings, presumably due to moisture attack. A wide variation was observed in debond and frictional sliding stresses among the different BN coatings.

Author

Ceramic Matrix Composites; Coatings; Fiber-Matrix Interfaces; Silicon Carbides; Strontium; Environment Effects; Fiber Composites; Crack Propagation; Barium

19990007785 NASA Langley Research Center, Hampton, VA USA

Influence of Impactor Mass on the Damage Characteristics and Failure Strength of Laminated Composite Plates

Ambur, Damodar R., NASA Langley Research Center, USA; Kemmerly, Heather L., NASA Langley Research Center, USA; 1998; 12p; In English; 39th; Strucrures, Structural Dynamics and Materials, 20-23 Apr. 1998, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): NASA/TM-1998-208123; NAS 1.15:208123; AIAA Paper 98-1784; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The results of an experimental study of the effect of impactor mass on the low-speed impact response of laminated flat composite plates is presented. Dropped weight impact response, damage characteristics, and residual strengths of quasi-isotropic flat plates are presented for a range of energy levels by systematically varying the mass of the impactor. Measured contact forces and damage areas are also presented. The results indicate that the contact force and damage area are nonlinear functions of the impactor mass and vary considerably over the entire range of energy levels considered. The different damage levels induced in a plate specimen when impacted at a given energy level with impactors of different masses significantly influence its compressive residual strength. The results provide clear and consistent trends in contact force, damage area, and compression-after-impact strength when the data are expressed as a function of the impactor momentum.

Author

Impact Damage; Energy Levels; Failure; Impact Strength; Impactors

19990007787 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

Propagation of Lamb Waves in Layered Composites Materials. Application to the Detection of Delaminations *Propagation des ondes de Lamb dans un materiau composite stratifie. Application a la detection de delaminages*

Simon, Christophe, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 168p; In French; In English; Original contains color illustrations

Report No.(s): ONERA-NT-1998-5; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This thesis concerns propagation of Lamb waves in a stratified composite, used for detection of delaminations, Because Lamb waves propagate over long distances, they can be used for fast non-destructive tests of for health monitoring in smart structures. First, the generalised theory of Lamb wave propagation is discussed. It is based on the theory of partial waves that combine to form a Lamb wave. It is characterized mathematically by the dispersion equation. Numerical simulations are conducted to understand and identify the different Lamb wave propagation modes. Various representations are introduced, including scatter curves, slowness curves and polarisation graphs showing the coupling between the dispersive effect and the material anisotropy. Identification of the propagation modes in a unidirectional composite evidenced a polarization transfer phenomenon. The dispersion

effect affects the attenuation as well as the wave velocity and polarisation. Lamb wave attenuation versus frequency is introduced by taking the material viscosity into account. The result shows that not only attenuation does increase with frequency, but is also strongly magnified by dispersion. These results were applied to Lamb wave propagation over long distances, for which the dispersion or attenuation factor was therefore minimized. An understanding of Lamb waves also allows selection of the polarisation for detection by optical systems. Lamb waves are generated either by wedge effect, or by miniaturised inserts bonded to the structure. The shoes allowed validation of the dispersion curves using phase velocity measurements. They also showed that composite delaminations could be detected by amplitude measurements. This results was used for long distance measurements with insert that can be integrated in the material, for use with sensitive materials and structures. New optical detection techniques were used for non-destructive testing without any contact with the material. This was the case for the heterodyne probe which gives local measurements of the normal plate movement with a high sensitivity and shearography which gives this measurement directly over a large surface area. The latter technique has been demonstrated for fast non-destructive testing for delamination detection.
Author
Lamb Waves; Propagation Modes; Layers; Composite Materials; Delaminating

19990007800 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Accelerated Environmental Testing of Composite Materials
Vodicka, Roger, Defence Science and Technology Organisation, Australia; Jul. 1997; 50p; In English
Report No.(s): DSTO-TR-0657; DODA-AR-010-516; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Australia), Hardcopy, Microfiche

Composite materials are found to lose mechanical on exposure to aircraft operating environments. This is mainly due to absorption of moisture from humid air by the matrix material. Composite materials are extensively used by the RAAF for both major structural components on the F/A-18 and for bonded repairs and doublers. The performance of these materials under long-term environmental exposure is an important aspect of both aircraft certification and in the understanding of how the components will age. Ms report provides a broad overview of environmental effects on composite materials and methods which may be used to predict their long-term behaviour. The use of accelerated testing environments in the laboratory is an attractive proposition as it enables tests to be carried out in reduced time frames. A number of accelerated testing methodologies and their implications are outlined here. Accelerated testing can be carried out with confidence if the exposure conditions are representative and the failure modes of the material during mechanical tests reflect those seen in service.
Author
Composite Materials; Accelerated Life Tests; Environment Effects; Matrix Materials; Structural Design

19990007925 Cleveland State Univ., Dept. of Chemical Engineering, Cleveland, OH USA
The Oxidation of CVD Silicon Carbide in Carbon Dioxide
Opila, Elizabeth J., Cleveland State Univ., USA; Nguyen, QuynchGiao N., Ohio Aerospace Inst., USA; 1997; 24p; In English; 98th, Apr. 1998, Indianapolis, IN, USA; Sponsored by American Ceramic Society, USA
Contract(s)/Grant(s): RTOP 537-04-22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chemically-vapor-deposited silicon carbide (CVD SiC) was oxidized in carbon dioxide (CO2) at temperatures of 1200-1400 C for times between 100 and 500 hours at several gas flow rates. Oxidation weight gains were monitored by thermogravimetric analysis (TGA) and were found to be very small and independent of temperature. Possible rate limiting kinetic laws are discussed. Oxidation of SiC by CO2 is negligible compared to the rates measured for other oxidants typically found in combustion environments: oxygen and water vapor.
Author
Vapor Deposition; Silicon Carbides; Carbon Dioxide; Chemical Reactions; Thermogravimetry; Flow Velocity; Oxidation

19990008196 Defence Science and Technology Organisation, Maritime Platforms Div., Melbourne, Australia
A Study of the High Strain-Rate Behaviour of GRP Composites
ShahKhan, M. Z., Defence Science and Technology Organisation, Australia; Simpson, G., Defence Science and Technology Organisation, Australia; Taylor, M., Defence Science and Technology Organisation, Australia; Jan. 1998; 19p; In English; Original contains color illustrations
Report No.(s): DSTO-RR-0120; DODA-AR-010-440; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

In this report a brief review of impact loading test methods suitable for testing composite materials is given. Results from two experimental studies undertaken to determine the dynamic behaviour of GRP composites under strain rates ranging from 40/s (low velocity) to 1000/s (high velocity) are presented. The strain rate of 40/s was achieved using a conventional dynamic tear test

apparatus. A modified Hopkinson Bar was used to achieve strain rates of 1000/s and above in compression. Responses of two types of GRP composites to impact at these strain rates are compared in terms of their strength and energy absorbed capacity in fracture. Author

Impact Loads; Strain Rate; Fracturing; Dynamic Characteristics; Reinforced Plastics; Glass Fiber Reinforced Plastics

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.

19990004085 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA

Mechanism of Combustion of Heterogeneous Solid Propellants ***Final Report, 15 Oct. 1988 - 31 Oct. 1995***

Price, E. W.; Sigman, R. K.; Chakravarthy, S. R.; Chaing, H. J.; Lee, S. T.; Sep. 1998; 189p; In English

Contract(s)/Grant(s): N00014-89-J-1293

Report No.(s): AD-A353001; GIT-AER-E-16-689; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The objective of the research is to establish the processes in solid propellant combustion that control steady and nonsteady combustion rate (composite propellants). The practical goal is to: 1. Tailor burning rate by variation of formulation (oxidizer particle size, ballistic modifiers, and choice of binders). This includes learning what processes lead to low or negative sensitivity of burning rate to pressure increase (plateau and mesa burning). 2. Determine steps in the combustion process that are most responsive to oscillatory flows (combustion instability). 3. Evaluate the combustion characteristics of new oxidizer and binder ingredients, and of propellants that include new ingredients (and compare results with those of AP oxidizer and Ap/hydrocarbon binder propellants). 4. Develop a realistic qualitative model of the combustion process that would identify the requirements for formulation of realistic analytical models.

DTIC

Combustion Chemistry; Solid Propellant Combustion; Heterogeneity; Combustion Stability; Composite Propellants

19990004136 Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM USA

Characterization of Emissions from Heaters Burning Leaded Diesel Fuel in Unvented Tents ***Annual Report, 7 Jun. 1997 - 6 Jun 1998***

Cheng, Yung Sung; Jul. 1998; 23p; In English

Contract(s)/Grant(s): DAMD17-96-1-6124

Report No.(s): AD-A353883; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this study is to simulate human exposure to aerosols produced by unvented heaters in tents used in the Persian Gulf, so that the contribution of exposure to this in-tent pollutant can be estimated. The specific aims include: 1. Physical and chemical characterization of aerosols produced by heaters that burned fuels in an unvented tent. 2. Estimation of exposure to particulate matter (PM), combustion gases (such as CO, NOx, and SO2), and other compounds (such as lead, PAHs etc.). During the first year of the project, we had extensive discussions with several Army laboratories on tents, tent heaters (US Army, Natick Research Development and Evaluation Center), and fuels (Fuels & Lubricants Technology Team, Mobility Technology Center - Fort Belvoir). Based on these discussions, it was determined that the unvented heaters most likely used in the Gulf War were commercial units that burned kerosene and aviation fuels, primarily JAl and JP8 fuels which are kerosene-based and have similar compositions.

DTIC

Aerosols; Heaters; Combustion Products; Air Pollution; Particulates; Contaminants; Persian Gulf

19990004389 State Univ. of New York, Dept. of Chemistry, Buffalo, NY USA

Gallium-Nitrogen Compounds Prepared by Dihydronaphthalene Structures of (PhMe2CCH2GaNH(t-Bu)2 and(H4C6)Me2CCH2GaNH(t-Bu)2Ga(CH2CMe2Ph)2

Beachley, O. T., Jr., State Univ. of New York, USA; Noble, Matthew J., State Univ. of New York, USA; Churchill, Melvyn R., State Univ. of New York, USA; Lake, Charles H., State Univ. of New York, USA; Sep. 24, 1998; 33p; In English

Contract(s)/Grant(s): N00014-96-1-0483

Report No.(s): AD-A353952; SUNY/AB-TR-52; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The dihydronaphthalene elimination reaction between Na2C10H8(GaR2Cl)2 (R = CH2CMe3, CH2CMe2Ph) and t-BuNH2 provided a room temperature route to R2GaNH(t-Bu)2. However, when Ga(CH2CMe2Ph)3 and t-BuNH2 were reacted at 140 - 150C, C6H5CMe3 was eliminated and the product was (H4C6)Me2CCH2GaNH(t-Bu)2Ga(CH2CMe2Ph)2, a gallium(III) amide with one GaC4 metallocyclic ring, rather than (PhMe2CCH2)2GaNH(t- Bu)2. X-ray structural studies confirmed the identity of this novel compound as well as that of the typical dimer. When the reaction temperature was increased to 210 - 230C, the product was (H4C6)Me2CCH2GaNH(t-Bu)2GaCH2CMe2(C6H4), a species with two GaC4 metallocyclic rings.
DTIC
Crystal Structure; Molecular Structure; Gallium Compounds; Nitrogen Compounds

19990005044 Illinois Univ., Dept. of Mechanical and Industrial Engineering, Urbana-Champaign, IL USA
Fuel/Air Mixing and Flame Structure Measurements for Advance Low Emission Gas Turbine Combustors ***Annual Report, 1 Aug. 1997 - 31 Jul. 1998***
Frazier, Timothy R., Illinois Univ., USA; Foglesong, Robert E., Illinois Univ., USA; Coverdill, Robert E., Illinois Univ., USA; Peters, James E., Illinois Univ., USA; Lucht, Robert P., Illinois Univ., USA; Sep. 01, 1998; 30p; In English
Contract(s)/Grant(s): F49620-97-1-0456; AF Proj. 3484
Report No.(s): AD-A353371; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A gas turbine combustion facility with optical access was developed which allows the use of laser diagnostic techniques to measure temperature and species concentrations within the combustion zone. The mixing effectiveness of a dual annular counter-rotating swirlier premixer was examined using planar laser induced fluorescence (PLIF) of acetone seeded gaseous fuel to provide quantitative maps of the spatial and temporal fuel/air distributions emanating from the premixer. Time averaged results showed maximum spatial variations on the order of 50% of the known overall equivalence ratio. Temporal unmixedness resulted in peak equivalence ratios 2.4 times greater than the overall stoichiometry.
DTIC
Flames; Combustion; Gas Turbines; Gaseous Fuels; Combustion Chambers

19990005958 Rutherford Appleton Lab., ISIS Spectroscopy and Support Div., Chilton, UK
ISIS Spectroscopy and Support Division Cryogenics Review: June 1997
Meissner, Michael, Rutherford Appleton Lab., UK; Feb. 1998; ISSN 1358-6254; 13p; In English
Report No.(s): RAL-TR-98-020; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche
As a summary I have grouped my recommendations below into four classes of interest. The relevant remarks can be found on the page number given in brackets. I trust that the recommendations within the first two classes should support the ”orange-business” for smooth and safe operation at ISIS. The options listed in the last two classes are more difficult for me to judge since investment of effort and money and, subsequently, new technology is involved. I find that for these items collaboration between ISIS and BENSC is helpful: like ISIS’s experience with the HELIOX and at BENSC with the KELVINOX or in using a shared data base for documentation of similar equipment at both institutions.
Author
Cryogenics; Helium-Oxygen Atmospheres; ISIS Satellites; Spectroscopy

19990005960 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Evaluation of Hydroxyethane Diphosphonic Acid (HEDPA) as Metal Cleaning Agent Using Chemical and Electrochemical Test Methods, Part I
Rao, A. S.; Murray, John N.; Jun. 1998; 49p; In English
Report No.(s): AD-A353280; CARDIVNSWC-TR-61-98-16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In order to evaluate the adaptability of hydroxyethane diphosphonic acid (HEDPA) as an environmentally benign alternative rust removal agent, a systematic investigation is being carried out. The effectiveness of 2 vol.% (0.082 M) HEDPA was thoroughly investigated in the temperature range 27 - 60 C. The results suggest that the acid, HEDPA, is very effective in the rust removal process. It was found that the rust was completely removed by the HEDPA within 3 hours at 27 C, or within 30 minutes at 60 C. The rust dissolution process was found to have an activation energy of 11 +/- 1 kcal/mole. Prolonged treatment of samples with HEDPA results in the re-deposition of the reaction products onto the cleaned sample surface. The reaction product appears to be a mixture of complex higher order iron phosphates.
DTIC
Reaction Products; Electrochemistry; Chemical Cleaning

19990007789 ESDU International Ltd., London, UK

Thermophysical Properties of Hydrogen Sulphide

Feb. 1996; 17p; In English; Included in the Physical Data, Chemical Engineering and in the Physical Data, Mechanical Engineering Sub-series

Report No.(s): ESDU-96034; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham Street, London, N1 6UA, England), Hardcopy, Microfiche

ESDU 96034 gives equations obtained from a critical evaluation of experimental data in the literature for the variation along the saturation line with temperature, for both the liquid and the vapour, of. density, enthalpy, heat capacity at constant pressure, dynamic viscosity and thermal conductivity. Also given are equations for the variation with temperature along the saturation line of the vapour pressure, latent heat of vaporisation and surface tension, together with equations for the variation with temperature for the ideal gas of specific heat capacity at constant pressure, enthalpy, dynamic viscosity and thermal conductivity. Results on the saturation line evaluated in SI units using the equations are tabulated at 5 K intervals and at 5 C intervals from the melting point to the critical point, or as close to it as possible for some properties. Results for the ideal gas evaluated also in SI units using the equations are also tabulated at 20 K and at 20 degree C intervals from the melting point to 700 K. In the absence of experimental values some of these results involve extrapolation and they are indicated in the tables. Conversion factors to facilitate use of the data in British units are included. Sources of the data are listed.

Author

Hydrogen; Sulfides; Thermal Conductivity; Equations of Motion; Data Acquisition; Extrapolation

19990008189 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Fishermens Bend, Australia

Comparison of CMC and SLF Model Predictions with Experimental Data for Turbulent Hydrogen Jet Flames

Smith, Nigel S. A., Defence Science and Technology Organisation, Australia; Mar. 06, 1998; 30p; In English

Report No.(s): DSTO-TR-0631; DODA-AR-010-468; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Jet diffusion flames have long been the basic model problem for developing and verifying models for turbulent nonpremixed combustion. In this report, a comprehensive jet flame study of two well known models is made as a foundation step for the incorporation of these models into DSTO's ongoing effort to develop a fundamentally-based generic gas turbine combustor predictive capability. Conditional Moment Closure (CMC) and Steady Laminar Flamelet (SLF) model predictions are compared with data measured from the two turbulent hydrogen jet flames studied experimentally by Kent and Bilger, and Barlow and Carter. The comparison highlights the advantages and disadvantages of each model in the context of predicting turbulent nonpremixed flame dynamics in general. The future application of these two models to the turbulent nonpremixed systems associated with gas turbine engine combustors is discussed in the light of the findings presented.

Author

Jet Flow; Prediction Analysis Techniques; Turbulent Flames; Turbulent Combustion; Hydrogen; Diffusion Flames

19990008240 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan

Synthesis and Properties of Poly ((Perfluoroalkyl) sulfonyl) amides and Methanide Ions as New Types of Anionic Phase-Transfer Catalysts in Azo Coupling Reactions

Kobayashi, Hiroshi, Kyushu Univ., Japan; MeyerZuDuettingdorf, Hans-Dieter, Kyushu Univ., Japan; Nie, Jin, Huazhong Univ. of Science and Technology, China; Sonoda, Takaaki, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1994; ISSN 0914-3793; Volume 8, No. 2, pp. 231-243; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A series of lithium salts of bis ((perfluoroalkyl)sulfonyl) amides with different chain lengths of perfluoroalkyl group and tris ((trifluoromethyl)sulfonyl) methanide (TTM) were prepared. The influence of the polyfluoroalkyl chain length of the imide ions on the solubility of their benzyltrimethylammonium salts in water and the partition coefficients (alpha) in dichloromethane/water system were discussed with respect to the applicability of these anions to new types of anionic phase-transfer catalysts. The catalytic activities of these anions were compared with TFPB anions in the azo coupling reactions of rho-nitrobenzenediazonium ions with N-ethylcarbazole in dichloromethane/water and dichloromethane/solid two-phase systems.

Author

Synthesis (Chemistry); Alkyl Compounds; Perfluoro Compounds; Chlorine Compounds; Catalytic Activity; Azo Compounds

19990008242 Kyushu Univ., Kasuga, Japan

Chemiluminescent Mechanism of Alkylacridines and Acridinium Salts

Yamabe, Kuniaki, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1994; ISSN 0914-3793; Volume 8, No. 2, pp. 253-258; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In the base catalyzed air oxidation of 9-substituted acridines and acridinuim salts in aprotic solvents, reaction mechanism involving a cleavage of 1.2 dioxetanes as key intermediates to give the excited singlet or triplet species is plausible for the luminescent reaction. The kinetics for the luminescence were investigated to determine the quantum yields of the direct and indirect chemiluminescence(CL), as well as the spin state selectivity with added 9,10 dibromoanthracene, 9,10 diphenylanthracene. The chemiexcitation for the generation of the excited singlet and triplet species was analyzed in a view point of the structure and substituent effects of the compounds.

Author

Catalysis; Oxidation; Chemiluminescence; Solvents

19990008342 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Submillimeter Wave Spectrum of Isotopic Methyl Cyanide

Pearson, J. C., Jet Propulsion Lab., California Inst. of Tech., USA; Mueller, H. S. P., Jet Propulsion Lab., California Inst. of Tech., USA; Astrophysical Journal; Nov. 10, 1996; ISSN 0004-6256; Volume 471, pp. 1067-1072; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The laboratory submillimeter wave rotational spectrum of the 13CH3CN, CH3C13CN, and CH3C15N isotopomers of methyl cyanide has been observed in natural abundance in the 294 to 607 GHz region. The maximum J and K values are 34 and 14, respectively. Fifteen additional CH3CN transitions up to K = 21 were also measured. The transitions of all four species are fitted to a symmetric top Hamiltonian, and the rotation and distortion constants are determined. The 14N quadrupole and spin rotation coupling constants are also calculated and presented. Suggested values for many other parameters, which could not be directly determined from the isotope spectra, are calculated from the normal species values and isotope relationships. The determined and calculated constants should predict the spectrum of the three isotopomers to well over 1 THz accurately enough for astronomical assignments.

Author

Nitrogen Isotopes; Wave Propagation; Nitrogen Ions; Computation; Spin Dynamics; Submillimeter Waves; Spectrum Analysis

19990008349 Meiji Univ., School of Science and Technology, Kawasaki Japan

Investigation of the Derivatization Method for Lignin Model Compounds Analysis Using Pyrolysis-Gas Chromatography

Murota, Akihiko, Meiji Univ., Japan; Maekawa, Susumu, Meiji Univ., Japan; Research Reports of the School of Science and Technology, Meiji University; 1996; ISSN 0916-4944, No. 14(70), pp. 31-41; In Japanese

Report No.(s): IV-3; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An applying analytical method for polar compound is reported using Curiepoint pyrolyzer-gas chromatography. Various polar substances are formed by the pyrolysis of polymer, for example condensation polymer and sugar. Therefore, it is difficult to analysis them simultaneously using on-lined pyrolysis-gas chromatography. to overcome this problems, three steps method was carried out. The first step was pylolysis by Curiepoint porolyzer in a sealed glass capillary. Second step was derivatization reaction of decomposition compounds with a trimethylsilylating reagent, such as N-trimethylsilyldiethylamine or N, O-bis(trimethylsilyl)- trifluoroacetamide. and third step, the glass capillary which was wrapped with a pyrofoil was inserted into a pyrolyzer connected to a GC system. (Three Steps Capsule method). The effectiveness of this modification was tested using knowing polar substances, such as phenol, catechol, pyrogallol, acetic acid, benzoic acid and terephthalic acid. In the case of phenol and catechol, the average of derivatization rate and CV% for seventh repeated GC analysis were 99.8% and 1.7%, 96.7% and 1.2 %, respectively. Unidentified polar substances, such as 3-methylphenol, 4-hydroxybenzoic acid methylester, 3-(4-hydroxyphenol)-3-oxopropanal and vanillic acid could be analyzed by application of this method for a synthesized-lignin. Therefore, the three steps capsuled method is rapid and direct, requiring on sample preparation and is able to use for the characterization of polymer.

Author

Research; Lignin; Models; Chemical Analysis; Numerical Analysis; Pyrolysis; Gases

26
METALLIC MATERIALS

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

19990004216 Naval Surface Warfare Center, Annapolis, MD USA
Processing and Property Evaluation of Metal Matrix Superconducting Materials
Rao, Appajosula S., Naval Surface Warfare Center, USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 260-268; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Metal-superconductor (YBCO) systems have been prepared and characterized by resistivity, ac susceptibility and dc SQUID magnetic moment measurements. The silver composites showed superconducting transition for all the composites processed and the superconducting transition temperature tends to depend upon the concentration of the silver in the composite. Aluminum composites showed an unusual resistivity result with two transitions around 90 K and 120 K. The superconducting property of silver composites can be explained qualitatively in terms of the proximity theory that has been suggested for the low temperature superconductors.
Author
Metal Matrix Composites; Superconductivity; YBCO Superconductors

19990004394 Johns Hopkins Univ., Dept. of Mechanical Engineering, Baltimore, MD USA
Promoting Atomic Scale Engineering by Quantifying Experimental Observations of Dislocation Cores ***Final Report, 1 Apr. 1996 - 31 Mar. 1998***
Hemker, Kevin J.; Sep. 01, 1998; 19p; In English
Contract(s)/Grant(s): F49620-95-1-0280
Report No.(s): AD-A353991; AFRL-SR-BL-TR-98-0652; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Intermetallic alloys are excellent materials for bridging the gap between atomic level processes and macroscopic properties, because the mechanical behavior of these alloys can be closely related to their dislocation structures. The research support by this grant, and described here, was undertaken to elucidate the relationship between atomic level dislocation core structures, alloy composition, and macroscopic mechanical behavior in a series of Nix,Fe(1-x)3Ge alloys and to develop the techniques necessary to perform microsample tensile tests of single crystalline intermetallic alloys. The results from this study, which are described below, have resulted in 6 journal articles, 5 conference proceedings, numerous conference presentations and two M.S. Dissertations. The dislocation structure observations provide benchmarks for first-principle electronic structure calculations and the availability of microsample testing allows for mesoscale testing of individual grains in a number of structural alloys. Both have proven to be valuable tools for bridging the length scales that govern the mechanical performance of high temperature structural materials.
DTIC
Intermetallics; Atomic Structure; Mesoscale Phenomena; Refractory Materials; Single Crystals; Mechanical Properties

19990004892 Ufa State Technical Aviation Univ., Inst. of Physics of Advanced Materials, Russia
Research and Application of Advanced Superplasticity in Ultra-Fine Grained Aluminum Alloys and Compositions ***Interim Report, 1 - 31 Aug. 1998***
Valiev, R. Z.; Zhernakov, V. S.; Aug. 31, 1998; 4p; In English
Contract(s)/Grant(s): N68171-98-M-5642
Report No.(s): AD-A354157; Rept-4521248; R/D-8480-MS-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Materials for investigations were selected and purchased. The results of structural characterization of ultrafine-grained A16061 + 10% Al2O3 composite processed by equal channel angular pressing are presented. In order to extend a range of industrial applications of ultrafine-grained Al alloys and composites, the ECA pressing die for processing the specimens of 40 mm in diameter and 150 nm in length was designed.
DTIC
Aluminum Alloys; Superplasticity

19990004893 Army Construction Engineering Research Lab., Champaign, IL USA
Demonstration of Remote Monitoring Technology for Cathodic Protection Systems, Phase 2 ***Final Report***
VanBlaricum, Vicki L.; Flood, Jack T.; Szeliga, Michael J.; Bushman, James B.; May 1998; 50p; In English
Report No.(s): AD-A354162; CERL-FEAP-TR-98/82-Phase-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cathodic protection (CP) is used to prevent corrosion on many buried and submerged metallic structures such as underground pipes and tanks. Periodic testing is required to ensure proper CP system operation, but many Directorates of Public Works (DPWs) do not have sufficient resources to conduct such tests regularly. Several companies have begun manufacturing remote monitoring units (RMUs) for CP systems. The technology allows personnel to monitor multiple CP systems from a central location so problems can be detected and repaired immediately. RMUs from three manufacturers were evaluated during Phase I of this study (FEAP TR 97/76) to determine their effectiveness. Only one of them performed successfully. During Phase II, RMUs from two additional manufacturers were evaluated. Results showed that both of the systems from Phase II performed successfully and are suitable for use at Army installations.
DTIC
Cathodic Coatings; Underground Structures; Detection

19990004894 Army Armament Research, Development and Engineering Center, Benet Labs., Watervliet, NY USA
The Role of Vanadium Carbide Traps in Reducing the Hydrogen Embrittlement Susceptibility of High Strength Alloy Steels *Final Report*
Spencer, G. L.; Duquette, D. J.; Aug. 1998; 27p; In English
Contract(s)/Grant(s): Proj. AMCMS6111.01.91A1.100
Report No.(s): AD-A354284; TR-ARCCB-TR-98016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
High strength alloy steels typically used for gun steel were investigated to determine their susceptibility to hydrogen embrittlement. Although AISI grade 4340 was quite susceptible to hydrogen embrittlement, ASTM A723 steel, which has identical mechanical properties but slightly different chemistries, was not susceptible to hydrogen embrittlement when exposed to the same conditions. The degree of embrittlement was determined by conducting notched tensile testing on uncharged and cathodically charged specimens. Chemical composition was modified to isolate the effect of alloying elements on hydrogen embrittlement susceptibility. Two steels-Modified A723 (C increased from 0.32% to 0.40%) and Modified 4340 (V increased from 0 to O.12%)-were tested. X-ray diffraction identified the presence of vanadium carbide, V4C3, in A?23 steels, and subsequent hydrogen extraction studies evaluated the trapping effect of vanadium carbide. Based on these tests, it was determined that adding vanadium carbide to 4340 significantly decreased hydrogen embrittlement susceptibility because vanadium carbide traps ties up diffusible hydrogen. The effectiveness of these traps is examined and discussed in this paper.
DTIC
Vanadium Carbides; Hydrogen Embrittlement; Guns; Notch Tests

19990005954 National Inst. for Fusion Science, Toki, Japan
Microstructure and Mechanical Property of Neutron Irradiated TiNi Shape Memory Alloy
Matsukawa, Y., Hokkaido Univ., Japan; Suda, T., Hokkaido Univ., Japan; Ohnuki, S., Hokkaido Univ., Japan; Namba, C., National Inst. for Fusion Science, Japan; Jan. 1998; ISSN 0915-633X; 10p; In English
Report No.(s): NIFS-534; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Microstructure and mechanical property of neutron irradiated TiNi shape memory alloy have been investigated. The doses were on the order of 10(exp 10) to 10(exp 23)n/sq m. All of the irradiation was performed below 423K. Amorphization was confirmed after the irradiation of 1.2 x 10(exp 23)n/sq m. The recovery behavior of the applied strain was drastically changed after the irradiation. The breaking point of the stress-strain curve, sigma(sub M) increased with increasing dose. These results indicate that amorphous phase dominates the suppression of the martensitic transformation and causes the change in mechanical property.
Author
Microstructure; Mechanical Properties; Nickel Alloys; Titanium Alloys; Amorphous Materials; Irradiation; Neutrons

19990008039 NASA Marshall Space Flight Center, Huntsville, AL USA
Effects of Gravity on Processing Heavy Metal Fluoride Fibers
Tucker, Dennis S., NASA Marshall Space Flight Center, USA; Workman, Gary L., Alabama Univ., USA; Smith, Guy A., Alabama Univ., USA; Journal of Materials Research; Sep. 1997; ISSN 0884-2914; Volume 12, No. 9, pp. 2223-2225; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The effects of gravity on the crystal nucleation of heavy metal fluoride fibers have been studied in preliminary experiments utilizing NASA's KC-135 reduced gravity aircraft and a microgravity sounding rocket flight. Commercially produced fibers were heated to the crystallization temperature in normal and reduced gravity. The fibers processed in normal gravity showed complete crystallization while the fibers processed in reduced gravity did not show signs of crystallization.
Author
Gravitational Effects; Metal Fluorides; Microgravity; Crystallization; Metal Fibers

19990008144 Helsinki Univ. of Technology, Lab. of Materials Processing and Power Metallurgy, Espoo, Finland
Helsinki University of Technology, Laboratory of Materials Processing and Powder Metallurgy ***Annual Report***
1998; ISSN 1455-2329; 62p; In English
Report No.(s): PB99-108334; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Laboratory continues research in the field of powder metallurgy and related areas. Several research pilot projects were carried out in 1997, related mostly to functional graded materials (FGM). A new project, financed by the Commission of the European Communities has been launched. This project deals with materials with a functional gradient of mechanical properties such as hardness, toughness and possibly wear resistance. For example, bars with a high toughness core and a hard rim that can be used as wear parts or for the fabrication of cutting tools with complex geometries such as drills. The design and processing of layered materials, FGMs and surface composites are very promising candidate solutions in the search for a way to tailor 'intelligent composites' to solve this problem and to satisfy the complex requirements of the new technologies.
NTIS
Powder Metallurgy; Computational Fluid Dynamics

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.

19990004088 Southwest Research Inst., TARDEC Fuels and Lubricants Research Facility, San Antonio, TX USA
Hydraulic Test Loop for Nonflammable Hydraulic Fluid ***Interim Report, Jul. 1992 - Jun. 1995***
Likos, William E.; Sep. 1998; 52p; In English
Contract(s)/Grant(s): DAAK70-92-C-0059
Report No.(s): AD-A353472; TFLRF-299; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A test stand was constructed to evaluate the suitability of the non-flammable hydraulic fluid, chlorotrifluoroethylene (CTFE) for Army applications. The test loop consists primarily of stainless steel and elastomers suited to the CTFE fluid. A 150-hp electric motor, capable of speeds from 0 to 1800 rpm drives a 40 gpm, 4500 psi, variable displacement hydraulic pump. The test apparatus features a "bootstrap" reservoir that utilizes the output pressure of the pump to pressurize the inlet to the pump to the required 80 psi. The reservoir also serves to dose the system to the atmosphere, a requirement to prevent exposure of the hydrophilic fluid to atmospheric water. Durability of the current pump on CTFE fluid was limited. However, the rig can be retrofitted with CTFE compatible pumps if required. The rig is completely instrumented to measure shaft horsepower delivered to the pump, fluid flows and pressures and temperatures. A personal computer is used for data acquisition and control of the drive motor and system hydraulics. Conceivably any hydraulic component i.e. valves, actuators, or pumps could be performance and autonomously endurance tested on this test stand.
DTIC
Hydraulic Equipment; Hydraulic Fluids; Nonflammable Materials; Flammability; Fluid Flow

19990004089 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Miscibility Studies of Coextruded Polycarbonate/Polymethyl Methacrylate Composites ***Final Report, Oct. 1996 - Sep. 1997***
Hsieh, Alex J.; Gutierrez, Alex W.; Jul. 1998; 36p; In English
Contract(s)/Grant(s): Proj-1L1-62618-A-H8-0
Report No.(s): AD-A353476; ARL-TR-1714; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Miscibility and molecular relaxation measurements have been carried out using dynamic mechanical analysis (DMA) on the coextruded polycarbonate (PC)/polymethyl methacrylate (PMMA) multilayers with various compositions. Three distinct transitions are observed; two of these are corresponding to the glass transition of the PC-rich phase and PMMA-rich phase. The glass transition temperatures, T(g), of both phases shift slightly toward each other, compared to the T(g) of pure PC and pure PMMA, indicating limited miscibility. A third relaxation, which was not observed with differential scanning calorimetry (DSC), is present at a temperature between the T(g) of PC-rich and PMMA-rich phases. The transition temperature of this intermediate relaxation increases as the PC composition increases, and it also shifts to a higher temperature with an increase in the molecular weight of PMMA. The origin of the intermediate transition is attributed to the molecular relaxation response of an interphase resulted from interdiffusion between the PC and PMMA. In addition, this intermediate relaxation is more sensitive to the change in frequency compared to the response of glass transition of either pure component. As a result, the apparent activation energy values deter-

mined for the corresponding third relaxation are consistently smaller than those measured for the glass transition of pure PC and pure PMMA. The former values, however, remain relatively constant with respect to the variation in composition and molecular weight for all the PC/PMMA multilayers.
DTIC
Polycarbonates; Polymethyl Methacrylate; Heat Measurement; Composite Materials; Molecular Relaxation; Solubility

19990004164 Brewer Science, Inc., Rolla, MO USA
Advanced Development of Polyimide Color Filters for Liquid Crystal Display Applications ***Final Report, 4 Dec. 1991 - 15 May 1995***
Flaim, Tony D.; Mayo, Jonathan W.; Stroder, Michael D.; Sep. 02, 1998; 28p; In English
Contract(s)/Grant(s): MDA972-92-C-0016; DARPA ORDER-6873
Report No.(s): AD-A352784; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report lists the approaches taken to improve the properties of color filter materials for Flat Panel Display applications. Significant developments include a high saturation blue dye with high temperature stability; a purification process for a black dye used to replace a combination of blue and brown dyes for a new black matrix material with increased optical density with specific application for the liquid crystal display industry; the development of a rapid thermal curing technique to allow for higher dye loaded materials; and the use of a higher transparency polymer in the blue formulation to improve peak transmission properties.
DTIC
Polyimides; Color; Liquid Crystals; Flat Panel Displays; Matrix Materials; Optical Filters

19990004166 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA
Hydraulic Fluids and Seals Workshop Proceedings ***Final Report, 17-18 Mar. 1998***
Flanagan, Stephanie R.; Fletcher, Alan; Gschwender, Lois; Snyder, Shashi; Schmidt, James; Mar. 1998; 371p; In English; Hydraulic Fluids and Seals, 17-18 Mar. 1998
Contract(s)/Grant(s): Proj. 4349
Report No.(s): AD-A352952; AFRL-ML-WP-TR-1998-4116; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche
The Hydraulic Fluids and Seals Workshop was presented by the Materials and Manufacturing Directorate of the Air Force Research Laboratory in order to disseminate information about military hydraulic fluid changes and developments. The main showcase of the workshop was the transition from MIL-H-5606 to MIL-PRF-83282 and MIL-PRF-87257 operational hydraulic fluids. Other topics included future hydraulic system development, seal compatibility testing, the search for a barium corrosion inhibitor replacement in the preservative oils, MIL-PRF-6083 and MIL-PRF-46170 which could be used in the operational fluids negating the need for the preservative oils, biodegradable testing for the operational hydraulic fluids, the development of the non-flammable hydraulic fluid, MIL-H-531 19, the amount of water a hydraulic fluid can hold before causing ice in hydraulic fluid and pump testing of the operational hydraulic fluids to see if purifiers will degrade pump life.
DTIC
Hydraulic Fluids; Hydraulic Equipment; Conferences; Seals (Stoppers)

19990004213 Ioffe (A. F.) Physical-Technical Inst., Saint Petersburg, Russia
Changes in the Superconducting Properties of High-T(sub c) Ceramics Produced by Applied Electric Fields
Smirnov, B. I., Ioffe (A. F.) Physical-Technical Inst., Russia; Orlova, T. S., Ioffe (A. F.) Physical-Technical Inst., Russia; Kaufmann, H.-J., Ioffe (A. F.) Physical-Technical Inst., Russia; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 232-240; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche
Effect of an electrostatic field in the electrode-insulator-superconductor system on the current-voltage characteristics of high-T(sub c) ceramics with various composition and different preparation technology has been studied at 77K. Ceramics of Y-Ba-Cu-O (123) and Bi-Pb-SR-Ca-Cu-O (2223) systems and also ones doped by Ag have been used. Electric field strength has been up to 140 MV/m. It has been shown that there are reversible changes in the critical current I(sub c) and in the conductivity in electric field at the currents somewhat more than I(sub c) at T
T(sub c) the noticeable electric field effect has not been found. These effects are qualitatively similar in both ceramic systems. High negative and positive gate voltages result in an increase of the conductivity. The electric field effect is modified by magnetic field H. The field effect decreases with increasing magnetic field and disappears at H > 30 O(sub e). In Y-Ba-Cu-O/Ag (10 wt.

%) ceramics the field effect is practically absent. It may be supposed that in the ceramics the field-induced effect is consistent with weak links at grain boundaries.
Author
Superconductivity; YBCO Superconductors; Electric Fields; Ceramics; High Temperature Superconductors

19990004379 NASA Langley Research Center, Hampton, VA USA
Room Temperature and Elevated Temperature Composite Sandwich Joint Testing
Walker, Sandra P., NASA Langley Research Center, USA; Nov. 1998; 32p; In English
Contract(s)/Grant(s): RTOP 537-06-34-20
Report No.(s): NASA/TM-1998-208742; L-17746; NAS 1.15:208742; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Testing of composite sandwich joint elements has been completed to verify the strength capacity of joints designed to carry specified running loads representative of a high speed civil transport wing. Static tension testing at both room and an elevated temperature of 350 F and fatigue testing at room temperature were conducted to determine strength capacity, fatigue life, and failure modes. Static tension test results yielded failure loads above the design loads for the room temperature tests, confirming the ability of the joint concepts tested to carry their design loads. However, strength reductions as large as 30% were observed at the elevated test temperature, where all failure loads were below the room temperature design loads for the specific joint designs tested. Fatigue testing resulted in lower than predicted fatigue lives.
Author
Composite Structures; Failure Modes; Fatigue Life; Fatigue Tests; High Temperature; Sandwich Structures

19990006003 National Physical Lab., Teddington, UK
Electronic Property Measurements for Piezoelectric Ceramics: Technical Notes
Cain, M. G., National Physical Lab., UK; Stewart, M., National Physical Lab., UK; Gee, M. G., National Physical Lab., UK; Hill, G. J., National Physical Lab., UK; Hall, D. A., National Physical Lab., UK; Mar. 1998; 82p; In English
Report No.(s): PB98-168420; Copyright Waived; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A series of measurement notes are presented, with emphasis placed on the technical nature of the testing methodology, for the determination of key electronic properties for piezoelectric ceramic materials that are used as sensors and actuators. The report is segmented into 'sections'. The following measurement issues are discussed: Polarization/Electric field (PE) loop measurements including a discussion of commercial and in-house constructed system that measures PE loops; Dielectric measurements at low and high stress application, including some thermal and stress dependency modelling of piezo materials properties, developed at NPL; Strain measurement techniques suitable for PE loop and other data acquisition; PE loop measurement and software analysis developed at CMMT and Manchester University.
NTIS
Piezoelectric Ceramics; Electrical Properties; Procedures; Strain Measurement; Data Acquisition

19990008394 National Inst. of Standards and Technology, Polymers Div., Gaithersburg, MD USA
Recertification of the SRM 706a, a Polystyrene *Final Report*
Guttman, C. M., National Inst. of Standards and Technology, USA; Blair, W. R., National Inst. of Standards and Technology, USA; Maurey, J. R., National Inst. of Standards and Technology, USA; Sep. 1998; 32p; In English
Report No.(s): PB99-103673; NISTIR-6091; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The recertification of the polystyrene standard reference material, SRM 706a, is described. The M(sub W) of SRM 706a by light scattering was determined to be 2.85 x 10(exp 5) g/mol with a sample standard deviation of 0.019 x 10(exp 5) g/mol. A combined expanded uncertainty of 0.23 x 10(exp 5) g/mol is estimated for this determination. The M(sub W) obtained for this recertification agrees with the M(sub W) of 2.87 x 10(exp 5) g/mol obtained from recent light scattering measurements on SRM 706. The M(sub W) obtained for SRM 706a is also in excellent agreement with the M(sub W) obtained by ultracentrifugation in 1967 of 2.88 x 10(exp 5) g/mol on SRM 706. Bottle-to-bottle variability was found to be below detectable levels for SRM 706a in a size exclusion chromatography study.
NTIS
Polystyrene; Certification

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.

19990004392 Michigan Univ., Dept. of Mechanical Engineering, Ann Arbor, MI USA
Computations of Droplet/Flow Interactions In Sprays ***Annual Report, 1 Sep. 1997 - 31 Aug. 1998***
Tryggvason, Gretar; Aug. 29, 1997; 9p; In English
Contract(s)/Grant(s): F49620-97-1-0525; AF Proj. 2308
Report No.(s): AD-A353983; AFRL-SR-BL-TR-98-0649; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The behavior of liquid fuel drops is studied by numerical simulations. The Navier-Stokes equations are solved by a finite difference/front tracking technique that allows resolution of inertial and viscous forces as well as the inclusion of surface tension at the deformable boundary between the fuel and the air. Two- and three-dimensional simulations are used to determine how the lift and the drag depend on the shear rate of the fluid. The deformation of the drops play a major role and while a nearly spherical drop experiences lift in the same direction as a solid particle, relatively modest deformation can lead to a lift force in the opposite direction. to examine more complex problems, a new three-dimensional code has been written that allows local grid refinement and the use of cylindrical coordinates. This code has been used to examine the development of three-dimensional disturbances during the primary breakup of jets. At finite amplitude the three-dimensional disturbance can dominate the two-dimensional one and lead to ”fiber” breakup
DTIC
Finite Difference Theory; Flow Characteristics; Drops (Liquids); Navier-Stokes Equation; Computational Grids; Computerized Simulation; Sprayers; Fuel Sprays

19990008136 Research Inst. of National Defence, Avd. foer Vapen och Skydd, Tumba, Sweden
Chemical Conversion of TNT ***Kemisk Modifiering av TNT***
Wellmar, U., Research Inst. of National Defence, Sweden; Apr. 1998; 24p; In Swedish
Report No.(s): PB99-102402; FOA-R-98-00759-310-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The report presents a literature search on chemical conversion of TNT as well as the results of the authors’ own experiments. The main goal has been to find methods to utilize a surplus of TNT by chemical conversion to other useful chemicals. Unfortunately, both the available literature and the authors’ own experiment indicate that the environmentally best way to use a surplus of TNT is in applications which use explosives anyway - as booster in civilian mining, road constructions, and so on. If there is a need for purification of TNT, a cheap and environmentally correct method consists in recrystallization from ethanol. As an alternative, surplus TNT may be used as an additive to unleaded petrol and diesel. A final approach is to burn the TNT under controlled forms to use it as a source of energy.
NTIS
Chemicals; Trinitrotoluene

19990008262 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA
A Review of the Flammability Hazard of Jet A Fuel Vapor in Civil Transport Aircraft Fuel Tanks ***Final Report***
Jun. 1998; 68p; In English
Report No.(s): PB99-102675; DOT/FAA/AR-98/26; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This reporting documents the findings of a Fuel Flammability Task Group made up of recognized fuel and combustion specialists investigating the flammability and explosiveness of fuel within an aircraft fuel tank. The task group reviewed all available reports on the subject and met and discussed the data with technical experts from Boeing Commercial Airplane Co., California Institute of Technology, and the National Transportation Safety Board. The scope of the report includes jet fuel definitions and specifications, jet fuel flammability data, influences of various factors on fuel flammability, and predictive analyses and models for flammability. The report discusses the impact of this knowledge on the needs for in-flight fuel fire prevention.
NTIS
Flammability; Hazards; Jet Engine Fuels; Vapors; Transport Aircraft; Fuel Tanks; Aircraft Fuels; Fuel Combustion; Civil Aviation

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MATERIALS PROCESSING

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

19990005996 Tulane Univ., Dept. of Pathology, New Orleans, LA USA
Effect of Microgravity on Afferent Innervation *Final Report*
1998; 112p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG2-999; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Presentations and publications are: (1) an audiovisual summary web presentation on results from SLM-MIR avian experiments. A color presentation summarizing results from the SLM-MIR and STS-29 avian experiments; (2) color threshold and ratio of S 100B MAP5, NF68/200, GABA and GAD; (3) chicken (Gallus domesticus) inner ear afferents; (4) microgravity in the STS-29 Space Shuttle Discovery affected the vestibular system of chick embryos; (5) expression of S 100B in sensory and secretory cells of the vertebrate inner ear; (6) otoconia biogenesis, phylogeny, composition and functional attributes;(7) the glycan keratin sulfate in inner ear crystals; (8) elliptical-P cells in the avian perilymphatic interface of the tegmentum vasculosum; and (9) LAMP2c and S100B upregulation in brain stem after VIIIth nerve deafferentation.
Derived from text
Microgravity; Biological Evolution; Brain Stem; Chickens; Ear; Embryos; Vestibules

19990007905 Universities Space Research Association, Huntsville, AL USA
Modeling of Thermal Field in 'Contactless' Physical Vapor Transport
Palosz, W., Universities Space Research Association, USA; Lowry, S., CFD Research Corp., USA; Krishnan, A., CFD Research Corp., USA; SPIE; 1997; ISSN 0277-786X; Volume 3123, pp. 177-183; In English; Materials Research in Low Gravity, 18-29 Jul. 1997, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A numerical model of the thermal field in the furnace-ampoule system developed for the 'contactless' Physical Vapor Transport growth geometry is presented. The model is used to assess the effect of the system geometry and growth parameters on the conditions of 'contactless' growth of cadmium telluride crystals.
Author
Vapor Deposition; Mathematical Models; Temperature Distribution

19990008239 Lockheed Martin Corp., Huntsville, AL USA
Space Manufacturing: The Next Great Challenge
Whitaker, Ann F., NASA Marshall Space Flight Center, USA; Curreri, Peter, NASA Marshall Space Flight Center, USA; Sharpe, Jonathan B., Lockheed Martin Corp., USA; Colberg, Wendell R., NASA Marshall Space Flight Center, USA; Vickers, John H., NASA Marshall Space Flight Center, USA; 1998; 5p; In English
Contract(s)/Grant(s): NAS8-36200
Report No.(s): NASA/CR-1998-208138; NAS 1.26:208138; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Space manufacturing encompasses the research, development and manufacture necessary for the production of any product to be used in near zero gravity, and the production of spacecraft required for transporting research or production devices to space. Manufacturing for space, and manufacturing in space will require significant breakthroughs in materials and manufacturing technology, as well as in equipment designs. This report reviews some of the current initiatives in achieving space manufacturing. The first initiative deals with materials processing in space, e.g., processing non-terrestrial and terrestrial materials, especially metals. Some of the ramifications of the USA Microgravity Payloads fourth (USMP-4) mission are discussed. Some problems in non-terrestrial materials processing are mentioned. The second initiative is structures processing in space. In order to accomplish this, the International Space Welding Experiment was designed to demonstrate welding technology in near-zero gravity. The third initiative is advancements in earth-based manufacturing technologies necessary to achieve low cost access to space. The advancements discussed include development of lightweight material having high specific strength, and automated fabrication and manufacturing methods for these materials.
CASI
Microgravity; Space Manufacturing; Space Processing; Spaceborne Experiments

31
ENGINEERING (GENERAL)

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

19990007863 Wright Lab., Armament Directorate, Eglin AFB, FL USA
Small Effective Air-to-Surface Munitions for Unmanned Tactical Aircraft Applications
Brubaker, D. R., Wright Lab., USA; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes two emerging munition technologies beneficial to Unmanned Tactical Aircraft (UTA) and attempts to define a necessary weapon load capability. to determine a weapon/loadout combination that maximized the lethal effectiveness of an UTA while minimizing the payload weight required, a mission level analysis was conducted and concludes that a minimum of 1000-lb (454 kg) of payload provides an UTA a viable air-to-ground combat mission capability. A 2000-lb (908 kg) payload provides an increased effectiveness but must be contrasted with the associated increase in UTA cost, size, weight and propulsion needed to employ the additional payload weight.
Author
Pilotless Aircraft; Weapons Delivery; Payload Integration; Air to Surface Missiles; Combat

19990008226 Commerce Dept., Office of Technology Policy, Washington, DC USA
New Innovators: Global Patenting Trends in Five Sectors
Albert, Michael B., Computer Horizons, Inc., USA; Yoshida, Phyllis Genther, Commerce Dept., USA; vanOpstal, Debra, President's Council on Competitiveness, USA; Sep. 1998; 48p; In English
Report No.(s): PB99-103798; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report analyzes the competitiveness of the research enterprises of the USA, the European Union (EU) as a group, and 14 other countries. This analysis uses key indicators generated from utility invention patents granted under the US patent system, which is generally considered to be the best level playing field for quantitative, international technological comparisons. These indicators show that the USA has a clear technological edge in each of the sectors examined-health, advanced materials, automotive, information technology, and express package transportation and logistics (EPTL)-and is not likely to relinquish this leadership to any nation in the near term. Nevertheless, the authors' analysis reveals quickening technology cycle times (TCTs) and greater linkages to leading-edge research-trends that may enable countries to leapfrog generations of technologies within a brief span of time. The process of transitioning from imitator to innovator has been dramatically compressed.
NTIS
Inventions; Patents; Trends; Information Systems

32
COMMUNICATIONS AND RADAR

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

19990004120 Georgia Inst. of Tech., Atlanta, GA USA
Macroscopic Numerical Analysis of Semiconductor Devices with Applications to Avalanche Photodiodes ***Annual Report, FY 1997***
Parks, Joseph Worthy, Jr., Georgia Inst. of Tech., USA; Sep. 1997; 222p; In English
Contract(s)/Grant(s): NAGw-2753; Copyright; Avail: Issuing Activity (Georgia Inst. of Tech., Atlanta, GA 30332-0250), Hardcopy, Microfiche

Macroscopic device simulation is a proven tool for the advancement of semiconductor design and development. Modem semiconductor devices often exhibit complex nonlinear properties which preclude the use of simple analytical methods for the prediction of their behavior. Numerical modeling obviates the need for these simplified analyses by including and predicting the behavior of the fundamental physical processes present within the devices. Specifically, macroscopic simulation can accurately describe the device's electrical behavior by predicting such quantities as the distribution of electric fields, carrier currents, and energy. These simulations produce estimates of observables such as the voltage and currents at contacts and transient responses such as device capacitance and rise/fall times. This work focuses upon the development and application of numerical device models to the simulation of actual semiconductor devices. The principal objectives of this research are to tailor an existing two-

dimensional hydrodynamic/drift-diffusion macroscopic simulator to the analysis of optoelectronic semiconductor devices and to provide an in-depth study of their workings and design requirements. Specifically, the design constraints and operating conditions of avalanche photodiodes, APDS, are examined. The applicability of APDs in high data rate communications systems and detectors within imaging systems are the prime focus. As an example of the design requirements of APDs used for communications systems, an InP/InGaAs separate absorption, grading,' charge, and multiplication (SAGCM) APD and several related structures configured for use as receivers in a long haul, high bit rate telecommunications system are investigated. In the examination of the design requirements of the second application of an APD device, that for an imaging sensor, an investigation is performed for the specific example of a silicon photodiode operated in the flux integration mode. Additionally photon recycling, the reabsorption of photons emitted through radiative recombination events, is examined as a possible generation mechanism which increases the effective carrier lifetime within optoelectronic devices based on direct band-gap semiconductor materials. In order to perform these analyses several important and extensive modifications to our basic simulator have been implemented. These enhancements include the ability to model non-normally incident, an external circuit model allowing one to simulate the electrical connection between the device and the external world, and the inclusion of interband tunneling. An accurate, fully numerical, of the photon recycling phenomenon is also included. Additionally, two novel boundary conditions are developed. The first is a smoothed boundary for the simulation of two-dimensional devices with a laterally varying boundary type and the other is a current controlled condition required for the accurate modeling of the reverse recovery in a photodiode.
Author
Avalanche Diodes; Circuits; Design Analysis; Electric Fields; Imaging Techniques; Mathematical Models; Optoelectronic Devices; Photodiodes; Semiconductors (Materials); Semiconductor Devices; Telecommunication

19990004125 Marquette Univ., Biotelemetry Lab., Milwaukee, WI USA
Radio Links for the NASA ABTS ***Final Report, 5 Dec. 1995 - 4 Dec. 1996***
Jeutter, Dean C., Marquette Univ., USA; 1996; 36p; In English
Contract(s)/Grant(s): NCC2-5108; REF-96-108; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Goals Determine Out-Link FSK Bandwidth Develop FSK Outlink Transmitter Develop Wideband Outlink FSK Receiver Develop OOK In-Link Transmitter Develop OOK In-Link Receiver Marry Out-Link & In-Link Components Outlink FSK Bandwidth preliminary inlink transmitter were accomplished in Summer 1995 visit. The calculation of FSK bandwidth is repeated in these notes. Spectrum analyzer measurements of the actual FSK spectrum agree well with the calculations. The goal to develop a wideband FSK receiver for outlink data was given first priority for end of Summer 1996 completion. The goal of developing OOK inlink transmitter and receiver system components and interfacing all outlink and inlink components into an operating closed loop prototypical system was given a December 1, 1996 completion date.
Author
Transmitter Receivers; Receivers; Frequency Shift Keying; Feedback Control

19990004148 NASA Goddard Space Flight Center, Greenbelt, MD USA
An Object-Oriented Interface to the CCSDS Ground Telecommand Services
Ray, Timothy Joseph, NASA Goddard Space Flight Center, USA; Condron, Jeffrey Todd, NASA Goddard Space Flight Center, USA; Journal of the Brazilian Society of Mechanical Sciences; 1998; 2p; In English; 2nd; Spacecraft Ground Control and Data Systems, 8-12 Feb. 1999, Iguassu Falls, Brazil; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Telecommand Data Routing and Channel Services defined by the Consultative Committee for Space Data Systems (CCSDS) are flexible enough to support a myriad of commanding models. Because the standard is so broad, the traditional approach has been to implement only the portion of the standard needed by the particular spacecraft being tested/operated. Tasked with providing Telecommand Services for an entire class of spacecraft, where each spacecraft may choose any valid CCSDS commanding model, NASA Code 584 designed a common architecture capable of handling the full CCSDS protocol. The solution uses another CCSDS standard - the Standard Formatted Data Unit (SFDU) as the interface to the Telecommand Services. SFDUs provide a consistent way of labelling data objects, as well as allowing data objects to encapsulate other data objects. The resulting interface is: - Flexible: The full Data Routing and Channel Services are available via a single interface. The client (i.e. the command source) may enter commands at any layer within the protocol stack, specify any of the data aggregation or segmentation methods, and dynamically set any configuration parameter defined in the standard. - Object-oriented: Each object specifies both the data and the actions to be performed with the data. An object may contain other objects. - Expandable: New capabilities are added by defining new objects. Objects pass thru the protocol layers until they reach the applicable layer. The resulting design is: - Modular: The logic for each protocol layer is contained in a separate Application Program Interface (API). The objects used for the external interface are also used for communication between layers. - Distributable: The design can be split along any layer boundary for distribution across multiple machines. The objects ensure data consistency across platforms. This paper describes

the SFDU-based interface and the resulting protocol implementation. The implementation is currently used by NASA (National Aeronautics and Space Administration) for integration & test of the microwave Anisotropy Probe (MAP) and Earth observer-I (EO-l) spacecraft. It will be used for post-launch operations of these spacecraft as well as the Imager for Magnetopause to Aurora Global Exploration (IMAGE) spacecraft.
Author
Spacecraft Launching; Telemetry; Protocol (Computers); Object-Oriented Programming; Microwave Probes; Data Systems; Data Structures; Command and Control; Anisotropy; Aerospace Systems

19990004163 Space and Naval Warfare Systems Center, San Diego, CA USA
Image-Data Transmission Demonstration over the Tracking and Data Relay Satellite System ***Final Report***
Bloomfield, R. A.; Dobson, G. R.; Aug. 1998; 21p; In English
Report No.(s): AD-A352534; TR-1778; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report details the feasibility of transmitting image data over the Tracking and Data Relay Satellite System (TDRSS). Measurements of transmission time and data compression quality at various baud rates were conducted. Stanford Telecom's portable TDRSS (PORTCOM) was evaluated.
DTIC
Data Transmission; TDR Satellites; Images; Communication Satellites

19990004184 Warsaw Univ., Inst. of Telecommunications, Warsaw, Poland
Fourteenth International Wroclaw Symposium and Exhibition on Electromagnetic Compatibility
Jul. 29, 1998; 764p; In English; 14th; Electromagnetic Compatibility, 23-25 Jun. 1998, Warsaw, Poland
Contract(s)/Grant(s): F61775-98-WE004
Report No.(s): AD-A353935; CSP-98-1001; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche
The Final Proceedings for 14th Int'l Wroclaw Symposium and Exhibition on Electromagnetic Compatibility, 23 June 1998-25 June 1998 This is an interdisciplinary conference. Topics include all aspects of EMO theory and practice: antennas and propagation, biological effects, ESO, lightning, EMI reduction techniques, grounding, shielding, and absorption.
DTIC
Conferences; Electromagnetic Compatibility

19990004390 Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA
Surveillance Alternatives: Cost Estimates and Technical Considerations for the En Route Domain ***Final Report, Period ending May 1998***
Geyer, Michael, Federal Aviation Administration, USA; Vilcans, Janis, Federal Aviation Administration, USA; Sep. 1998; 118p; In English
Report No.(s): AD-A353953; DOT-VNTSC-FAA-98-9; DOT/FAA/ND-98/10; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This report presents cost estimates and technical performance projections for ten aircraft surveillance architectures. The architectures are intended for use in the en route flight domain, and are comprised of various combinations of Automatic Dependent Surveillance - Broadcast (ADS-B), Monopulse Secondary Surveillance Radar (MSSR), and multilateration systems. Cost estimates are developed for use in comparing technologies (rather than specific programs). Technical performance information is presented in the areas of coverage, accuracy, and capacity.
DTIC
Search Radar; Surveillance; Cost Estimates; Performance Prediction; Aerospace Vehicles

19990004393 Syracuse Univ., Dept. of Electrical and Computer Engineering, NY USA
Methods to Determine Wideband System Response Utilizing only Narrowband Information ***Final Report, May 1995 - Feb. 1996***
Sarkar, Tapan K.; Adve, Raviraj S.; Aug. 1998; 41p; In English
Contract(s)/Grant(s): F30602-95-C-0120; AF Proj. 2338
Report No.(s): AD-A353987; AFRL-IF-RS-TR-1998-167; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In this report a novel interpolation/extrapolation is developed, based on the Cauchy method, which interpolates/extrapolates system responses in a narrow frequency band to system responses over a broad frequency band. The given information can be either theoretical data points or measured experimental data over the narrowband. For theoretical data interpolation/extrapolation, the sampled values (magnitude and phase) of the function and, optimally, a few of its derivatives have been used to reconstruct

the function. For measured data, only measured values of the parameter are used to create the broadband information as the derivative information is too noisy. This method assumes that the parameter to be interpolated/extrapolated as a function of frequency is a ratio of two polynomials. The problem then is to determine the required order of the polynomials and the polynomial coefficients. The required order of the polynomials is estimated by applying Singular Value Decomposition (SVD) to the system matrix to determine the singular values and vectors. The number of nonzero singular values and their ratio of largest to smallest value are used to estimate the required polynomial order and the applicability of the method to the given data set. Polynomial coefficients then are determined using the method of Total Least Squares.
DTIC
Signal Processing; Cauchy Problem; Broadband; Narrowband

19990004633 Georgia Inst. of Tech., Atlanta, GA USA
A Comprehensive Analysis of the Physical Properties of Advanced GaAs/AlGaAs Junctions ***Semiannual Report No. 2, FY 1995***
Menkara, Hicham M., Georgia Inst. of Tech., USA; Jun. 1996; 248p; In English
Contract(s)/Grant(s): NAGw-2753; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Extensive studies have been performed on MQW junctions and structures because of their potential applications as avalanche photodetectors in optical communications and imaging systems. The role of the avalanche photodiode is to provide for the conversion of an optical signal into charge. Knowledge of junction physics, and the various carrier generation/recombination mechanisms, is crucial for effectively optimizing the conversion process and increasing the structure's quantum efficiency. In addition, the recent interest in the use of APDs in imaging systems has necessitated the development of semiconductor junctions with low dark currents and high gains for low light applications. Because of the high frame rate and high pixel density requirements in new imaging applications, it is necessary to provide some front-end gain in the imager to allow operation under reasonable light conditions. Understanding the electron/hole impact ionization process, as well as diffusion and surface leakage effects, is needed to help maintain low dark currents and high gains for such applications. In addition, the APD must be capable of operating with low power, and low noise. Knowledge of the effects of various doping configurations and electric field profiles, as well as the excess noise resulting from the avalanche process, are needed to help maintain low operating bias and minimize the noise output.
Derived from text
Aluminum Gallium Arsenides; Gallium Arsenides; Semiconductors (Materials); Ionization; Quantum Efficiency; Imaging Techniques; Optical Communication; Semiconductor Junctions

19990005104 Space Systems/Loral, Palo Alto, CA USA
On-Board Switching and Routing Advanced Technology Study ***Final Report***
Yegenoglu, F., Communications Satellite Corp., USA; Inukai, T., Communications Satellite Corp., USA; Kaplan, T., Communications Satellite Corp., USA; Redman, W., Communications Satellite Corp., USA; Mitchell, C., Space Systems/Loral, USA; Oct. 1998; 122p; In English
Contract(s)/Grant(s): NAS3-27559; RTOP 632-50-5C
Report No.(s): NASA/CR-1998-208668; NAS 1.26:208668; E-11388; SS/L-TR01529; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Future satellite communications is expected to be fully integrated into National and Global Information Infrastructures (NII/GII). These infrastructures will carry multi gigabit-per-second data rates, with integral switching and routing of constituent data elements. The satellite portion of these infrastructures must, therefore, be more than pipes through the sky. The satellite portion will also be required to perform very high speed routing and switching of these data elements to enable efficient broad area coverage to many home and corporate users. The technology to achieve the on-board switching and routing must be selected and developed specifically for satellite application within the next few years. This report presents evaluation of potential technologies for on-board switching and routing applications.
Author
Onboard Equipment; Technology Assessment; Switching; Switching Theory

19990007733 Research and Technology Organization, Neuilly-sur-Seine, France

Advanced Pattern Recognition Techniques ***Techniques avancees de reconnaissance de forme***

Advanced Pattern Recognition Techniques; Sep. 1998; 168p; In English; Advanced Pattern Recognition Techniques, 14-15 Sep. 1998, Bristol, Rome, Lisbon, UK, Italy, Portugal; Sponsored by Research and Technology Organization, France; Also announced as 19990007734 through 19990007745; Original contains color illustrations

Report No.(s): RTO-EN-2; AC/323-(SET)-TP/1; RTO-LS-214; ISBN 92-837-1001-0; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

Pattern recognition is the extraction of consistent information from noisy spatiotemporal data. It can be and is currently being used in systems for battlefield supervision, smart weapons, and anti-counterfeiting of all kinds. A current application is the automatic detection of land mines and unexploded ordnance (UXO). The methods employed can be subdivided in the following manner: (1) statistical methods; (2) neuro-methods; (3) fuzzy-methods; and (4) neuro-fuzzy methods. Each of these methods has its special advantages and drawbacks, but all of them require the computation of feature variables from measurement or simulation data, e.g. from microwave backscattering. The Lecture Series covers the following topics: (1) Introductory Overview on Pattern Recognition Techniques, (1)-(4); (2) Feature Extraction for Pattern Recognition by Electromagnetic, magnetic, and acoustic singularity identification, model based scattering signatures, wavelet techniques, SAR/ISAR imaging, bistatic microwave imaging, and electromagnetic inversion techniques; (3) Real-time Implementation of Pattern Recognition Methods; and Introduction to Software and Hardware for Pattern Recognition.

Author

Conferences; Imaging Techniques; Pattern Recognition; Target Recognition; Image Processing; Radar Imagery; Radar Signatures; Radar Targets

19990007735 Air Force Research Lab., Kirkland AFB, NM USA

Signature Based Target Recognition

Baum, Carl E., Air Force Research Lab., USA; Advanced Pattern Recognition Techniques; Sep. 1998; 3p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

In identifying a target as a member of a target class (e.g., a particular model of aircraft) one can use the scattering signatures from a transient type of radar (or a radar with a large number of frequencies). There are various types of signatures that one can use and a number of the most common ones are discussed.

Author

Target Recognition; Radar Targets; Radar Signatures; Radar Scattering

19990007736 Ohio State Univ., Electrical Engineering Dept., Columbus, OH USA

Wavelet Techniques and Other Multiresolution Techniques for Target Phenomenology Studies

Walton, Eric K., Ohio State Univ., USA; Sep. 1998; 33p; In English; Also announced as 19990007733; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Many types of radar systems are available that can obtain the band limited calibrated impulse response of the radar target. This can be done by using a broad band coherent radar and then transforming from the frequency domain to the time domain, or it can be done by actually transmitting a very short time impulse (or other waveform) and receiving the voltage versus time response of the signal scattered from a target technique shown as an example here). Considerable information about the radar target electromagnetic phenomenology can be obtained by time-frequency analysis of the resulting band limited impulse response. Such time-frequency analysis of the impulse response is usually at the upper limit of spectral resolution in cases where the target has resonant effects over the radar frequency band. In this paper, we will discuss these time frequency techniques especially including wavelet transformations and show examples for a specific target measured using an impulse radar.

Author

Wavelet Analysis; Signal Processing; Radar Targets; Fourier Transformation; Time Functions; Spectrum Analysis; Imaging Techniques

19990007737 Physics and Electronics Lab. TNO, The Hague, Netherlands

Electromagnetic Inversion

Zwamborn, A. Peter M., Physics and Electronics Lab. TNO, Netherlands; Advanced Pattern Recognition Techniques; Sep. 1998; 2p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Abstract Only

The paper is comprised of an introduction to a lecture discussing electromagnetic inversion as applied to the problem of land mine pollution and detection.
CASI
Imaging Techniques; Image Reconstruction; Mines (Ordnance); Explosives Detection; Target Recognition

19990007738 University of Western Ontario, Dept. of Electrical and Computer Engineering, London, Ontario Canada
Microwave Image Reconstruction Methods
Primak, Sergey, University of Western Ontario, Canada; LoVetri, Joe, University of Western Ontario, Canada; Zhang, Beibei, University of Western Ontario, Canada; Advanced Pattern Recognition Techniques; Sep. 1998; 8p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

In this paper we give a tutorial type overview of microwave tomographic imaging, or inverse synthetic aperture ISAR (and SAR) imaging, of perfectly conducting bodies by considering the simplest high-frequency model of scattering and we review methods allowing one to obtain these images.
Author
Image Reconstruction; Microwave Imagery; Synthetic Aperture Radar; Tomography; Mathematical Models; Imaging Techniques; Radar Scattering

19990007739 Technische Univ., Dept. of Electrical Engineering, Eindhoven, Netherlands
Two-Dimensional Inverse Profiling: Nonlinear Optimization and Embedding
Tijhuis, Anton G., Technische Univ., Netherlands; Belkebir, Kamal, Technische Univ., Netherlands; Litman, Amelie, Technische Univ., Netherlands; Geffrin, Jean-Michel, Centre National de la Recherche Scientifique, France; Bolomey, Jean-Charles, Centre National de la Recherche Scientifique, France; Advanced Pattern Recognition Techniques; Sep. 1998; 3p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

Previous work by the first two authors has shown that iteration procedures for solving nonlinear inverse-scattering problems that are based on a local linearization can be used to reconstruct objects of large contrast with a given resolution, provided that multiple-frequency information is available. This approach has become feasible since combining the CGFFT method with a special extrapolation procedure leads to an extremely fast solution of the corresponding direct-scattering problem for varying angle of incidence and contrast. Presently, we are trying to overcome two of the limitations of this approach. First, we replace the ”update step” by a line search in a nonlinear optimization procedure. Second, we use the scattering response of estimated objects in a homogeneous environment to reconstruct objects in more realistic measurement set ups like a water-filled metal cylinder.
Author
Optimization; Inverse Scattering; Imaging Techniques; Iterative Solution; Image Reconstruction

19990007740 Technische Univ., Lab. of Electromagnetic Research, Delft, Netherlands
Non-linear Inversion Based on Contrast Source Gradients
vandenBerg, Peter M., Technische Univ., Netherlands; Bloemenkamp, Richard F., Technische Univ., Netherlands; Zwamborn, A. P. M., Physics and Electronics Lab. TNO, Netherlands; Advanced Pattern Recognition Techniques; Sep. 1998; 7p; In English; Also announced as 19990007733
Contract(s)/Grant(s): F9620-96-1-0039; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper describes a simple algorithm for reconstructing the complex index of refraction of a bounded object immersed in a known background from a knowledge of how the object scatters known incident radiation. The method described here is versatile accommodating both spatially and frequency varying incident fields and allowing a priori information about the scatterer to be introduced in a simple fashion. Numerical results show that this new algorithm outperforms the modified gradient approach which until now has been one of the most effective reconstruction algorithms available.
Author
Algorithms; Image Contrast; Image Processing; Image Reconstruction; Iterative Solution; Refractivity

19990007741 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
Mine Detection with Microwaves
Magg, M., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Nitsch, J., Otto-von-Guericke Univ., Germany; Advanced Pattern Recognition Techniques; Sep. 1998; 12p; In English; Also announced as 19990007733; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Location and identification of buried landmines is a real challenge for sensor technology and target identification algorithms. We analyze the performance of a bistatic microwave imaging system with a focused synthetic aperture. If the soil is homogeneous

and dry with a very smooth surface it will be possible to identify even plastic mines under a 10 cm overburden. However, under a rough surface or in wet soil even a relatively big metallic anti-tank mine could be missed, since the signal to clutter ratio gets quite poor under these circumstances.
Author
Microwave Imagery; Mine Detectors; Synthetic Aperture Radar; Remote Sensing; Radar Targets; Signal to Noise Ratios; Clutter; Imaging Techniques

19990007742 Ohio State Univ., Electrical Engineering Dept., Columbus, OH USA
Superresolution and Multiresolution SAR/ISAR Imaging
Walton, Eric K., Ohio State Univ., USA; Advanced Pattern Recognition Techniques; Sep. 1998; 17p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper will discuss radar target imaging using model based spectral analysis applied to synthetic aperture radar (SAR) data or inverse synthetic aperture radar (ISAR) data. The techniques are based on the realization that radar target SAR/ISAR scattering can be modeled as autoregressive. This permits an autoregressive radar scattering model, where the parameters of the model permit model-based imaging. Finally, we will show a number of different example images where the model based resolution greatly exceeds the resolution available from Fourier based techniques.
Author
Imaging Techniques; Radar Targets; Radar Scattering; Radar Data; Spectrum Analysis; Synthetic Aperture Radar; Autoregressive Processes; Algorithms

19990007743 Air Force Research Lab., Kirkland AFB, NM USA
Recognition of Buried Targets
Baum, Carl E., Air Force Research Lab., USA; Sep. 1998; 4p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

A difficult problem concerns the identification of buried mines and unexploded ordnance (UXO). This paper reviews the use of the singularity expansion method and symmetry to identify such targets and distinguish them from other buried objects of comparable size.
Author
Mines (Ordnance); Radar Targets; Target Recognition; Imaging Techniques; Remote Sensing; Mine Detectors

19990007744 Physics and Electronics Lab. TNO, The Hague, Netherlands
Mine-detection test facilities at TNO-FEL test location "Waalsdorp"
Rhebergen, Jan, Physics and Electronics Lab. TNO, Netherlands; Zwamborn, Peter, Physics and Electronics Lab. TNO, Netherlands; Advanced Pattern Recognition Techniques; Sep. 1998; 11p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

As part of the TNO-FEL Ultra-Wide-Band Ground-Penetrating-Radar (UWB-GPR) project, a test facility for controlled GPR experiments was planned. Construction of this sand-box test facility has recently been completed. At the same site another test facility, for evaluating various commercial off the shelf (COTS) sensors for the Dutch humanitarian mining program HOM2000, has been realized. This article describes the test facilities themselves as well as the framework in which they were realized.
Author
Mine Detectors; Test Facilities; Ground Penetrating Radar

19990007763 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Report to the Honorable Harry Reid, US Senate. Environmental Protection: DOD Management Issues Related to Chaff
Sep. 1998; 30p; In English
Report No.(s): GAO/NSIAD-98-219; B-279055; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chaff works like a decoy by presenting a false target to enemy radar systems. It has been used by the military for more than 50 years. It was used during World War II and more recently during Operation Desert Storm. Chaff is also used in the peacetime training and testing of weapons. Chaff may be dispersed in bundles weighing from a few ounces to 24 pounds or from rolls in a continuous stream of over 30 pounds per minute. DOD updated controls over the use of chaff in an October 1997 interim draft of section 3212.02 of the Chairman of the Joint Chiefs of Staff manual. The manual sets the procedures for controlling the types of chaff to be used, the areas where it can be used, and altitudes at which it can be released. Each military facility has the authority to set local procedures that govern the use of chaff at training ranges and other locations near the facility. Concern about the potential effects of chaff continues to be an issue and has been expressed mainly by citizens and various public interest groups. In addi-

tion, some DOD research on the effects of chaff has expressed concerns and recommended further research. Most of the public concerns center around its effects on human health and the environment, including the potential for chaff particles to be inhaled or ingested and chaff's effects on land, water, plants, and animals.
Derived from text
Environment Protection; Loads (Forces); Education; Chaff; Warfare

19990007802 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
ATM Signalling in Perspective
Au, T. A., Defence Science and Technology Organisation, Australia; May 1998; 48p; In English
Report No.(s): DSTO-TR-0671; DODA-AR-010-542; Copyright; Avail: Issuing Activity (DSTO, Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, South Australia 5108), Hardcopy, Microfiche

Signalling has great impact on the efficient use of network resources, and the services that an Asynchronous Transfer Mode (ATM) network can offer. Importantly, signalling allows the transfer of service-related information in real time between the user and the network, and among network entities to establish, maintain and release end-to-end virtual connections. For each particular signalling function, the corresponding procedures are defined such that the sequence and message format are specific to the network interface across which the exchange of signalling information takes place. This report reviews the signalling architectures for the user-network interface and the network-network interface in both private and public ATM network environments. It is hoped that readers will gain a proper perspective of the signalling protocols involved in ATM networks, and thereby an appreciation of their significant contributions.
Author
Networks; Asynchronous Transfer Mode; Sound Generators

19990007857 Marconi S.p.A., Defence Div., Genoa, Italy
Integrated Data Link for UTA Applications: Design Considerations and Development Results
Bianchi, L., Marconi S.p.A., Italy; Battaini, G., Marconi S.p.A., Italy; Scazzola, G. L., Marconi S.p.A., Italy; Crovari, E., Marconi S.p.A., Italy; Jul. 1998; 16p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The UTA (Unmanned Tactical Aircraft) or, in general, the UAV (Unmanned Air Vehicle) typical requirements for either non-lethal or lethal tactical missions, imply both the capability to transmit, by means of a Data Link, real-time data (for instance IR, Video, Radar or Navigation Data) and to receive commands (to reprogram partially or completely the mission profile) to/from Ground Stations. The paper faces various aspects related to Data Links for UTA/UAV, presents system considerations and describes the development results obtained with the J Band UAV Data Link realized in Marconi and provided to Italian MoD.
Author
Data Links; Real Time Operation; Ground Stations; Pilotless Aircraft; Superhigh Frequencies

19990007859 Thomson-CSF, Applications Radar, Velizy, France
CRESUS: Radar Payload for Surveillance UAVs *CRESUS: Charge Radar Embarquee sur UAV de Surveillance*
Perret, Frederic, Thomson-CSF, France; Hermer, Jean-Michel, Thomson-CSF, France; Gach, Thierry, Thomson-CSF, France; Sicsik-Pare, Emmanuel, Ministry of Defence, France; Jul. 1998; 10p; In French; Also announced as 19990007836; Original contains color Illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Under a contract awarded in 1994 by French MOD (DGA), THOMSON-CSF has developed a demonstrator for a SAR/MTI Air-Ground Surveillance radar on low speed UAVs. After having explained the operational requirement (part 2) and the method used to develop CRESUS (part 3), the principal choices made for CRESUS are explained (part 4), especially the choice of medium range. This range enables one to take advantage, at the maximum possible extent, of the intrinsic features of a radar, that is to say its capability to look through the clouds and, as a direct consequence, its ability to observe from a higher and farther position. A description of MTI and SAR signal processing (Part 5), performances and characteristics (part 6), a physical and functional description (part 7) and a description of the ground segment (part 8) are then given. The conclusion (part 9) emphasizes the versatility of the demonstrator since it can be improved, at low cost, by adding a high resolution SAR mode. Furthermore a low cost installation of the final radar on different classes of UAVs (tactical, MALE, ...) is possible.
Author
Surveillance Radar; Moving Target Indicators; Signal Processing

19990007910 Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain

Derivation of the True Far Field Radiation Pattern from the Measured Illumination and the Measured Pattern in a Compact Range

Garcia-Muller, P. L., Instituto Nacional de Tecnica Aeroespacial, Spain; Montiel, I., Instituto Nacional de Tecnica Aeroespacial, Spain; Jan. 15, 1998; 95p; In English

Report No.(s): EDB/PLN/4810/003/INTA/98; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The results of the validation of the program are presented in this report. A 2.4 m reflector antenna has been measured in the semi-open chamber at INTA. The transmitter antenna was placed at a distance fulfilling the far field condition and the antenna radiation pattern data was acquired. Two data sets were obtained, VV (transmitting vertical polarization and receiving vertical) and HV, scanning the positioner in azimuth-roll (theta-phi). This pattern was considered the true radiation pattern of the AUT since the illumination was almost a perfect plane wave, only perturbed by the small reflectivity from the walls and the phase error due to the non far-field distance to the transmitter. In order to check the validity of the software, a perturbed illumination was created by rotating the transmitter antenna in the azimuth plane until an amplitude taper of around 7 dB in the test zone area is reached. Not only the copolar illumination has been distorted (mainly in the horizontal plane), there is also an increase on the Xpolar level. The distorted illumination was scanned in plane-polar coordinates with a probe gadget able to maintain the polarization as it rotates. The complete set VV, VH, HV and HH were measured. Once the distorted illumination has been calibrated, the AUT was measured again obtaining an inaccurate radiation pattern. An attempt was made to apply the correction in 2-D as proposed on the document report ref. EDB/RPT/4810/INTA/95, this attempt failed, and the reason may be on the disalignment between the two antennas when creating the perturbed quit zone. The 1-D correction was applied instead, giving acceptable results in both copolar and crosspolar. 1-D correction means the application of the correction on a phi-cut basis, using the illumination on the horizontal (azimuth) plane.

Derived from text

Antenna Radiation Patterns; Reflector Antennas; Transmitters; Phase Error; Polar Coordinates

19990008040 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA

Inconsistency of Ulysses Millisecond Langmuir Spikes with Wave Collapse in Type 3 Radio Sources

Cairns, Iver H., Iowa Univ., USA; Robinson, P. A., Sydney Univ., Australia; Geophysical Research Letters; Dec. 15, 1995; ISSN 0094-8534; Volume 22, No. 24, pp. 3437-3440; In English

Contract(s)/Grant(s): NAGw-2040

Report No.(s): Paper-95GL03513; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Recent Ulysses observations of millisecond spikes superposed on broader Langmuir wave packets in type 3 radio sources are compared quantitatively with constraints from the theory of wave collapse. It is found that both the millisecond spikes and the wave packets have fields at least 10 times too small to be consistent with collapse, contrary to previous interpretations in terms of this process. Several alternative explanations are considered and it is argued that the spikes should be interpreted as either non-collapse phenomena or observational artifacts. to the extent the observations are representative, this rules out theories for type 3 bursts at approx. 1 - 4 AU that rely on collapse.

Author

Radio Sources (Astronomy); Wave Degradation; Type 3 Bursts; Spike Potentials

19990008133 Research Inst. of National Defence, Avdelningen foer Sensorteknik, Linkoeping, Sweden

Optical Signal Distribution of Reference Signals to a Digital Beamforming Antenna ***Optisk Signaldistribution av Referenssignaler till en Digital Gruppantenn***

Oennegren, J., Research Inst. of National Defence, Sweden; Pettersson, L., Research Inst. of National Defence, Sweden; Mar. 1998; 48p; In Swedish

Report No.(s): PB99-102337; FOA-R-98-00753-408-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report describes the possibilities to use fiberoptic techniques for distributing reference signals to a digital beamforming antenna. The reference signals that are used in the antenna to calibrate the receiver modules must be stable in both amplitude and phase. The temperature dependence for the components in the calibration network, for example the PIN-diode, laser, optical coupler, bias-T and directional coupler, has been evaluated as described in chapter 4-6. The realized optical calibration network in chapter 9 fulfills the electrical requirements from chapter 2. Two problems have been identified, the polarization dependence of the optical coupler and the temperature dependence of the directional coupler.

NTIS

Fiber Optics; Beamforming; Antennas; Optical Relay Systems; Antenna Arrays; Digital Systems; Signal Processing

19990008169 Defence Science and Technology Organisation, Salisbury, Australia
Automatic Speaker Recognition Using Statistical Models
Roberts, William, Defence Science and Technology Organisation, Australia; Jun. 1998; 24p; In English
Report No.(s): DSTO-RR-0131; DODA-AR-010-533; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, South Australia), Hardcopy, Microfiche

In this report we describe the automatic identification of speakers from their voices. This process has application in forensics and in voice actuated security systems. The implementation and theoretic underpinnings of a statistical based speaker recognition system are presented in addition to the performance of the system on standard speech corpora. In a speaker verification experiment, the system yielded an equal error rate of under 5% when identical microphones are used for testing and training.
Author
Speech Recognition; Mathematical Models; Education

19990008170 Defence Science and Technology Organisation, Electronic and Surveillance Research Lab., Salisbury, Australia
Analysis of Sea Clutter Data
Antipov, Irina, Defence Science and Technology Organisation, Australia; Mar. 1998; 32p; In English
Report No.(s): DSTO-TR-0647; DODA-AR-010-489; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This report presents the results of comparative analysis of the models which have been applied to sea clutter amplitude distribution, and the methods for estimation of their parameters. More detail consideration among others is given to the K-distribution as the most appropriate model for sea clutter in the low Probability of False Alarm (PFA) region.
Author
Clutter; Probability Theory; Seas

19990008172 Helsinki Univ. of Technology, Lab. of Telecommunications Technology, Espoo, Finland
Helsinki University of Technology, Laboratory of Telecommunications Technology *Annual Report*
Haenninen, Arja, Editor, Helsinki Univ. of Technology, Finland; 1998; 34p; In English
Report No.(s): PB99-108375; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Contents include the following: Introduction; Personnel; Research Projects; Models for Integrated Telecommunication Network Traffic and Architecture (MITTA); Signal Processing in Digital Receivers; Smart Antennas in new radio systems; Cost 257; Studies in Queuing theory; IP/Voice; IP/Switch; Teaching; Activities; Participation in Boards and Committees; and Publications.
NTIS
Telecommunication; Signal Processing; Communication Networks; Architecture; Antennas

19990008219 National Security Telecommunications Advisory Committee, Washington, DC USA
President's National Security Telecommunications Advisory Committee (NSTAC): Issue Review. A Review of NSTAC Issues Addressed Prior to NSTAC XXI
Sep. 1998; 112p; In English
Report No.(s): PB99-109076; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Contents include the following: Information Assurance/Infrastructure Protection; Network Security; Legislation and Regulation; Industry-Government Coordination and Response; National Information Infrastructure; Wireless Services; Common Channel Signaling; Obtaining Critical Telecommunications Facility Protection During a Civil Disturbance; Energy; Enhanced Call Completion; Underground Storage Tanks; International National Security and Emergency Preparedness Telecommunications; and Telecommunications Systems Survivability.
NTIS
Law (Jurisprudence); Industries; Security; Communication Networks; Information Systems; Satellite Communication

19990008264 Federal Trade Commission, Bureau of Consumer protection, Washington, DC USA
Privacy Online: A Report to Congress
Landesberg, Martha K., Federal Trade Commission, USA; Levin, Toby Milgrom, Federal Trade Commission, USA; Curtin, Caroline G., Federal Trade Commission, USA; Lev, Ori, Federal Trade Commission, USA; Jun. 1998; 250p; In English
Report No.(s): PB99-103145; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report to Congress provides an assessment of the effectiveness of self-regulation as a means of protecting consumer privacy on the World Wide Web ('the Web'). It is based on a comprehensive online survey of the information practices of commercial Web sites, including sites directed to children, conducted in March 1998; an examination of current industry guidelines governing

information practices online; and the record developed in Commission hearings and workshops held since 1995. Part II of the report provides a brief history of the Commission's work in the area of online privacy, and a summary of the privacy concerns raised by the new online marketplace. Part III describes what have come to be recognized as the core principles of privacy-protective information practices. Part IV then compares current industry guidelines with these generally accepted principles, and Part V presents the findings of the Commission's survey of Web sites. Part VI sets forth the Commission's conclusions.
NTIS
Privacy; Congressional Reports; Consumers; Information Systems; World Wide Web

19990008345 Helsinki Univ. of Technology, Radio Lab., Espoo, Finland
Empirical Modelling of the Effects of Tropospheric Scintillation on Radiowave Propagation for Satellite Communications
Tervonen, Jouni Kaarlo, Helsinki Univ. of Technology, Finland; Sep. 1997; 154p; In English; Sponsored in part by Jenny and Antti Wihuri Fund and Foundation of Technology in Finland
Report No.(s): Rept-S-227; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Small-scale turbulent fluctuations of the refractive index along a propagation path cause amplitude, phase, and angle of arrival variations known as tropospheric scintillation. The theory of scintillation and the several prediction, models available are summarized. Scintillation is an important phenomenon particularly for low elevation paths and for low fade margin systems. Radio wave propagation measurements using 19.8 and 29.7 GHz beacon signals from the Olympus satellite were operated by the Radio Laboratory of Helsinki University of Technology at a mean elevation angle of 12.7 deg at Kirkkonummi (60.22 N, 24.40 E) in Finland, Because of the low elevation angle, the measurements at this site are suitable for scintillation analysis. The measurement system evolution and the resulting data sets suitable for the scintillation analysis and the analysis procedures are described. In order to improve prediction models one needs statistical results from many sites. Therefore, the various aspects of scintillation are studied both by analysing only our own measurements and by comparing our results with those of many other sites found in open literature. The frequency dependence of scintillation, as observed from measurement results at various sites, shows remarkable differences. No convincing correlation of this effect could be found with any meteorological or system parameter, except a slight correlation with the elevation angle. Both theoretical and the experimental study showed that scintillation is polarisation independent.
Author
Turbulent Flow; Refractivity; Satellite Communication; Wave Propagation; Scintillation; Radio Waves

19990008384 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA
Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 846P Inventory Inquiry/Advice (Physical Inventory/Transaction History). Implementation Convention
Favreau, Jean-Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 28p; In English
Report No.(s): PB99-109480; NIST/SP-881-78; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the Inventory Inquiry/Advice Transaction Set (846) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used in the following ways: (1) for a seller of goods and services to provide inventory information to a prospective purchaser, with no obligation to the purchaser to acquire these goods or services; (2) for a representative of a seller of goods and services to supply inventory information to that seller; (3) for one location to supply another location with inventory information; and (4) for an inquiry as to the availability of inventory with no obligation on the seller of goods and services to reserve that inventory.
NTIS
Conventions; Inventories; Information Systems; Standards; Computer Networks; Inventory Controls; Data Processing

19990008398 Helsinki Univ. of Technology, Dept. of Electrical and Communications Engineering, Espoo, Finland
HUT Radio Laboratory Research and Education 1997
Raeisaenen, Antti, Editor, Helsinki Univ. of Technology, Finland; Holopainen, Helena, Editor, Helsinki Univ. of Technology, Finland; Apr. 1998; 46p; In English
Report No.(s): PB99-108557; REPT-230; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Contents include the following: General; Facilities and Finance; Personnel; Foreign Visitors and Visits; Teaching; Degrees; Research: Participation in International Research Programs/Projects; Millimeter Wave Techniques; Microwave and Millimeter Wave Propagation; RF Applications in Mobile Communications; Institutes; Participation in Boards and Committees; and Conferences, Meetings and Visits.
NTIS
Communication Equipment; Radio Communication; Education; Wave Propagation; Radio Transmission; Mobile Communication Systems

19990008404 National Inst. of Standards and Technology, Electronic Commerce Acqisition Program Management Office, Gaithersburg, MD USA
Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 527R Material Due-In and Receipt (Receipt, Inquiry, Response and MRA). Implementation Convention
Favreau, Jean-Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 54p; In English
Report No.(s): PB99-110322; NIST/SP-881-71; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This Draft Standard for Trial Use contains the format and establishes the data contents of the Material Due-In and Receipt Transaction Set (527) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used to provide advanced notification of scheduled material receipts, to report receipts, and to inquire about the status of receipt reporting. This transaction set may be used to convey a description of the material, receiving conditions and quantities, necessary contract information, and other logistics information. This transaction set is bi-directional between trading partners.
NTIS
Conventions; Information Systems; Standards; Computer Networks; Procurement; Data Processing

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ELECTRONICS AND ELECTRICAL ENGINEERING

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

19990004074 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA
Acoustic Transduction - Materials and Devices, Volume 2 ***Annual Report, 31 Jul. 1996 - 31 Dec. 1997***
Uchino, Kenji; May 01, 1998; 200p; In English
Contract(s)/Grant(s): N00014-96-1-1173
Report No.(s): AD-A353872; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche
In Material Studies, undoubtedly major breakthroughs have occurred in the ultra- high strain relaxor ferroelectric systems. Earlier reports of unusual piezoelectric activity in single crystal perovskite relaxors have been amply confirmed in the lead zinc niobate : lead titanate, and lead magnesium niobate : lead titanate systems for compositions of rhombohedral symmetry close to the Morphotropic Phase Boundary (MPB) in these solid solutions. Analysis of the unique properties of 001 field poled rhombohedral ferroelectric crystals suggests new intrinsic mechanisms for high strain and carries the first hints of how to move from lead based compositions. A major discovery of comparable importance is a new mode of processing to convert PVDF:TrFE copolymer piezoelectric into a relaxor ferroelectric in which electrostrictive strains of 4% have been demonstrated at high fields. Both single crystal and polymer relaxors appear to offer energy densities almost order of magnitude larger than in earlier polycrystal ceramic actuators.
DTIC
Ferroelectricity; Piezoelectric Crystals; Piezoelectricity; Piezoelectric Transducers; Ferroelectric Materials

19990004083 Tracor Aerospace Electronic Systems, Inc., Lansdale, PA USA
Millimeter Wave Optical Link/Frequency Converter System ***Final Report, Sep. 1995 - Sep. 1997***
Logan, Ronald T., Jr.; Bynum, R. Dake; Jul. 1998; 51p; In English
Contract(s)/Grant(s): F30602-95-C-0053; AF Proj. 4600
Report No.(s): AD-A352989; AFRL-SN-RS-TR-1998-160; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Direct frequency conversion between mmW frequencies and baseband frequencies in the optical domain were validated. The technique utilized a dual wavelength phase locked laser system feeding an external Mach Zehnder modulator. The frequency difference between the two laser lines act as the local oscillator (LO) that up/down converts between baseband frequencies and millimeter wave frequencies. Additional work was performed to examine an alternate conversion technique that would eliminate the

radio frequency and LO feed through on the output of the fiber optic link. In addition, the technique could increase the usable dynamic range by allowing more of the current saturating the photodetector to be from the signal and increasing the third order intercept point by 6 dB.
DTIC
Millimeter Waves; Radio Frequencies; Frequency Converters; Data Links

19990004114 Cardiff Univ., UK
Fourth International Workshop on Expert Evaluation and Control of Compound Semiconductor Materials and Technologies
Jun. 1998; 112p; In English; 4th; Expert Evaluation and Control of Compound Semiconductor Materials and Technologies, 21-24 Jun. 1998, Cardiff, UK; Sponsored in part by British Associaton for Crystal Growth; Wafer Technology Ltd.; IEM Technologies Ltd. and Chell Instruments Ltd.
Report No.(s): AD-A353906; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The proceedings of the Fourth International Workshop on Expert Evaluation and Control of Compound Semiconductor Materials and Technologies is presented. Technological areas discusses include: Latest developments in VGF technology: GaAs InP, and GaP; Photoelastic characterisation of residual strain in GaAs wafers annealed in different holder geometrics; Non destructive Mode index Measurement using Resonant Coupling; X-ray Characterisation of InP Substrates; Reliability issues due to hot electrons in GaAs and InP HEMTS; Optical and structural analysis of degraded high power in InGaAlAs/As/AlGaAs lasers; Failure analysis of heavily proton irradiated p+-n InGaP solar cells by EBIC and cathodoluminescence; Electron irradiation and thermal annealing effects on GaAs solar cells; Structural characterisation of InGaP/GaAs heterojunction bipolar transistors; III-Nitrides for Red and IR applications; Large area GaN substrates.
DTIC
Composite Materials; Semiconductors (Materials); Semiconductor Devices; Conferences

19990004124 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design and Flight Performance of NOAA-K Spacecraft Batteries
Rao, Gopalakrishna M., NASA Goddard Space Flight Center, USA; Chetty, P. R. K., Krispin Technologies, Inc., USA; Spitzer, Tom, NASA Goddard Space Flight Center, USA; Chilelli, P., Lockheed Martin Missiles and Space, USA; 1998; 28p; In English; Aerospace Battery Workshop, 27-29 Oct. 1998, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The US National Oceanic and Atmospheric Administration (NOAA) operates the Polar Operational Environmental Satellite (POES) spacecraft (among others) to support weather forecasting, severe storm tracking, and meteorological research by the National Weather Service (NWS). The latest in the POES series of spacecraft, named as NOAA-KLMNN', one is in orbit and four more are in various phases of development. The NOAA-K spacecraft was launched on May 13, 1998. Each of these spacecraft carry three Nickel-Cadmium batteries designed and manufactured by Lockheed Martin. The battery, which consists of seventeen 40 Ah cells manufactured by SAFT, provides the spacecraft power during the ascent phase, orbital eclipse and when the power demand is in excess of the solar array capability. The NOAA-K satellite is in a 98 degree inclination, 7:30AM ascending node orbit. In this orbit the satellite experiences earth occultation only 25% of the year. This paper provides a brief overview of the power subsystem, followed by the battery design and qualification, the cell life cycle test data, and the performance during launch and in orbit.
Author
Electric Batteries; Life (Durability); Nickel Cadmium Batteries; Flight Characteristics; Ascent; Launching

19990004147 NASA Goddard Space Flight Center, Greenbelt, MD USA
Performance of Nickel-Cadmium Batteries on the GOES I-K Series of Weather Satellites
Singhal, Sat P., Computer Science Corp., USA; Rao, Gopalakrishna M., NASA Goddard Space Flight Center, USA; Alsbach, Walter G., Kris Engineering, Inc., USA; 1997; 30p; In English; Battery Workshop, 18-20 Nov. 1997, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The US National Oceanic and Atmospheric Administration (NOAA) operates the Geostationary Operational Environmental Satellite (GOES) spacecraft (among others) to support weather forecasting, severe storm tracking, and meteorological research by the National Weather Service (NWS). The latest in the GOES series consists of 5 spacecraft (originally named GOES I-M), three of which are in orbit and two more in development. Each of five spacecraft carry two Nickel-Cadmium batteries, with batteries designed and manufactured by Space Systems Loral (SS/L) and cells manufactured by Gates Aerospace Batteries (sold to SAFT in 1993). The battery, which consists of 28 cells with a 12 Ah capacity, provides the spacecraft power needs during the ascent

phase and during the semi-annual eclipse seasons lasting for approximately 45 days each. The maximum duration eclipses are 72 minutes long which result in a 60 percent depth of discharge (DOD) of the batteries. This paper provides a description of the batteries, reconditioning setup, DOD profile during a typical eclipse season, and flight performance from the 3 launched spacecraft (now GOES 8, 9, and 10) in orbit.
Author
GOES Satellites; Electric Batteries; Meteorological Satellites; Nickel Cadmium Batteries

19990004149 NASA Goddard Space Flight Center, Greenbelt, MD USA
RH1020 Single Event Clock Upset Summary Report
Katz, Richard B., NASA Goddard Space Flight Center, USA; Wang, J. J., Actel Corp., USA; Mar. 05, 1998; 12p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the testing and analysis of ”single event clock upset’ in the RH1020. Also included are SEU-rate predictions and design recommendations for risk analysis and reduction. The subject of ”upsets” in the RH1020 is best understood by using a model consisting of a global clock buffer and a D-type flip-flop as the basic memory unit. The RH1020 is built on the ACT 1 family architecture. As such, it has one low-skew global clock buffer with a TTL-level input threshold that is accessed via a single dedicated pin. The clock signal is driven to full CMOS levels, buffered, and sent to individual row buffers with one buffer per channel. For low-skew performance, the outputs of all of the RH1020 row buffers are shorted together via metal lines, as is done in the A1020B. All storage in the RH1020 consists of routed flip-flops, constructed with multiplexors and feedback through the routing segments. A simple latch can be constructed from a single (combinatorial or C) module; an edge-triggered flip-flop is constructed using two concatenated latches. There is no storage in the I/O modules. The front end of the clock buffering circuitry, at a common point relative to the row buffer, is a sub-circuit that was determined to be the most susceptible to heavy ions. This is due, in part, to its smaller transistors compared to the rest of the circuitry. This conclusion is also supported by SPICE simulations and an analysis of the heavy ion data, described in this report. The edge triggered D flip-flop has two single-event-upset modes. Mode one, called C-module upset, is caused by a heavy ion striking the C-module’s sensitive area on the silicon and produces a soft single bit error at the output of the flip-flop. Mode two, called clock upset, is caused by a heavy ion strike on the clock buffer, generating a runt pulse interpreted as a false clock signal and consequently producing errors at the flip-flop outputs. C-module upset sensitivity in the RH1020 is essentially the same as that of its ACT 1 siblings (A1020, A1020A and A1020B), which were well tested, analyzed, and documented in the literature.
Author
Single Event Upsets; Combinatorial Analysis; Clocks; Modules; Heavy Ions

19990004175 Paris Univ., Inst. of Technology, France
PIERS 1998: Progress in Electromagnetics Research Symposium, Volume 1
Jul. 22, 1998; 570p; In English; Progress in Electromagnetics Research, 13-17 Jul. 1998, Nantes, France
Contract(s)/Grant(s): F61775-98-WE031
Report No.(s): AD-A353859; EOARD-CSP-98-1031; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche

The Final Proceedings for Progress in Electromagnetics Research Symposium (PIERS) 98 was held 13-17 July 1998 at Nantes, France. This is an interdisciplinary conference. Topics include: electromagnetic theory, computational techniques, guided waves and propagation, antennas, components, composite, and complex materials, signal processing, polarimetry, remote sensing, wireless communication systems, measurement techniques.
DTIC
Conferences; Electromagnetism; Signal Processing; Polarimetry; Remote Sensing; Wireless Communication; Antennas; Electromagnetic Radiation

19990004177 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA
Acoustic Transduction - Materials and Devices, Volume 1 ***Annual Report, 31 Jul. 1996 - 31 Dec. 1997***
Uchino, Kenji; May 01, 1998; 212p; In English
Contract(s)/Grant(s): N00014-96-1-1173
Report No.(s): AD-A353871; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In Material Studies, undoubtedly major breakthroughs have occurred in the ultra- high strain relaxor ferroelectric systems. Earlier reports of unusual piezoelectric activity in single crystal perovskite relaxors have been amply confirmed in the lead zinc niobate : lead titanate, and lead magnesium niobate : lead titanate systems for compositions of rhombohedral symmetry close to the Morphotropic Phase Boundary (MPB) in these solid solutions. Analysis of the unique properties of 001 field poled rhombohedral ferroelectric crystals suggests new intrinsic mechanisms for high strain and carries the first hints of how to move from lead

based compositions. A major discovery of comparable importance is a new mode of processing to convert PVDF:TrFE copolymer piezoelectric into a relaxor ferroelectric in which electrostrictive strains of 4% have been demonstrated at high fields. Both single crystal and polymer relaxors appear to offer energy densities almost order of magnitude larger than in earlier polycrystal ceramic actuators.
DTIC
Piezoelectric Transducers; Acoustics; Ferroelectricity; Polycrystals; Ferroelectric Materials

19990004186 Montpellier Univ., France
Eighth International Conference on Shallow-Level Centers in Semiconductors (SLCS 1998)
Jul. 1998; 206p; In English; 8th; Shallow-Level Centers in Semiconductors, 27-30 Jul. 1998, Montpellier, France
Report No.(s): AD-A353913; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The proceedings of the Eight International Conference on Shallow-Level Centers in Semiconductors is presented. Technological areas discuss include: Metal-insulator transitions and defect interactions; Bound excitons and Raman scattering at shallow centers; Wide-gap I; Wide-gap II-SiC; Poster Session: Hydrogen passivation and related topics, thermal donors; Low-D systems I; Shallow excited states of deep level impurities and shallow-deep crossover; New methods in experiment. New methods in theory; Low-D systems II; Wide-gap III.
DTIC
Conferences; Semiconductors (Materials)

19990004374 NASA Goddard Space Flight Center, Greenbelt, MD USA
Technique for Predicting the RF Field Strength Inside an Enclosure
Hallett, M., NASA Goddard Space Flight Center, USA; Reddell, J., Boeing Co., USA; Aug. 1998; 92p; In English
Contract(s)/Grant(s): NAS5-39722
Report No.(s): NASA/TP-1998-206864; Rept-98B00064; NAS 1.60:206864; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This Memorandum presents a simple analytical technique for predicting the RF electric field strength inside an enclosed volume in which radio frequency radiation occurs. The technique was developed to predict the radio frequency (RF) field strength within a launch vehicle's fairing from payloads launched with their telemetry transmitters radiating and to the impact of the radiation on the vehicle and payload. The RF field strength is shown to be a function of the surface materials and surface areas. The method accounts for RF energy losses within exposed surfaces, through RF windows, and within multiple layers of dielectric materials which may cover the surfaces. This Memorandum includes the rigorous derivation of all equations and presents examples and data to support the validity of the technique.
Author
Radio Frequencies; Predictions; Radio Waves; Enclosure; Electric Field Strength; Electromagnetic Fields; Dielectrics; Field Strength; Energy Dissipation

19990004614 NASA Lewis Research Center, Cleveland, OH USA
Study of Bulk and Elementary Screw Dislocation Assisted Reverse Breakdown in Low-Voltage (less than 250 V) 4H-SiC p(+)n Junction diodes, Part 1, DC Properties
Neudeck, Philip G., NASA Lewis Research Center, USA; Huang, Wei, State Univ. of New York, USA; Dudley, Michael, State Univ. of New York, USA; IEEE Transactions on Electronic Devices; 1998; ISSN 0018-9383; 24p; In English
Contract(s)/Grant(s): DE-AC02-76CH-00016; DAAH04-94-G-0091; DAAH04-94-G-0121; RTOP 505-23-2Q; DARPA Order D149; DARPA Order E111; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Given the high density (approx. 10(exp 4)/sq cm) of elementary screw dislocations (Burgers vector = 1c with no hollow core) in commercial SiC wafers and epilayers, all appreciable current (greater than 1 A) SiC power devices will likely contain elementary screw dislocations for the foreseeable future. It is therefore important to ascertain the electrical impact of these defects, particularly in high-field vertical power device topologies where SiC is expected to enable large performance improvements in solid-state high-power systems. This paper compares the DC-measured reverse-breakdown characteristics of low-voltage (less than 250 V) small-area (less than 5 x 10(exp -4)/sq cm) 4H-SiC p(+)n diodes with and without elementary screw dislocations. Compared to screw dislocation-free devices, diodes containing elementary screw dislocations exhibited higher pre-breakdown reverse leakage currents, softer reverse breakdown I-V knees, and highly localized microplasmic breakdown current filaments. The observed

localized 4H-SiC breakdown parallels microplasmic breakdowns observed in silicon and other semiconductors, in which space-charge effects limit current conduction through the local microplasma as reverse bias is increased.
Author
Research; Semiconductors (Materials); Silicon Carbides; Screw Dislocations; Junction Diodes; Low Voltage

19990004615 Analex Corp., Cleveland, OH USA
Computational Investigation of Experimental Interaction Impedance Obtained by Perturbation for Helical Traveling-Wave Tube Structures
Kory, Carol L., Analex Corp., USA; Dayton, James A., Jr., NASA Lewis Research Center, USA; 1997; 34p
Contract(s)/Grant(s): NAS3-27600; RTOP-632-50-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Conventional methods used to measure the cold-test interaction impedance of helical slow-wave structures involve perturbing a helical circuit with a cylindrical dielectric rod placed on the central axis of the circuit. It has been shown that the difference in resonant frequency or axial phase shift between the perturbed and unperturbed circuits can be related to the interaction impedance. However, because of the complex configuration of the helical circuit, deriving this relationship involves-several approximations. With the advent of accurate three- dimensional helical circuit models, these standard approximations can be fully investigated. This paper addresses the most prominent approximations made in the analysis for measured interaction impedance by Lagerstrom and investigates their accuracy using the three-dimensional simulation code MAFIA. It is shown that a more accurate value of interaction impedance can be obtained by using three-dimensional computational methods rather than performing costly and time consuming experimental cold-test measurements.
Author
Computerized Simulation; Cylindrical Bodies; Dielectrics; Frequency Shift; Impedance; Perturbation; Traveling Wave Tubes

19990004616 Analex Corp., Cleveland, OH USA
Traveling-Wave Tubes
Kory, Carol L., Analex Corp., USA; Feb. 09, 1998; 26p; In English
Contract(s)/Grant(s): NAS3-27600; RTOP 632-50-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The traveling-wave tube (TWT) is a vacuum device invented in the early 1940's used for amplification at microwave frequencies. Amplification is attained by surrendering kinetic energy from an electron beam to a radio frequency (RF) electromagnetic wave. The demand for vacuum devices has been decreased largely by the advent of solid-state devices. However, although solid state devices have replaced vacuum devices in many areas, there are still many applications such as radar, electronic countermeasures and satellite communications, that require operating characteristics such as high power (Watts to Megawatts), high frequency (below 1 GHz to over 100 GHz) and large bandwidth that only vacuum devices can provide. Vacuum devices are also deemed irreplaceable in the music industry where musicians treasure their tube-based amplifiers claiming that the solid-state and digital counterparts could never provide the same "warmth" (3). The term traveling-wave tube includes both fast-wave and slow-wave devices. This article will concentrate on slow-wave devices as the vast majority of TWTs in operation fall into this category.
Derived from text
Traveling Wave Tubes; Amplification; Satellite Communication; Radio Frequencies; Electronic Countermeasures; Vacuum; Microwave Frequencies; Solid State Devices

19990004617 Analex Corp., Brook Park, OH USA
Accurate Cold-Test Model of Helical TWT Slow-Wave Circuits
Kory, Carol L., Analex Corp., USA; Dayton, James A., Jr., NASA Lewis Research Center, USA; 1997; 20p; In English
Contract(s)/Grant(s): NAS3-27600; RTOP 632-50-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recently, a method has been established to accurately calculate cold-test data for helical slow-wave structures using the three-dimensional electromagnetic computer code, MAFIA. Cold-test parameters have been calculated for several helical traveling-wave tube (TWT) slow-wave circuits possessing various support rod configurations, and results are presented here showing excellent agreement with experiment. The helical models include tape thickness, dielectric support shapes and material properties consistent with the actual circuits. The cold-test data from this helical model can be used as input into large-signal helical TWT interaction codes making it possible, for the first time, to design a complete TWT via computer simulation.
Author
Traveling Wave Tubes; Computer Programs; Computerized Simulation; Wave Propagation; Dielectrics

19990004618 NASA Lewis Research Center, Cleveland, OH USA

Effect of Helical Slow-Wave Circuit Variations on TWT Cold-Test Characteristics

Kory, Carol L., Analex Corp., USA; Dayton, James A., Jr., NASA Lewis Research Center, USA; IEEE Transactions on Electron Devices; 1997, pp. 1-12; In English

Contract(s)/Grant(s): NAS3-27600; RTOP 632-50-5D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent advances in the state of the art of computer modeling offer the possibility for the first time to evaluate the effect that slow-wave structure parameter variations, such as manufacturing tolerances, have on the cold-test characteristics of helical traveling-wave tubes (TWT's). This will enable manufacturers to determine the cost effectiveness of controlling the dimensions of the component parts of the TWT, which is almost impossible to do experimentally without building a large number of tubes and controlling several parameters simultaneously. The computer code MAFIA is used in this analysis to determine the effect on dispersion and on-axis interaction impedance of several helical slow-wave circuit parameter variations, including thickness and relative dielectric constant of the support rods, tape width, and height of the metallized films deposited on the dielectric rods. Previous computer analyses required so many approximations that accurate determinations of the effect of many relevant dimensions on tube performance were practically impossible.

Author

Traveling Wave Tubes; Computerized Simulation; Wave Propagation; Metal Films; Cost Effectiveness; Circuits

19990005100 University of Southern California, Dept. of Chemistry, Los Angeles, CA USA

An ASSERT Proposal for Development of Advanced EO Modulators ***Final Report, 1 Jul. 1995 - 30 Jun. 1998***

Dalton, Larry E., University of Southern California, USA; Aug. 31, 1998; 16p; In English

Contract(s)/Grant(s): F49620-95-1-0450; AF Proj. 3484

Report No.(s): AD-A353017; AFRL-SR-BL-TR-98-0614; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary objective of this contract was to develop processible nonlinear optical materials and processing protocols that permit fabrication of prototype electrooptic modulator devices and integrated optoelectronic circuits.

DTIC

Modulators; Nonlinearity; Protocol (Computers); Fabrication; Optoelectronic Devices

19990005116 NASA Goddard Space Flight Center, Greenbelt, MD USA

Technique for Predicting the RF Field Strength Inside an Enclosure

Hallett, M., NASA Goddard Space Flight Center, USA; Reddell, J., NASA Goddard Space Flight Center, USA; Aug. 1998; 94p; In English

Report No.(s): NASA/TP-1998-206864; NAS 1.60:206864; Rept-98B00064; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This Memorandum presents a simple analytical technique for predicting the RF electric field strength inside an enclosed volume in which radio frequency radiation occurs. The technique was developed to predict the radio frequency (RF) field strength within a launch vehicle's fairing from payloads launched with their telemetry transmitters radiating and to the impact of the radiation on the vehicle and payload. The RF field strength is shown to be a function of the surface materials and surface areas. The method accounts for RF energy losses within exposed surfaces, through RF windows, and within multiple layers of dielectric materials which may cover the surfaces. This Memorandum includes the rigorous derivation of all equations and presents examples and data to support the validity of the technique.

Author

Dielectrics; Electric Field Strength; Electromagnetic Fields; Energy Dissipation; Field Strength; Laminates; Payloads; Radio Frequencies; Radio Waves; Telemetry

19990007765 NASA Goddard Space Flight Center, Greenbelt, MD USA

Prediction Accuracy of Error Rates for MPTB Space Experiment

Buchner, S. P., Sachs/Freeman Associates, Inc., USA; Campbell, A. B., Sachs/Freeman Associates, Inc., USA; Davis, D., Sachs/Freeman Associates, Inc., USA; McMorrow, D., Sachs/Freeman Associates, Inc., USA; Petersen, E. L., Petersen (E. L.), USA; Stassinopoulos, E. G., NASA Goddard Space Flight Center, USA; Ritter, J. C., Science Applications International Corp., USA; Nuclear Instruments and Methods in Physics Research; 1998; 15p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper addresses the accuracy of radiation-induced upset-rate predictions in space using the results of ground-based measurements together with standard environmental and device models. The study is focused on two part types - 16 Mb NEC DRAM's (UPD4216) and 1 Kb SRAM's (AMD93L422) - both of which are currently in space on board the Microelectronics and Photonics

Test Bed (MPTB). to date, ground-based measurements of proton-induced single event upset (SEM cross sections as a function of energy have been obtained and combined with models of the proton environment to predict proton-induced error rates in space. The role played by uncertainties in the environmental models will be determined by comparing the modeled radiation environment with the actual environment measured aboard MPTB. Heavy-ion induced upsets have also been obtained from MPTB and will be compared with the ”predicted” error rate following ground testing that will be done in the near future. These results should help identify sources of uncertainty in predictions of SEU rates in space.
Author
Microelectronics; Scanning Electron Microscopy; Single Event Upsets; Environment Models; Errors; Spaceborne Experiments; Test Stands

19990008141 Helsinki Univ. of Technology, Dept. of Electrical and Communication Engineering, Espoo, Finland
Helsinki University of Technology, Department of Electrical and Communications Engineering, Electron Physics Laboratory *Annual Report*
Majamaa, Tero, Editor, Helsinki Univ. of Technology, Finland; 1998; 42p; In English
Report No.(s): PB99-108250; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
Contents include the following: Electron Physics Laboratory; Electron Physics Laboratory Personnel; Educational Activities in Electron Physics Laboratory; Research Activities; Publication and Theses in 1996; and Microelectronics Centre.
NTIS
Electrical Engineering; Microelectronics

19990008145 Helsinki Univ. of Technology, Lab. of Electromechanics, Espoo, Finland
Helsinki University of Technology, Laboratory of Electromechanics *Annual Report*
Alander, Lea, Editor, Helsinki Univ. of Technology, Finland; Jokinen, Tapani, Editor, Helsinki Univ. of Technology, Finland; 1998; 30p; In English
Report No.(s): PB99-108359; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Laboratory of Electromechanics was founded in 1908. At that time, the Laboratory staff taught the basics of electrical engineering, including electrical machines. Nowadays the research and teaching area of the Laboratory is concentrated on rotating electrical machines, transformers, and other equipment converting energy by means of magnetic fields. The laboratory staff also gives lectures in the field of product development.
NTIS
Electrical Engineering; Electromechanics; Transformers; Magnetic Fields

19990008238 National Inst. of Standards and Technology, Optical Technology Div., Gaithersburg, MD USA
Standard Reference Materials: Film Step Tablet Standards of Diffuse Visual Transmission Density: SRM 1001 and SRM 1008
Early, Edward A., National Inst. of Standards and Technology, USA; O’Brian, Thomas R., National Inst. of Standards and Technology, USA; Saunders, Robert D., National Inst. of Standards and Technology, USA; Parr, Albert C., National Inst. of Standards and Technology, USA; Jul. 1998; 64p; In English
Report No.(s): PB99-103632; NIST/SP-260-135; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Transmission density is an important physical property for exposed films in the fields of medicine, non-destructive testing, photography, and graphic arts. Standards for transmission density are provided by the National Institute of Standards and Technology (NIST) in the form of Standard Reference Materials (SRMs). A double emulsion x-ray film is used for SRM 1001, while a single emulsion photographic film is used for SRM 1008. The transmission densities of film step tablets for both SRM 1001 and 1008 are determined with an instrument using the diffuse influx mode. The measurement equations relevant to the determination of transmission density using the diffuse influx mode are derived in section 2. The instrument used for measuring transmission density is described in section 3; its characterization, particularly in relation to the applicable international standards for this measurement, is detailed in section 4; and its operation is discussed in section 5. Finally, the uncertainties in the measured transmission density resulting from various components are derived in section 6.
NTIS
Photographic Film; Tablets; Photography

19990008260 Technical Univ. of Budapest, Dept. of Electrical Engineering, Hungary
Periodica Polytechnica Electrical Engineering, Volume 41 ***Quarterly Report***
Wettl, F., Editor, Technical Univ. of Budapest, Hungary; 1997; ISSN 0324-6000; 90p; In English
Report No.(s): PB99-102287; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: On Two-Point Resolution of Imaging Systems; Improved Localization for Traffic Flow Control; The Rafael Multi-target Heterogeneous Signal-flow Graph Compiler; Av Experimental Investigation of a Multi-Processor Scheduling System; and Low-cost Robot Controller and its Software Problems.
NTIS
Electrical Engineering; Imaging Techniques; Position (Location); Signal Flow Graphs; Compilers; Controllers; Air Traffic Control

19990008261 Technical Univ. of Budapest, Dept. of Electrical Engineering, Hungary
Periodica Polytechnica, Electrical Engineering, Volume 41 ***Quarterly Report***
Wettl, F., Editor, Technical Univ. of Budapest, Hungary; 1997; ISSN 0324-6000; 96p; In English
Report No.(s): PB99-102295; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: A Comprehensive Method for the Test Calculation of Complex Digital Circuits; Novel Method to Simulate Single Non-linear Inductive Load Voltage-reactive Power Characteristics; Single-row Routing Problem with Alternative Terminals; Application Specific Speed Identification for Induction Motors; General Description of the Barrel Shifter Event Building Methods; and Issues and Problems in the Recognition of Arabic Printed Texts.
NTIS
Electrical Engineering; Induction Motors; Logic Circuits; Electric Power; Integrated Circuits

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FLUID MECHANICS AND HEAT TRANSFER

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

19990004072 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Smoothed Particle Hydrodynamics Simulation of Disk-Shaped Penetrator Impact
Schraml, Stephen J., Army Research Lab., USA; Kimsey, Kent D., Army Research Lab., USA; Aug. 1998; 49p; In English
Report No.(s): AD-A354109; ARL-TR-1766; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Smoothed particle hydrodynamics (SPH) is a method of continuum mechanics analysis in which materials are modeled by a discrete set of particles. The SPH code Magi has been used to simulate the penetration of a semi-infinite steel target by tungsten alloy disks traveling at an initial impact velocity of 2 km/s. Calculations were performed to simulate experimental configurations using one, two, and four disks. All disks had a constant length-to-diameter ratio of 0.125. The computed penetration depth into the target material is compared to the experimental data for each case. The study included a set of calculations in which the problem resolution was varied to determine the ability of the method to converge on a penetration depth as the number of particles in the problem was increased. Advantages and limitations observed in the application of SPH to the field of penetration mechanics are discussed.
DTIC
Simulation; Continuum Mechanics; Penetration; Hydrodynamics; Computerized Simulation; Impact Velocity

19990004073 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Computational Fluid Dynamics Modeling of Multi-body Missile Aerodynamic Interference ***Final Report***
Sahu, Jubaraj, Army Research Lab., USA; Edge, Harris L., Army Research Lab., USA; Heavey, Karen R., Army Research Lab., USA; Ferry, Earl N., Army Research Lab., USA; Aug. 1998; 37p; In English
Contract(s)/Grant(s): Proj-1L162618AH80
Report No.(s): AD-A354107; ARL-TR-1765; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Computational fluid dynamics (CFD) calculations have been performed for a multi-body system consisting of a main missile and a number of submunitions. Numerical flow field computations have been made for various orientations and locations of submunitions using an unsteady, zonal Navier-Stokes code and the chimera composite grid discretization technique at transonic speeds and zero degree angle of attack. Both steady state and unsteady numerical results have been obtained and compared for two submunitions and a missile system. Computed results show the details of the expected flow field features, including the shock

interactions. Computed results are compared with limited experimental data obtained for the same configuration and conditions and are generally found to be in good agreement with the data. Comparison of the unsteady and steady state results shows an appreciable change in the aerodynamic forces and moments.
DTIC
Computational Fluid Dynamics; Aerodynamic Forces; Mathematical Models; Computational Grids; Position (Location); Grid Generation (Mathematics); Flow Distribution

19990004076 Stanford Univ., Dept. of Mechanical Engineering, Stanford, CA USA
Support for Graduate Research in Supersonic Reacting Flows ***Final Report, 1 Jul. 1995 - 30 Jun. 1998***
Mungal, M. G., Stanford Univ., USA; Sep. 09, 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0448; AF Proj. 3484
Report No.(s): AD-A354071; AFRL-SR-BL-TR-98-0662; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This work was aimed at obtaining a more fundamental understanding of mixing and combustion in supersonic flows. Advanced laser based techniques for measurements in an existing supersonic shear layer facility were primarily used. The main scientific question addressed was a comparison of the similarities and differences between mixing and reaction when compressibility plays a significant role. to this end, Particle Image Velocimetry (PIV) was used to obtain detailed, whole field velocity measurements under a range of compressibility conditions. These measurements are complementary to earlier measurements of scalar concentrations in similar flows. New observations concerning the nature of the instantaneous velocity and vorticity fields were made as a function of compressibility. In addition, Planar Laser Mie Scattering is used to obtain structure velocity measurements for comparison with the actual fluid velocities.
DTIC
Compressible Flow; Supersonic Flow; Particle Image Velocimetry; Research; Velocity Measurement; Reacting Flow

19990004093 Old Dominion Univ., College of Engineering and Technology, Norfolk, VA USA
Transition and Breakdown to Turbulence in Incompressible Boundary Layers ***Final Report, Period ending 5 Jan. 1998***
Balakumar, Ponnampalam, Old Dominion Univ., USA; Nov. 1998; 32p; In English
Contract(s)/Grant(s): NAG1-1934; ODURF Proj. 172831; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have developed a code where the nonlinear terms are treated implicitly. The equations are discretized using the two-point fourth order compact scheme in the y-direction and the backward Euler method in the x-direction. We investigated the transition process in a Blasius boundary layer due to fundamental type breakdown. With 8 modes in the w and 3 planes, we could compute the evolution of disturbances up to Re(x)=910, which is well into the strongly nonlinear region. The transition onset point is located around Re(x)=850. The comparison with the measurements and with the DNS computations are very good up to Re(x)=880.
Author
Incompressible Boundary Layer; Turbulence; Turbulent Boundary Layer; Three Dimensional Boundary Layer; Supersonic Boundary Layers; Mixing Layers (Fluids)

19990004126 NASA Goddard Space Flight Center, Greenbelt, MD USA
Testing of the Geoscience Laser Altimeter System (GLAS) Prototype Loop Heat Pipe
Douglas, Donya, NASA Goddard Space Flight Center, USA; Ku, Jentung, NASA Goddard Space Flight Center, USA; Kaya, Tarik, NASA Goddard Space Flight Center, USA; 1998; 14p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-0473; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes the testing of the prototype loop heat pipe (LHP) for the Geoscience Laser Altimeter System (GLAS). The primary objective of the test program was to verify the loop's heat transport and temperature control capabilities under conditions pertinent to GLAS applications. Specifically, the LHP had to demonstrate a heat transport capability of 100 W, with the operating temperature maintained within +/-2K while the condenser sink was subjected to a temperature change between 273K and 283K. Test results showed that this loop heat pipe was more than capable of transporting the required heat load and that the operating temperature could be maintained within +/-2K. However, this particular integrated evaporator-compensation chamber design resulted in an exchange of energy between the two that affected the overall operation of the system. One effect was the high temperature the LHP was required to reach before nucleation would begin due to inability to control liquid distribution during ground testing. Another effect was that the loop had a low power start-up limitation of approximately 25 W. These Issues may be a concern for other applications, although it is not expected that they will cause problems for GLAS under micro-gravity conditions.
Author
Heat Pipes; Prototypes; Heat Transfer; Operating Temperature; Temperature Control; Laser Altimeters

19990004127 NASA Goddard Space Flight Center, Greenbelt, MD USA

Mathematical Modeling of Loop Heat Pipes

Kaya, Tarik, NASA Goddard Space Flight Center, USA; Ku, Jentung, NASA Goddard Space Flight Center, USA; Hoang, Triem T., TTH Research, Inc., USA; Cheung, Mark L., Naval Research Lab., USA; 1998; 10p; In English

Report No.(s): AIAA Paper 99-0477; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary focus of this study is to model steady-state performance of a Loop Heat Pipe (LHP). The mathematical model is based on the steady-state energy balance equations at each component of the LHP. The heat exchange between each LHP component and the surrounding is taken into account. Both convection and radiation environments are modeled. The loop operating temperature is calculated as a function of the applied power at a given loop condition. Experimental validation of the model is attempted by using two different LHP designs. The mathematical model is tested at different sink temperatures and at different elevations of the loop. Tbc comparison of the calculations and experimental results showed very good agreement (within 3%). This method proved to be a useful tool in studying steady-state LHP performance characteristics.

Author

Heat Pipes; Loops; Mathematical Models; Operating Temperature; Energy Budgets; Convection; Heat Transfer

19990004129 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

On the Universality of the Kolmogorov Constant in Numerical Simulations of Turbulence ***Final Report***

Yeung, P. K., Georgia Inst. of Tech., USA; Zhou, Ye, Institute for Computer Applications in Science and Engineering, USA; Nov. 1997; 16p; In English

Contract(s)/Grant(s): NAS1-19480; NSF CTS-93-07973; NSF INT-95-26868; RTOP 505-90-52-01

Report No.(s): NASA/CR-97-206251; NAS 1.26:206251; ICASE-97-64; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Motivated by a recent survey of experimental data, we examine data on the Kolmogorov spectrum constant in numerical simulations of isotropic turbulence, using results both from previous studies and from new direct numerical simulations over a range of Reynolds numbers (up to 240 on the Taylor scale) at grid resolutions up to 512(exp 3). It is noted that in addition to k(exp -5/3) scaling, identification of a true inertial range requires spectral isotropy in the same wavenumber range. We found that a plateau in the compensated three-dimensional energy spectrum at k(eta) approx. = 0.1 - -0.2, commonly used to infer the Kolmogorov constant from the compensated three-dimensional energy spectrum, actually does not represent proper inertial range behavior. Rather, a proper, if still approximate, inertial range emerges at k(eta) approx. = 0.02 - 0.05 when R(sub lambda) increases beyond 140. The new simulations indicate proportionality constants C(sub 1) and C in the one- and three-dimensional energy spectra respectively about 0.60 and 1.62. If the turbulence were perfectly isotropic then use of isotropy relations in wavenumber space (C(sub 1) = 18/55 C) would imply that C(sub 1) approx. = 0.53 for C = 1.62, in excellent agreement with experiments. However the one- and three-dimensional estimates are not fully consistent, because of departures (due to numerical and statistical limitations) from isotropy of the computed spectra at low wavenumbers. The inertial scaling of structure functions in physical space is briefly addressed. Since DNS is still restricted to moderate Reynolds numbers, an accurate evaluation of the Kolmogorov constant is very difficult. We focus on providing new insights on the interpretation of Kolmogorov 1941 similarity in the DNS literature and do not consider issues pertaining to the refined similarity hypotheses of Kolmogorov (K62).

Author

Isotropic Turbulence; Direct Numerical Simulation; Kolmogorov Theory; Energy Spectra

19990004165 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia

Numerical Modelling of Shock Wave and Pressure Pulse Generation by Underwater Explosions

Brett, John M., Defence Science and Technology Organisation, Australia; Jun. 1998; 36p; In English

Report No.(s): AD-A352831; DSTO-TR-0677; DODA-AR-010-558; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The continuing development of multi-purpose finite element analysis (FEA) codes permits their application to provide new and penetrating insights into the difficult subject of underwater explosive effects and the coupled response of nearby structures. In this paper we investigate the use of one such code (DYNA2D) to model the physical processes associated with an underwater explosion. We compute models covering a range in explosive masses and depths of detonation. The models are shown to simulate much of the important physics of an underwater explosion including: explosive detonation, shock wave generation and transmission, bubble pulsation and the generation of bubble pulse pressure waves. The model results are compared to published experimental data for key features of an underwater explosion such as bubble periods, maximum bubble radii and characteristics of the shock and bubble pressure waves. The good quantitative agreement found for many of these features demonstrates that FEA codes can

be used to model important aspects of an underwater explosion. Nevertheless a number of limitations are identified, the most serious of which is the absence of some important energy loss mechanisms associated with bubble collapse.
DTIC
Shock Waves; Pressure Pulses; Underwater Explosions; Finite Element Method; Wave Generation; Computational Fluid Dynamics

19990004404 Ben Gurion Univ. of the Negev, Beersheva, Israel
The 13th International Mach Reflection Symposium: Scientific Program and Book of Abstracts
Ben-Dor, Gabi, Editor; Jul. 03, 1998; 85p; In English; 13th; Mach Reflection, 28 Jun. - 3 Jul. 1998, Beer Sheva, Israel
Report No.(s): AD-A354149; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche; Abstracts Only; Abstracts Only

The report is a book of abstracts which documents information presented at the 13th International symposium on Mach Reflection. The conference held from 28 June to 03 Jul 98 in Ben-Gurion University of the Negev, Beer Sheva, Israel. The purpose of the scientific program provided a professional forum for a broad exchange of information and ideas on Shock Wave reflection and computational fluid dynamics for aerospace applications.
DTIC
Shock Waves; Computational Fluid Dynamics; Aerodynamics; Mach Reflection

19990005045 California Inst. of Tech., Graduate Aeronautical Lab., Pasadena, CA USA
Mixing, Chemical Reactions, and Combustion in Subsonic and Supersonic Turbulent Flows ***Annual Report, 1 Oct. 1997 - 31 Aug. 1998***
Dimotakis, Paul E., California Inst. of Tech., USA; Leonard, Anthony, California Inst. of Tech., USA; Sep. 01, 1998; 12p; In English
Contract(s)/Grant(s): F49620-98-1-0052; AF Proj. 2308
Report No.(s): AD-A353373; AFRL-SR-BL-TR-98-0619; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Work completed, or in progress, by the end of the first grant year includes a study of the effects of initial conditions on high Reynolds number shear layers, where it was shown that they also influence molecular mixing far downstream of the splitter plate; moderate Reynolds number, liquid-phase transverse jets in a cross flow, including their three-dimensional structure; the discovery of a power-law similarity in the surface-to root-area ratio of scalar structures in liquid-phase turbulent jets; numerical investigations of hydrocarbon ignition and the effects of additives in a high-strain rate environment, as would be encountered in air-breathing scramjet propulsion; and further advances and applications of velocity-field measurements from image sequences of convected scalars.
DTIC
Chemical Reactions; Combustion; Subsonic Flow; Supersonic Flow; Turbulent Flow; Turbulent Jets; Fluid Mechanics

19990005046 Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA
High Resolution Measurements of Supersonic Shear Flow Mixing and Combustion ***Annual Report***
Dahm, Werner J.; Driscoll, James F.; Aug. 1998; 9p; In English
Contract(s)/Grant(s): F49620-98-1-0003; AF Proj. 2308
Report No.(s): AD-A353383; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An initial experimental study of the effects of compressibility on the outer variable scalings and large-scale structure of a supersonic coflowing turbulent jet operating in the wake-like mode was completed. The results showed that the large-scale structure is clearly evident in the downstream portion of the flow, where the convective Mach number has become subsonic. However the structures appear to be suppressed in the upstream portion of the flow, at supersonic convective Mach numbers. The results also showed that the local flow width and growth rate in the downstream portions of the flow are good in agreement with the scaling laws for the corresponding incompressible flow.
DTIC
High Resolution; Supersonic Jet Flow; Shear Flow; Combustion; Fluid Mechanics; Jet Mixing Flow

19990005049 Academy of Sciences (USSR), Inst. of Theoretical and Applied Mechanics, Novosibirsk, USSR
Symmetric and Asymmetric Crossing-Shock-Waves/Turbulent Boundary Layer Interactions ***Final Report, Jul. 1997 - Jul. 1998***
Zheltovodov, Alexander A.; Maksimov, Alexander I.; Jul. 1998; 78p; In English
Contract(s)/Grant(s): F61708-97-W-0136
Report No.(s): AD-A353759; EOARD-SPC-97-4045; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report results from a contract tasking Institute of Theoretical and Applied Mechanics as follows: The contractor will analyze experimental data (obtained at ITAM) such as surface flow visualization, surface pressure, adiabatic wall temperature and surface heat transfer for symmetric and asymmetric crossing shock waves/turbulent boundary layer interactions as detailed in his proposal submitted in April 1997.
DTIC
Asymmetry; Crossings; Shock Waves; Turbulent Boundary Layer; Theoretical Physics; Axisymmetric Flow

19990005984 Physics and Electronics Lab. TNO, The Hague, Netherlands
High Speed Body Motion in Water ***Final Report***
Volwerk, C., Physics and Electronics Lab. TNO, Netherlands; Windt, J., Maritime Research Inst. Netherlands, Netherlands; Apr. 1998; 23p; In English, 1-3 Sep. 1997, Kiev, Ukraine
Contract(s)/Grant(s): A97/KM/745; TNO Proj. 27322
Report No.(s): TNO-FEL-98-A027; TD97-0393; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., P.O. Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, Microfiche

From 1-3 September 1997, a workshop on 'High Speed Body Motion in Water' was held at the Institute of Hydromechanics, Kiev, Ukraine. The workshop was divided in five sessions: hydrobionics, boundary layer flows, supercavitating flows, air-water penetration and control of cavitation. This report gives a summary of the presented lectures. The workshop was intended to improve the contacts between European/American and Ukrainian/Russian scientists and succeeded in this. The presented lectures were theoretical as well as practical and gave more insight in the behaviour of high speed body motion in water. However, still not everything is clearly understood and further research is recommended.
Author
Supercavitating Flow; Body Fluids; Hydromechanics; Boundary Layer Flow; Cavitation Flow

19990006020 Brown Univ., Div. of Applied Mathematics, Providence, RI USA
Equipment for Visualization of Transient Flow Simulations ***Final Report, 1 Mar. 1997 - 28 Mar. 1998***
Fischer, Paul F., Brown Univ., USA; Jun. 30, 1998; 5p; In English
Contract(s)/Grant(s): F49620-97-1-0123
Report No.(s): AD-A353220; AFRL-SR-BL-TR-98-0615; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This work entails both fundamental and applied research in high-order approximation methods (e.g. Essentially Non-Oscillatory (ENO) schemes, spectral, and spectral element methods) for compressible and incompressible flow simulations, electromagnetic scattering, and image processing, as well as fundamental and applied work in algorithms for high-performance parallel computers. The goal of the DURIP proposal was to improve the computer infrastructure to provide adequate storage for multiple three-dimensional data sets, to facilitate the migration of data to and from remote HPC sites as well as data movement amongst local disk farms and graphics engines, and provide fast workstations for data interrogation, visualization and video imaging.
DTIC
Scientific Visualization; Flow Visualization; Electromagnetic Scattering; Image Processing; Imaging Techniques; Parallel Computers; Simulation; Oscillations; Incompressible Flow; Compressible Flow

19990007753 Defence Science and Technology Organisation, Aeronautical and Martime Research Lab., Melbourne, Australia
Numerical Modelling of Shock Wave and Pressure Pulse Generation by Underwater Explosions
Brett. John M., Defence Science and Technology Organisation, Australia; Jun. 1998; 26p; In English
Report No.(s): DSTO-TR-0677; DODA-AR-010-558; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The continuing development of multi-purpose finite element analysis (FEA) codes permits their application to provide new and penetrating insights into the difficult subject of underwater explosive effects and the coupled response of nearby structures. In this paper we investigate the use of one such code (DYNA2D) to model the physical processes associated with an underwater explosion. We compute models covering a range in explosive masses and depths of detonation. The models are shown to simulate much of the important physics of an underwater explosion including: explosive detonation, shock wave generation and transmission, bubble pulsation and the generation of bubble pulse pressure waves. The model results are compared to published experimental data for key features of an underwater explosion such as bubble periods, maximum bubble radii and characteristics of the shock and bubble pressure waves. The good quantitative agreement found for many of these features demonstrates that FEA codes can

be used to model important aspects of an underwater explosion. Nevertheless a number of limitations are identified, the most serious of which is the absence of some important energy loss mechanisms associated with bubble collapse.
Author
Mathematical Models; Shock Waves; Pulse Generators; Underwater Explosions; Finite Element Method; Computer Programs

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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.

19990004139 Aerojet-General Corp., Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A): Performance Verification Report. Subassembly and Complete Instrument Assembly: EOS AMSU-A1 Antenna Drive Subassembly, P/N 1356008-1, S/N 202 ***Final Report***
Nieto, A., Aerojet-General Corp., USA; Jul. 1998; 129p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): AEROJET-11183; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
This is the Performance Verification Report, EOS AMSU-AL Antenna Drive Subassy, P/N 1356008-1, SN 202 for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Antenna Components; Microwave Sounding; Rocket Sounding

19990004150 NASA Goddard Space Flight Center, Greenbelt, MD USA
Temperature Tunable Air-Gap Etalon Filter
Krainak, Michael A., NASA Goddard Space Flight Center, USA; Stephen, Mark A., NASA Goddard Space Flight Center, USA; Lunt, David L., Coronado Instrument Group, USA; Optics Letters; 1998; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We report on experimental measurements of a temperature tuned air-gap etalon filter. The filter exhibits temperature dependent wavelength tuning of 54 pm/C. It has a nominal center wavelength of 532 nm. The etalon filter has a 27 pm optical bandpass and 600 pm free spectral range (finesse approximately 22). The experimental results are in close agreement with etalon theory.
Author
Etalons; Temperature Dependence; Temperature Measurement; Tunable Filters

19990004151 NASA Goddard Space Flight Center, Greenbelt, MD USA
Novel Spectrograph/Radiometer for Cloud Top Height Measurement Using Three Complementary Techniques
Park, Hongwoo, NASA Goddard Space Flight Center, USA; Soulen, Peter F., NASA Goddard Space Flight Center, USA; Prasad, Coorg R., Science and Engineering Services, Inc., USA; 1997; 7p; In English; Aerospace Remote Sensing, 22-26 Sep. 1997, London, UK; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
A proof-of-concept (POC) instrument system to measure cloud top height from space using three complementary techniques is presented. These techniques use measurements of: (1) thermal infrared (IR); (2) molecular oxygen 'A' band absorption; and (3) filling-in of Fraunhofer lines (the Ring effect), respectively. Combining three techniques is achieved with a single grating spectrograph with bandpass and order sorting filters by measuring I I jim radiation from the zeroth order of the grating for the IR, 750-780 nm radiation from the first order for the 'A' band absorption, and 390-400 mn radiation from the second order for the Ca K and H Fraunhofer line filling-in effect. The POC system and its measurement results with the POC system are described.
Author
Cloud Height Indicators; Infrared Radiation; Fraunhofer Lines; H Lines; Bandpass Filters

19990004179 Northwestern Univ., Center for Quantum Devices, Evanston, IL USA
GaAs-GaInP Superlattices for Intersubband Photodetection ***Final Report, Jun. 1995 - May 1998***
Razeghi, Manijeh; Sep. 1998; 14p; In English
Contract(s)/Grant(s): F49620-95-1-0422
Report No.(s): AD-A353981; AFRL-SR-BL-TR-98-0645; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have demonstrated the first QWIP detectors using the quaternary InGaAlAs/InP materials system. We have observed excellent responsivity in the InGaAlAs/InP system compared to GaAs/AlGaAs QWIPs. by increasing the bandgap from ternary InGaAs to quaternary InGaAlAs we have shifted the responsivity out to longer wavelengths resulting in cutoff wavelengths of 13.3 and 19.4 micrometers, respectively for AlAs mole fractions of 0.1 and 0.15. We have also demonstrated lattice-matched mid-wavelength infrared detectors using InGaAs/InAlAs quantum wells. by combining both types of devices, we have produced the first lattice-matched dual band mid-wavelength and long-wavelength QWIP detectors on InP substrate. We have also demonstrated long-wavelength QWIPs (Lambda > 12 micrometers) in GaAs-GaInP structures, and theoretically calculated the performance of these devices.
DTIC
Gallium Arsenides; Gallium Phosphides; Indium Phosphides; Superlattices; Photometers; Infrared Detectors

19990004345 NASA Goddard Space Flight Center, Greenbelt, MD USA
Maintaining Flatness of a Large Aperture Potassium Bromide Beamsplitter Through Mounting and Vibration
Losch, Patricia, NASA Goddard Space Flight Center, USA; Lyons, James J., III, NASA Goddard Space Flight Center, USA; Morell, Armando, NASA Goddard Space Flight Center, USA; Heaney, Jim, Swales Aerospace, USA; 1998; 14p; In English; 8th; Cyrogenic Optical Systems and Instruments, Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Composite Infrared Spectrometer (CIRS) instrument on the Cassini Mission launched in October of 1997. The CIRS instrument contains a mid-infrared (MIR) and a far-infrared interferometer (FIR) and operates at 170 Kelvin. The MIR is a Michelson Fourier transform spectrometer utilizing a 76 mm (3 inch) diameter potassium bromide beamsplitter and compensator pair. The potassium bromide elements were tested to verify effects of cooldown and vibration prior to integration into the instrument. The instrument was then aligned at ambient temperatures, tested cryogenically and re-verified after vibration. 'Me stringent design optical figure requirements for the beamsplitter and compensator included fabrication errors, mounting stresses and vibration load effects. This paper describes the challenges encountered in mounting the elements to minimize distortion and to survive vibration.
Author
Infrared Spectrometers; Cassini Mission; Potassium Bromides; Fourier Transformation; Vibration Effects; Beam Splitters; Flatness

19990004641 Rutherford Appleton Lab., Chilton, UK
The Performance of Gas Microstrip and Gas Pixel Detectors for Use on ISIS Beam Lines: A Monte Carlo Study
Bateman, J. E., Rutherford Appleton Lab., UK; Rhodes, N. J., Rutherford Appleton Lab., UK; Stephenson, R., Rutherford Appleton Lab., UK; Feb. 1998; ISSN 1358-6254; 11p; In English
Report No.(s): RAL-TR-98-024; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

A monte carlo model has been developed to simulate the interaction of a slow neutron beam with Gas MicroStrip Detectors (GMSD) and other forms of gas detector. The model permits the exploration of the trade-off between spatial resolution and detection efficiency in detectors proposed for various applications on ISIS.
Author
Performance Tests; Gas Detectors; Models; Monte Carlo Method

19990005964 AeroSurvey, Inc., Manhattan, KS USA
Design, Construction, and Performance of a Plume Generator for Remote Sensing Research ***Final Report, Aug. 1996 - Dec. 1997***
Chaffin, C. T., AeroSurvey, Inc., USA; Marshall, T. L., AeroSurvey, Inc., USA; Apr. 1998; 31p; In English
Contract(s)/Grant(s): DAAD05-97-P-0616; DAAD05-97-P-2053
Report No.(s): AD-A353374; ERDEC-CR-261; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A device has been built to generate heated plumes with controlled temperature and composition profiles. The plume generator is intended as a tool to facilitate remote sensing research. This report details construction of the device, provides performance specifications for the plume generator and its components, and includes data illustrating the device's capabilities.
DTIC
Construction; Plumes; Remote Sensing; Temperature Profiles

19990005987 Rutherford Appleton Lab., Chilton, UK
Gain Stabilisation in Proportional Counters
Bateman, J. E., Rutherford Appleton Lab., UK; Jul. 16, 1998; ISSN 1358-6254; 16p; In English
Report No.(s): RAL-TR-1998-044; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

In studying the sensitivity of the gain of flow gas counters to ambient conditions it is found that a simple model of the avalanche process can be adapted to give an excellent description of the dependence of the gas gain on pressure (P) and temperature (T) around ambient. Four types of detector are studied: the wire counter, the pin detector, the parallel gap detector and the gas microstrip detector. It is found that a simple linear servo equation using the variable P/T can be used to stabilize counters by adjusting the applied anode potential.
Author
Gas Detectors; Proportional Counters; Gas Pressure; Ambience; Stabilization; Avalanches

19990007760 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Calibration of the ROSAT HRI Spectral Response ***Annual Report Nos. 1-3, 1 Oct. 1995 - 30 Sep. 1998***
Prestwich, Andrea, Smithsonian Astrophysical Observatory, USA; Sep. 1998; 18p; In English
Contract(s)/Grant(s): NAG5-3069; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ROSAT High Resolution Imager has a limited (2-band) spectral response. This spectral capability can give X-ray hardness ratios on spatial scales of 5 arcseconds. The spectral response of the center of the detector was calibrated before the launch of ROSAT, but the gain decreases-with time and also is a function of position on the detector. to complicate matters further, the satellite is ”wobbled”, possibly moving a source across several spatial gain states. These difficulties have prevented the spectral response of the ROSAT HRI from being used for scientific measurements. We have used Bright Earth data and in-flight calibration sources to map the spatial and temporal gain changes, and written software which will allow ROSAT users to generate a calibrated XSPEC response matrix and hence determine a calibrated hardness ratio. In this report, we describe the calibration procedure and show how to obtain a response matrix. In Section 2 we give an overview of the calibration procedure, in Section 3 we give a summary of HRI spatial and temporal gain variations. Section 4 describes the routines used to determine the gain distribution of a source. In Sections 5 and 6, we describe in detail how the Bright Earth database and calibration sources are used to derive a corrected response matrix for a given observation. Finally, Section 7 describes how to use the software.
Author
ROSAT Mission; Calibrating; Spatial Distribution; Spectra

19990008143 Helsinki Univ. of Technology, Lab. of Media Technology, Espoo, Finland
Helsinki University of Technology, Laboratory of Media Technology ***Annual Report***
1998; 72p; In English
Report No.(s): PB99-108300; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

Contents include the following: General; Set-Ups for Optical Characterization of Papers and Prints; High Performance Products for Ink Jet Printing; Paper as Information Carrier; Information Efficiency in Print and Net Media; Colour Image Processing in Networked Environment; Measurement of EP Color Quality; Education; Publications; and Contact Information.
NTIS
Image Processing; Electronic Publishing; Media

19990008255 Princeton Univ., Dept. of Mechanical and Aerospace Engineering, NJ USA
Preston Probe Calibrations at High Reynolds Number
Smits, Alexander J., Princeton Univ., USA; Nov. 13, 1998; 12p; In English
Contract(s)/Grant(s): NAG1-1920; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall goal of the research effort is to study the performance of two Preston probes designed by NASA Langley Research Center across an unprecedented range of Reynolds number (based on friction velocity and probe diameter), and perform an accurate calibration over the same Reynolds number range. Using the Superpipe facility in Princeton, two rounds of experiments were performed. In each round of experiments for each Reynolds number, the pressure gradient, static pressure from the Preston probes and the total pressure from the Preston probes were measured. In the first round, 3 Preston probes having outer diameters of 0.058 inches, 0.083 inches and 0.203 inches were tested over a large range of pipe Reynolds numbers. Two data reduction methods were employed: first, the static pressure measured on the Preston probe was used to calculate P (modified Preston probe configuration), and secondly, the static pressure measured at the reference pressure tap was used to calculate P (un-modified Preston probe configuration). For both methods, the static pressure was adjusted to correspond with the static pressure at the Preston probe tip using

the pressure gradient. The measurements for Preston probes with diameters of 0.058 inches, and 0.083 inches respectively were performed in the test pipe before it was polished a second time. Therefore, the measurements at high pipe Reynolds numbers may have been affected by roughness. In the second round of experiments the 0.058 inches and 0.083 inches diameter, un-modified probes were tested after the pipe was polished and prepared to ensure that the surface was smooth. The average velocity was estimated by assuming that the connection between the centerline velocity and the average velocity was known, and by using a Pitot tube to measure the centerline velocity. A preliminary error estimate suggests that it is possible to introduce a 1% to 2% error in estimating the average velocity using this approach. The evidence on the errors attending the second data set is somewhat circumstantial, and the measurements have not been repeated using a better approach, it seems probable that the correlation given applies to un-modified Preston probes over the range 6.4 less than x* less than 11.3.
CASI
Calibrating; Shear Stress; Wall Pressure; Pitot Tubes; Dynamic Pressure; High Reynolds Number; Pressure Measurement

36
LASERS AND MASERS

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

19990004077 Army Natick Research and Development Command, MA USA
Experimental Uncertainty in Laser-Based Optical Density Measurements ***Final Report, Jun. 1997 - Aug. 1997***
Kimball, Brian R., Army Natick Research and Development Command, USA; DeCristofano, Barry S., Army Natick Research and Development Command, USA; Nakashima, Masata, Army Natick Research and Development Command, USA; Sep. 1997; 16p; In English
Report No.(s): AD-A354056; NATICK/TR-97/018; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report summarizes the development and application of an uncertainty analysis used to define the tolerances in experimentally determined laser-based optical density values of laser protective materials and devices, Uncertainty expressions are derived, which can be used to generate a unique tolerance for each experimental optical density measurement performed. The laboratory setup is described and a sample experimental run is presented, which compares ODs obtained using a UV/vis spectrophotometer to those obtained with the described laser system. In all cases the ODs of the laser-based system fall within the predicted tolerances.
DTIC
Safety; Experimentation; Optical Density; Density Measurement; Protective Coatings; Protection; Lasers

19990004080 Naval Research Lab., Washington, DC USA
How the Cost of Electricity Varies with Laser Efficiency and Target Gain ***Interim Report***
Bodner, Stephen E., Naval Research Lab., USA; Sep. 30, 1998; 9p; In English
Report No.(s): AD-A354049; NRL/MR/6730--98-8193; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The cost of electricity in a laser fusion power plant is relatively insensitive to the efficiency of the laser, if the target gain is approximately 110. The cost of electricity will be more sensitive to laser parameters such as the beam uniformity, the operation and maintenance costs, and the capital costs.
DTIC
Lasers; Costs; Electricity; Sensitivity

19990004084 Duke Univ., Dept. of Ophthalmology, Durham, NC USA
Ultrashort Laser Pulse Effects on Ocular Tissue: Histopathologic Analysis and Surgical Techniques ***Final Report, 15 Apr. 1995 - 14 Apr. 1998***
Toth, Cynthia A., Duke Univ., USA; 1998; 12p; In English
Contract(s)/Grant(s): F49620-95-1-0266; AF Proj. 2312
Report No.(s): AD-A352998; AFRL-SR-BL-TR-98-0609; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Toth et al. identified the acute pathologic retinal events which determined the extent of tissue damage from minimal laser energy and suprathreshold energy. She identified the acute pathology of primate maculas with minimal visible retinal lesions generated by 90 femtosecond and 5 picosecond pulses of 580 nm laser energy. Dr. Toth's study included light microscopic evaluation of macular damage and electron microscopic ultrastructural analysis of melanosome ruptures within the retinal pigment epithelium. The pathology was reported at AFOSR with a CDROM summary of lesion data provided to Armstrong Laboratory for reference. Dr. Toth scored the area and extent of tissue damage and compiled a list for Dr. Rockwell and Dr. Clarence Cain at Armstrong

Laboratory, Brooks, AFB for analysis and comparison to the ED50 MVL data. A paper summarizing this work has been published as the lead article in October, 1997 in Investigative Ophthalmology and Visual Science (I0VS). Dr. Toth's Laboratory group gathered significant tissue data on ultrashort pulses of other laser wavelengths. They collaborated with Armstrong Laboratory (Dr. Cain et al.) in analyzing near-infrared ultrashort laser pulse injury MVL data which was published at Society of Photo-Optical Instrumentation Engineers (SPIE), 1997 (Cain, Toth, et al.).
DTIC
Pulsed Lasers; Ophthalmology; Biology; Tissues (Biology)

19990004116 Max-Born-Inst., Berlin, Germany
Seventh International Workshop on Laser Physics (LPHYS 1998) ***Final Report***
Aug. 18, 1998; 166p; In English; 7th; Laser Physics, 6-10 Jul. 1998, Berlin, Germany
Contract(s)/Grant(s): F61775-98-W-E068
Report No.(s): AD-A353908; EOARD-CSP98-1043; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The Final Proceedings for 7th International Workshop on Laser Physics LPHYS '98, 6 July 1998- 10 July 1998. This is an interdisciplinary conference. Topics include strong-field phenomena, laser spectroscopy, laser cooling and atom optics, physics of solid state lasers, and modern trends in laser physics, including far IR, X-ray, and gamma ray lasers.
DTIC
Conferences; Lasers; Laser Applications

19990004400 Academy of Sciences (USSR), Inst. of General Physics, Moscow, USSR
7th International Workshop on Laser Physics (LPHYS 1998), Volume 1, Program and Book of Abstracts
Jul. 1998; 165p; In English; 7th; Laser Physics, 6-10 Jul. 1998, Berlin, Germany
Report No.(s): AD-A354024; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The proceedings of the 7th International Workshop on Laser Physics. The topics covered at this seminar include; Modern Trends in Laser Physics, Laser Spectroscopy ; Laser Cooling and Atom Optics, Physics of Solid State Lasers and Laser Methods in Medicine.
DTIC
Conferences; Laser Applications; Lasers; Quantum Electronics

19990004401 Academy of Sciences (USSR), Inst. of General Physics, Moscow, USSR
7th International Workshop on Laser Physics (LPHYS 1998), Volume 2, Program and Book of Abstracts
Haus, Magnus; Heraeus, Wilhelm H.; Heraeus-Stiftung, Else; Jul. 1998; 207p; In English; 7th; Laser Physics, 6-10 Jul. 1998, Berlin, Germany
Report No.(s): AD-A354025; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
The proceedings of the 7th International Workshop on Laser Physics. The topics covered at this seminar include; Modern Trends in Laser Physics, Laser Spectroscopy; Laser Cooling and Atom Optics, Physics of Solid State Lasers; Laser Methods in Medicine; and WE-Heraeus Seminar on "Strong-Field Phenomena".
DTIC
Conferences; Laser Applications; Lasers; Solid State Lasers; Quantum Electronics

19990006019 University of Central Florida, Dept. of Physics, CREOL and EE, Orlando, FL USA
Mode-locked Semiconductor Laser at 0.2 mm (1.5 THz) ***Final Report, 1 Jun. 1997 - 31 May 1998***
Peale, Robert E., University of Central Florida, USA; Aug. 30, 1998; 19p; In English; Sponsored in part with DURIP.
Contract(s)/Grant(s): F49620-97-1-0434
Report No.(s): AD-A353214; TR-1168506; AFRL-SR-BL-TR-98-0616; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Pulse separation control for mode-locked far-infrared p-Ge lasers, self-mode-locking in p-Ge laser emission, and high-field stark effect for shallow impurity lines in p-Ge laser emission are reported.
DTIC
Semiconductor Lasers; Stark Effect; Far Infrared Radiation; Laser Mode Locking

37
MECHANICAL ENGINEERING

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

19990005997 Ohio Aerospace Inst., Brook Park, OH USA
ASU Formula Lightning Race Vehicle Report Prepared for Ohio Aerospace Institute ***Final Report***
Sirkis, Murray D., Ohio Aerospace Inst., USA; Happ, John B., III, Ohio Aerospace Inst., USA; Gilbert, Nicholas, Ohio Aerospace Inst., USA; 1994; 166p; In English
Contract(s)/Grant(s): NCC3-373; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report describes the drive system in the Arizona State University Formula Lightning electric race car when it participated in the 1994 Cleveland Electric Formula Classic on 9 July 1994. In addition, the telemetry system used to monitor the car's performance and plans for improving the car's performance are described.
Author
Computation; Data Acquisition; Automobiles; Mechanical Drives

19990008011 NASA Ames Research Center, Moffett Field, CA USA
Full-Scale Wind Tunnel Test of the Aeroelastic Stability of a Bearingless Main Rotor
Warmbrodt, William, NASA Ames Research Center, USA; McCloud, John L., III, NASA Ames Research Center, USA; Sheffler, Marc, Boeing Vertol Co., USA; Staley, James, Boeing Vertol Co., USA; Vertica; 1982; ISSN 0360-5450; Volume 6, pp. 165-180; In English; 37th, 17-20 May 1981, New Orleans, LA, USA; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A full-scale wind tunnel test of a helicopter bearingless main rotor was conducted in the NASA- Ames 40- by 80-ft Wind Tunnel. The primary objective of the test A as to thoroughly investigate the aeroelastic stability characteristics of this advanced technology rotor in a controlled wind tunnel test environment. Rotor stability was determined in hover and at speeds up to 143 kt as a function of lift, tip speed, and shaft angle. The rotor was stable for all conditions tested. No significant decreases in stability due to support mode coalescence with the rotor inplane regressing mode were observed. Stability levels increased with increasing collective at constant tip speed and shaft angle. At constant lift, tip speed and shaft angle, the rotor stability increased between 60 and 90 kt. decreased at 120 kt, and significantly increased again at 143 kt. At constant shaft angle, tip speed, and pitch setting, the rotor loses damping with increasing airspeed above 60 kt. Reduction in the control system stiffness reduced the stability level in hover at 400 rpm but had little effect at other tip speeds. Correlation with existing stability test data is shown. Stability testing in the wind tunnel yielded similar damping trends to those obtained from whirl tower and flight tests. Comparison of wind tunnel data with calculated stability results shows that although the analysis correctly predicts stability trends with tip speed and pitch setting. the predicted damping values are generally too large. The analysis does not predict the decrease in rotor stability with airspeed at constant shaft angle, tip speed, and pitch setting as determined from the wind tunnel test.
Author
Wind Tunnel Tests; Full Scale Tests; Aeroelasticity; Stability Tests; Bearingless Rotors

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QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990004612 Connecticut Univ., Dept. of Electrical and Systems Engineering, Storrs, CT USA
Multiple Fault Isolation in Redundant Systems ***Final Report***
Pattipati, Krishna R., Connecticut Univ., USA; May 1997; 124p; In English
Contract(s)/Grant(s): NCC2-5123; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Fault diagnosis in large-scale systems that are products of modem technology present formidable challenges to manufacturers and users. This is due to large number of failure sources in such systems and the need to quickly isolate and rectify failures with minimal down time. In addition, for fault-tolerant systems and systems with infrequent opportunity for maintenance (e.g., Hubble telescope, space station), the assumption of at most a single fault in the system is unrealistic. In this project, we have developed novel block and sequential diagnostic strategies to isolate multiple faults in the shortest possible time without making the unrealistic single fault assumption.
Author
Fault Tolerance; Error Analysis; Modems; Space Stations

19990008160 Research Inst. of National Defence, Avdelningen foer Sensorteknik, Linkoeping, Sweden
ARKEN: A Preliminary Overview of Quality Issues ***ARKEN: En Inledande, Oevergripande Kvalitetsgranskning***
Akermark, H., Research Inst. of National Defence, Sweden; Apr. 1998; 58p; In Swedish
Report No.(s): PB99-102360; FOA-R-98-00775-616-SE; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In this report, the authors attempt to investigate the radar measurement system ARKEN from this broader perspective: first using Utmarkselsen Svensk Kvalitet, similar to the Malcolm Baldridge Award, then seen from the view of certification program supported by ISO 9001, EN 45 001, and NIST. In these programs, the analysis of measurement accuracy is an important issue, and the authors make a survey of the factors that influence the ARKEN system. The report concludes with a number of recommendations aimed to give ARKEN a solid, quality-oriented foundation from which it should be possible to perform broadband radar measurements of good quality.
NTIS
Radar Measurement; Broadband; Metrology

39
STRUCTURAL MECHANICS

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

19990004109 California Univ., Flight Systems Research Center, Los Angeles, CA USA
Dynamics and Control of Articulated Anisotropic Timoshenko Beams
Balakrishnan, A. V., California Univ., USA; Sep. 1996; 98p; In English
Contract(s)/Grant(s): NCC2-374
Report No.(s): TR-1-FSRC-96; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The paper illustrates the use of continuum models in control design for stabilizing flexible structures. A 6-DOF anisotropic Timoshenko beam with discrete nodes where lumped masses or actuators are located provides a sufficiently rich model to be of interest for mathematical theory as well as practical application. We develop concepts and tools to help answer engineering questions without having to resort to ad hoc heuristic (”physical”) arguments or faith. In this sense the paper is more mathematically oriented than engineering papers and vice versa at the same time. For instance we make precise time-domain solutions using the theory of semigroups of operators rather than formal ”inverse Laplace transforms.” We show that the modes arise as eigenvalues of the generator of the semigroup, which are then related to the eigenvalues of the stiffness operator. With the feedback control, the modes are no longer orthogonal and the question naturally arises as to whether there is still a modal expansion. Here we prove that the eigenfunctions yield a biorthogonal Riesz basis and indicate the corresponding expansion. We prove mathematically that the number of eigenvalues is nonfinite, based on the theory of zeros of entire functions. We make precise the notion of asymptotic modes and indicate how to calculate them. Although limited by space, we do consider the root locus problem and show for instance that the damping at first increases as the control gain increases but starts to decrease at a critical value, and goes to zero as the gain increases without bound. The undamped oscillatory modes remain oscillatory and the rigid-body modes go over into deadbeat modes. The Timoshenko model dynamics are translated into a canonical wave equation in a Hilbert space. The solution is shown to require the use of an ”energy” norm which is no more than the total energy: potential plus kinetic. We show that, under an appropriate extension of the notion of controllability, rate feedback with a collocated sensor can stabilize the structure in the sense that all modes are damped and the energy decays to zero. An example, non-numeric, is worked out in some detail illustrating the concepts and theory developed.
Author
Continuum Modeling; Dynamic Control; Timoshenko Beams; Heuristic Methods; Feedback Control; Eigenvectors; Anisotropy

19990004110 Wayne State Univ., Dept. of Mathematics, Detroit, MI USA
Active Control of Panel Vibrations Induced by a Boundary Layer Flow ***Final Report, 10 Aug. 1990 - 30 Jun. 1998***
Chow, Pao-Liu, Wayne State Univ., USA; Oct. 22, 1998; 18p; In English
Contract(s)/Grant(s): NAG1-1175; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In recent years, active and passive control of sound and vibration in aeroelastic structures have received a great deal of attention due to many potential applications to aerospace and other industries. There exists a great deal of research work done in this area. Recent advances in the control of sound and vibration can be found in the several conference proceedings. In this report we will summarize our research findings supported by the NASA grant NAG-1-1175. The problems of active and passive control

of sound and vibration has been investigated by many researchers for a number of years. However, few of the articles are concerned with the sound and vibration with flow-structure interaction. Experimental and numerical studies on the coupling between panel vibration and acoustic radiation due to flow excitation have been done by Maestrello and his associates at NASA/Langley Research Center. Since the coupled system of nonlinear partial differential equations is formidable, an analytical solution to the full problem seems impossible. For this reason, we have to simplify the problem to that of the nonlinear panel vibration induced by a uniform flow or a boundary-layer flow with a given wall pressure distribution. Based on this simplified model, we have been able to study the control and stabilization of the nonlinear panel vibration, which have not been treated satisfactorily by other authors. The vibration suppression will clearly reduce the sound radiation power from the panel. The major research findings will be presented in the next three sections. In Section II we shall describe our results on the boundary control of nonlinear panel vibration, with or without flow excitation. Section III is concerned with active control of the vibration and sound radiation from a nonlinear elastic panel. A detailed description of our work on the parametric vibrational control of nonlinear elastic panel will be presented in Section IV. This paper will be submitted to the Journal of Acoustic Society of America for publication.
Derived from text
Boundary Layer Flow; Active Control; Vibration; Pressure Distribution; Aeroelasticity; Uniform Flow

19990004187 Old Dominion Univ., Dept. of Civil and Environmental Engineering, Norfolk, VA USA
New Parallel Algorithms for Structural Analysis and Design of Aerospace Structures ***Final Report, Period ending 30 Jun. 1998***
Nguyen, Duc T., Old Dominion Univ., USA; Oct. 1998; 88p; In English
Contract(s)/Grant(s): NAG1-858; ODURF Proj. 184047; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Subspace and Lanczos iterations have been developed, well documented, and widely accepted as efficient methods for obtaining p-lowest eigen-pair solutions of large-scale, practical engineering problems. The focus of this paper is to incorporate recent developments in vectorized sparse technologies in conjunction with Subspace and Lanczos iterative algorithms for computational enhancements. Numerical performance, in terms of accuracy and efficiency of the proposed sparse strategies for Subspace and Lanczos algorithm, is demonstrated by solving for the lowest frequencies and mode shapes of structural problems on the IBM-R6000/590 and SunSparc 20 workstations.
Author
Algorithms; Aircraft Structures; Structural Analysis; Vibration Mode

19990004391 New Hampshire Univ., Dept. of Mechanical Engineering, Durham, NH USA
Stress-Intensity Factors Along Three-Dimensional Elliptical Crack Fronts ***Final Report***
Gosz, M., New Hampshire Univ., USA; Moran, B., Federal Aviation Administration, USA; May 1998; 14p; In English
Report No.(s): AD-A353955; DOT/FAA/AR-96/97; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the present investigation is to determine the model stress-intensity factors along two symmetric surface cracks emanating from a centrally located hole in a rectangular plate (the so-called Round Robin Problem) using the domain integral method. In order to validate the present three-dimensional domain integral implementation, two comparisons were made with benchmark solutions. We first considered the problem of an elliptical crack embedded in a rectangular plate. For plate dimensions much greater than the largest characteristic dimension of the elliptical crack, we compared the present finite element results with the solution of Irwin (1962) for an elliptical crack embedded in an infinitely extended solid. Next, we considered the problem of a quarter-elliptical corner crack in a rectangular,plate and compared the results with those of Newman and Raju (1983). Excellent agreement was obtained for both benchmark comparisons.
DTIC
Stress Intensity Factors; Three Dimensional Bodies; Fuselages; Research; Rectangular Plates; Cracks; Corners

19990005547 NASA Langley Research Center, Hampton,VA USA
GIF Animation of Mode Shapes and Other Data on the Internet
Pappa, Richard S., NASA Langley Research Center, USA; Dec. 1998; 20p; In English; 17th; Modal Analysis, 8-11 Feb. 1999, Kissimmee, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 632-10-14-04
Report No.(s): NASA/TM-1998-208748; L-17789; NAS 1.15:208748; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The World Wide Web abounds with animated cartoons and advertisements competing for our attention. Most of these figures are animated Graphics Interchange Format (GIF) files. These files contain a series of ordinary GIF images plus control information, and they provide an exceptionally simple, effective way to animate on the Internet. to date, however, this format has rarely

been used for technical data, although there is no inherent reason not to do so. This paper describes a procedure for creating high-resolution animated GIFs of mode shapes and other types of structural dynamics data with readily available software. The paper shows three example applications using recent modal test data and video footage of a high-speed sled run. A fairly detailed summary of the GIF file format is provided in the appendix. All of the animations discussed in the paper are posted on the Internet available through the following address: http://sdb-www.larc.nasa.gov/.
Author
Dynamic Structural Analysis; Internets; Animation; Format

19990005979 Wisconsin Univ., Platteville, WI USA
Deterministic and Probabilistic Creep and Creep Rupture Enhancement to CARES/Creep: Multiaxial Creep Life Prediction of Ceramic Structures Using Continuum Damage Mechanics and the Finite Element Method ***Final Report***
Jadaan, Osama M., Wisconsin Univ., USA; Powers, Lynn M., Case Western Reserve Univ., USA; Gyekenyesi, John P., NASA Lewis Research Center, USA; Oct. 23, 1998; 25p; In English
Contract(s)/Grant(s): NAG3-1968; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High temperature and long duration applications of monolithic ceramics can place their failure mode in the creep rupture regime. A previous model advanced by the authors described a methodology by which the creep rupture life of a loaded component can be predicted. That model was based on the life fraction damage accumulation rule in association with the modified Monkman-Grant creep ripture criterion However, that model did not take into account the deteriorating state of the material due to creep damage (e.g., cavitation) as time elapsed. In addition, the material creep parameters used in that life prediction methodology, were based on uniaxial creep curves displaying primary and secondary creep behavior, with no tertiary regime. The objective of this paper is to present a creep life prediction methodology based on a modified form of the Kachanov-Rabotnov continuum damage mechanics (CDM) theory. In this theory, the uniaxial creep rate is described in terms of stress, temperature, time, and the current state of material damage. This scalar damage state parameter is basically an abstract measure of the current state of material damage due to creep deformation. The damage rate is assumed to vary with stress, temperature, time, and the current state of damage itself. Multiaxial creep and creep rupture formulations of the CDM approach are presented in this paper. Parameter estimation methodologies based on nonlinear regression analysis are also described for both, isothermal constant stress states and anisothermal variable stress conditions This creep life prediction methodology was preliminarily added to the integrated design code CARES/Creep (Ceramics Analysis and Reliability Evaluation of Structures/Creep), which is a postprocessor program to commercially available finite element analysis (FEA) packages. Two examples, showing comparisons between experimental and predicted creep lives of ceramic specimens, are used to demonstrate the viability of this methodology and the CARES/Creep program.
Author
Creep Analysis; Creep Properties; Ceramics; Cavitation Flow; Continuum Mechanics; Damage; Finite Element Method; Deterioration; Deformation

19990008182 NASA Langley Research Center, Hampton, VA USA
A Back Face Strain Compliance Expression for the Compact Tension Specimen
Riddell, William T., NASA Langley Research Center, USA; Piascik, Robert S., NASA Langley Research Center, USA; Oct. 1998; 12p; In English
Contract(s)/Grant(s): RTOP 538-02-10-01
Report No.(s): NASA/TM-1998-208453; NAS 1.15:208453; L-17759; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A numerically generated expression to determine crack length in a compact tension specimen from back face strain compliance is presented. The numerically generated back face strain expression is bounded by two experimentally determined expressions previously published in the literature. Additionally, stress intensity factor and crack mouth opening expressions are determined. These expressions agree well with previously published results.
Author
Stress Intensity Factors; Crack Propagation; Tensile Stress; Stress Distribution; Fracture Mechanics; Cracking (Fracturing)

19990008348 Meiji Univ., School of Science and Technology, Kawasaki Japan
Analytical Study on Shear Strength of Multi-Storied Shear Walls
Takagi, Hitoyuki, Meiji Univ., Japan; Research Reports of the School of Science and Technology, Meiji University; 1996; ISSN 0916-4944, No. 14(70), pp. 11-29; In Japanese
Report No.(s): III-57; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The effects of loading condition, and height- to- width ratio and the other main parameters to the ultimate shear strength of R/C multi-storied shear wall was discussed based on series of the numerical results obtained by the finite element analysis. The aim of this paper was to take up and discuss the problem of the current shear strength formulas. It was found that the shear strength predicted by the macroscopic model of Plastic Theory compatible well with the results of the finite element method.
Author
Numerical Analysis; Shear Strength; Walls

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GEOSCIENCES (GENERAL)

19990004375 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, Y. J., NASA Goddard Space Flight Center, USA; Ramanathan, V., Scripps Institution of Oceanography, USA; 1998; 33p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

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 (EOS-AM) 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.
Author
Earth (Planet); Earth Sciences; Climate Models; Climate

19990004387 Geological Survey, Water Resources Div., Tallahassee, FL USA
Assessment of the Potential Effects of Phytoremediation on Ground-Water Flow Around Area C at Orlando Naval Training Center, Florida
Halford, K. J., Geological Survey, USA; 1998; 38p; In English
Report No.(s): PB99-103715; USGS/WRI-98-4110; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of a study to estimate the potential changes to the ground-water flow system beneath area C at Orlando NTC resulting from phytoremediation. The Report includes a description of the hydrogeologic framework, estimates of the lateral and vertical hydraulic conductivity of the upper zone and lower zone of the surficial aquifer system, and estimates of the recharge rate and average groundwater discharge to Lake Druid. Two remediation alternatives were investigated using a calibrated groundwater flow model.
NTIS
Ground Water; Water Flow; Aquifers; Water Pollution; Pollution Control; Computerized Simulation

19990005993 Lamont-Doherty Geological Observatory, Palisades, NY USA
Atmospheric, Climatic, and Environmental Research ***Final Report, 1 Oct. 1983 - 31 Dec. 1994***
Broecker, Wallace S., Lamont-Doherty Geological Observatory, USA; Gornitz, Vivien M., Columbia Univ., USA; 1994; 33p; In English
Contract(s)/Grant(s): NCC5-29; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The climate and atmospheric modeling project involves analysis of basic climate processes, with special emphasis on studies of the atmospheric CO2 and H2O source/sink budgets and studies of the climatic role of CO2, trace gases and aerosols. These studies are carried out, based in part on use of simplified climate models and climate process models developed at GISS. The principal models currently employed are a variable resolution 3-D general circulation model (GCM), and an associated "tracer" model which simulates the advection of trace constituents using the winds generated by the GCM.
Derived from text
Atmospheric Composition; Three Dimensional Models; Climatology; Climate Models; Atmospheric General Circulation Models; Atmospheric Models

19990008138 Forest Service, Rocky Mountain Research Station, Fort Collins, CO USA
Data Estimation and Prediction for Natural Resources Public Data ***Topical Report***
Schreuder, Hans T., Forest Service, USA; Reich, Robin M., Forest Service, USA; Sep. 1998; 10p; In English
Report No.(s): PB99-105413; RMRS-RN-2; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The purpose of the document is to assess the utility of multiple imputation procedures (MIPs) for missing data and predicting non-remeasured data points in multiresource inventories such as Forest Inventory and Analysis (FIA) of the USDA Forest Service (USFS) and Natural Resources Inventory (NRI) of the Natural Resources Conservation Service (NRCS). We focus on MIPs since they are well documented and often accepted for imputing missing data. They have been proposed for use in the Southern Annual Forest Inventory System (SAFIS) for predicting data in non-remeasured plots. Traditionally FIA and NRI have replaced units that could not be measured because access to the site was refused or for other reasons. Both FIA and NRI are considering adopting an annual inventory in each population of interest.
NTIS
Populations; Predictions; Earth Resources; Statistical Analysis; Data Base Management Systems

19990008142 Helsinki Univ. of Technology, Dept. of Materials Science and Rock Engineering, Espoo, Finland
Laboratory of Engineering Geology and Geophysics, Department of Materials Science and Rock Engineering, Helsinki University of Technology ***Annual Report***
Tammenmaa, Jalle, Helsinki Univ. of Technology, Finland; 1997; ISSN 0785-9740; 46p; In English
Report No.(s): PB99-108284; TKK-IGE-D-47; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Contents include the following: Preface; Curricula; Teaching; Research; Funding; Personnel; Publications; International Activities; Domestic Activities; and Mining Technology and Economic Linkage Program.
NTIS
Education; Economics; Personnel; Geophysics; Mining

19990008256 Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC USA
Evaluating Ground Water Plumes Under the Hazard Ranking System
Sep. 1998; 6p; In English
Report No.(s): PB98-963326; EPA-540-F-98-051; OSWER-9320.8-01FS; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This fact sheet provides information on potential National Priorities List (NPL) sites evaluated as contaminated ground water plumes with no identified source of contamination and how such sites are evaluated under the Hazard Ranking System (HRS). It defines steps that should be taken before a ground water plume can be evaluated as a source of contamination and summarizes scoring considerations for sites that consist solely of a ground water plume. Responses to commonly asked questions about evaluating contaminated ground water plumes at potential NPL sites are also presented. This fact sheet provides guidance only and may be amended by EPA on a site-specific basis.
NTIS
Ground Water; Plumes; Hazards; Ranking; Priorities; Contamination; Nonpoint Sources; Hazardous Materials; Water Pollution

19990008257 Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC USA
Evaluating Karst Geology Using the Hazard Ranking System
Sep. 1998; 4p; In English
Report No.(s): PB98-963327; EPA-540-F-98-052; OSWER-9320.8-02FS; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Hazard Ranking System (HRS) contains special considerations to account for the increased threat posed at sites where karst underlies any part of a source. This fact sheet discusses the definition and identification of karst, the ways in which karst conditions at the location of a source affect the HRS scoring process, and commonly-asked questions and answers.
NTIS
Karst; Geology; Ranking; Hazards; Hazardous Materials

19990008393 Geological Survey, Environmental management Technical Center, Onalaska, WI USA
Successful Water Quality Monitoring: The Right Combination of Intent, Measurement, Interpretation, and a Cooperating Ecosystem. Long Term Resource Monitoring Program
Soballe, David M., Geological Survey, USA; Journal of Lake and Reservoir Management; Aug. 1998, pp. 10-20; In English
Report No.(s): PB99-103640; LTRMP-98-R010; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper focuses on water quality monitoring that is intended to track trends in aquatic resources and advance ecological understanding. It includes examples from three monitoring programs and a simulation exercise that illustrate problems that arise when the information content of monitoring data differs from expectation. The examples show (1) how inconsistencies among, or lack of information about, the basic elements of a monitoring program (intent, design, measurement, interpretation, and the monitored system) can produce a systematic difference (bias) between monitoring measurements and sampling intent or interpretation, and (2) that bias is not just a statistical consideration, but an insidious problem that can undermine the scientific integrity of a monitoring program. Some general suggestions are provided and hopefully these examples will help those engaged in water quality monitoring to enhance and protect the value of their monitoring investment.
NTIS
Water Quality; Ecosystems; Information; Environmental Monitoring

19990008400 Geological Survey, Water Resources Div., Sacramento, CA USA
Water Resources Data for California, Water Year 1997, Volume 2, Pacific Slope Basins from Arroyo Grande to Oregon State Line Except Central Valley ***Annual Report, 1 Oct. 1996 - 30 Sep. 1997***
Webster, M. D., Geological Survey, USA; Friebel, M. F., Geological Survey, USA; Freeman, L. A., Geological Survey, USA; Oct. 1998; 346p; In English
Report No.(s): PB99-109423; USGS/WDR/CA-97/2; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
Volume 2 contains discharge records for 101 gaging stations, gage height records for 7 stations, stage and contents for 6 lakes and reservoirs, and water quality for 12 stations and 10 water-quality partial-record miscellaneous sites. Also included are data for 1 low-flow partial-record station and 3 miscellaneous measurement stations.
NTIS
Water Quality; Water Resources; Surface Water; Hydrology; Discharge

19990008401 Geological Survey, Water Resources Div., Sacramento, CA USA
Water Resources Data for California, Water Year 1997, Volume 3, Southern Central Valley Basins and the Great Basin from Walker River to Truckee River ***Annual Report, 1 Oct. 1996 - 30 Sep. 1997***
Anderson, S. W., Geological Survey, USA; Hayes, P. D., Geological Survey, USA; Rockwell, G. L., Geological Survey, USA; Oct. 1998; 494p; In English
Report No.(s): PB99-109431; USGS/WDR/CA-97/3; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche
Volume 3 contains discharge records for 170 gaging stations, stage and contents for 43 lakes and reservoirs, and water quality for 30 stations. Also included is 1 crest-stage partial-record station and 1 miscellaneous partial-record site.
NTIS
Water Quality; Water Resources; Surface Water; Hydrology; River Basins; Tables (Data); Discharge

19990008402 Geological Survey, Water Resources Div., Sacramento, CA USA
Water Resources Data for California, Water Year 1997., Volume 1, Southern Great Basin from Mexican Border to Mono Lake Basin, and Pacific Slope Basins from Tijuana River to Santa Maria River ***Annual Report, 1 Oct. 1996 - 30 Sep. 1997***
Hayes, P. D., Geological Survey, USA; Agajanian, J., Geological Survey, USA; Rockwell, G. L., Geological Survey, USA; Oct. 1998; 438p; In English
Report No.(s): PB99-109449; USGS/WDR/CA-97/1; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche
Volume 1 contains discharge records for 151 gaging stations and 16 crest-stage partial-record stations, stage and contents for 21 lakes and reservoirs, gage height records for 1 station, water quality for 23 streamflow-gaging stations and 10 partial-record stations, and precipitation data for 5 stations.
NTIS
Water Quality; Water Resources; Surface Water; Hydrology; River Basins; Tables (Data); Discharge

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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.

19990004170 Woods Hole Oceanographic Inst., MA USA
Coastal Landform Management in Massachusetts
Crago, Tracey I.; DeRosa, Sheri D.; Aug. 1998; 119p; In English, 9-10 Oct. 1997, Woods Hole, MA, USA
Report No.(s): AD-A353480; WHOI-98-16; WHOI-W-97-001; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The primary objective of this publication is to share with a wider audience the information and ideas that were shared by those attending the first workshop on Coastal Landform Management in Massachusetts that was held at the Woods Hole Oceanographic Institution on October 9 and 10, 1997. The workshop was designed to benefit resource management decision-makers through interactive exercises and discussions of coastal problems ranging from those that arise everyday to those of unusual complexity. The immediate objective of the workshop was to improve familiarity with existing management methodologies. The long-term objective was to improve the methodologies themselves.
DTIC
Conferences; Landforms; Oceanography; Resources Management

19990005961 Scripps Institution of Oceanography, La Jolla, CA USA
Curating SIO Geological Collections
Berger, Wolf H., Scripps Institution of Oceanography, USA; Sanfilippo, Annika, Scripps Institution of Oceanography, USA; Sep. 1998; 4p; In English
Contract(s)/Grant(s): N00014-96-1-0218
Report No.(s): AD-A353282; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of curating the Geological Collections at Scripps Institution of Oceanography is: (1) to receive, maintain and preserve the deep-sea sediments and dredge hauls under conditions that will minimize their deterioration, (2) to collect and disseminate data about core and dredge samples to the geological community and the community at large, (3) to make appropriate research materials available for areas of investigation such as ocean history, paleoclimate, continental weathering processes and plankton evolution, and (4) to promote the educational goals of SIO and UCSD. Effective curating helps investigators in many ways. For example, a new investigation can be based largely on existing cores and dredge hauls, thus saving or reducing the cost of mounting a special-purpose collecting expedition, and each investigator benefits by being able to place his/her results precisely in the context provided by earlier investigators. We use a variety of databases to store and retrieve information on our collections and the research results derived from them. The activities toward achieving these objectives will continue through the period of the current proposal. The directions and scope of the purely curatorial tasks will remain much the same as during the past. SIO Geological Collections will acquire new research and teaching materials from several recently retired principal investigators. Another long-range goal is to re-curate numerous samples collected in the 1950s to ensure their continued accessibility and future usefulness.
DTIC
Oceanography; Dredging; Data Bases; Education; Geology; Collection

19990005994 NASA Goddard Space Flight Center, Greenbelt, MD USA
Satellite Estimation of Spectral Surface UV Irradiance, 2, Effect of Horizontally Homogeneous Clouds
Krothov, N., Raytheon STX Corp., USA; Herman, J. R., NASA Goddard Space Flight Center, USA; Bhartia, P. K., NASA Goddard Space Flight Center, USA; Ahmad, Z.a, Science and Data Systems, USA; Fioletov, V., Atmospheric Environment Service, Canada; 1998; 26p; In English; ECUV, 2 Nov. 1998, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The local variability of UV irradiance at the Earth's surface is mostly caused by clouds in addition to the seasonal variability. Parametric representations of radiative transfer RT calculations are presented for the convenient solution of the transmission T of ultraviolet radiation through plane parallel clouds over a surface with reflectivity R(sub s). The calculations are intended for use with the Total Ozone Mapping Spectrometer (TOMS) measured radiances to obtain the calculated Lambert equivalent scene reflectivity R for scenes with and without clouds. The purpose is to extend the theoretical analysis of the estimation of UV irradiance from satellite data for a cloudy atmosphere. Results are presented for a range of cloud optical depths and solar zenith angles for the cases of clouds over a low reflectivity surface R(sub s) less than 0.1, over a snow or ice surface R(sub s) greater than 0.3, and for transmission through a non-conservative scattering cloud with single scattering albedo omega(sub 0) = 0.999. The key finding for conservative scattering is that the cloud-transmission function C(sub T), the ratio of cloudy-to clear-sky transmission,

is roughly C(sub T) = 1 - R(sub c) with an error of less than 20% for nearly overhead sun and snow-free surfaces. For TOMS estimates of UV irradiance in the presence of both snow and clouds, independent information about snow albedo is needed for conservative cloud scattering. For non-conservative scattering with R(sub s) greater than 0.5 (snow) the satellite measured scene reflectance cannot be used to estimate surface irradiance. The cloud transmission function has been applied to the calculation of UV irradiance at the Earth's surface and compared with ground-based measurements.
Author
Ultraviolet Radiation; Annual Variations; Estimates; Optical Thickness; Radiative Transfer; Spectral Emission

19990008045 NASA Marshall Space Flight Center, Huntsville, AL USA
Analysis of Vegetation Within A Semi-Arid Urban Environment Using High Spatial Resolution Airborne Thermal Infrared Remote Sensing Data
Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; Ridd, Merrill K., Utah Univ., USA; Atmospheric Environment; 1998; ISSN 1352-2310; Volume 32, No. 1, pp. 19-33; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

High spatial resolution (5 m) remote sensing data obtained using the airborne Thermal Infrared Multispectral Scanner (TIMS) sensor for daytime and nighttime have been used to measure thermal energy responses for 2 broad classes and 10 subclasses of vegetation typical of the Salt Lake City, Utah urban landscape. Polygons representing discrete areas corresponding to the 10 subclasses of vegetation types have been delineated from the remote sensing data and are used for analysis of upwelling thermal energy for day, night, and the change in response between day and night or flux, as measured by the TIMS. These data have been used to produce three-dimensional graphs of energy responses in W/ sq m for day, night, and flux, for each urban vegetation land cover as measured by each of the six channels of the TIMS sensor. Analysis of these graphs provides a unique perspective for both viewing and understanding thermal responses, as recorded by the TIMS, for selected vegetation types common to Salt Lake City. A descriptive interpretation is given for each of the day, night, and flux graphs along with an analysis of what the patterns mean in reference to the thermal properties of the vegetation types surveyed in this study. From analyses of these graphs, it is apparent that thermal responses for vegetation can be highly varied as a function of the biophysical properties of the vegetation itself, as well as other factors. Moreover, it is also seen where vegetation, particularly trees, has a significant influence on damping or mitigating the amount of thermal radiation upwelling into the atmosphere across the Salt Lake City urban landscape. Published by Elsevier Science Ltd.
Author
Vegetation; Spatial Resolution; Infrared Detectors; Remote Sensing; Thermodynamic Properties

19990008124 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Enhancement to Hitran to Support the NASA EOS Program ***Progress Report No. 2, 21 Apr. 1997- 20 Apr. 1998***
Kirby, Kate P., Smithsonian Astrophysical Observatory, USA; Rothman, Laurence S., Smithsonian Astrophysical Observatory, USA; Nov. 1998; 40p; In English
Contract(s)/Grant(s): NAS5-96023; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The HITRAN molecular database has been enhanced with the object of providing improved capabilities for the EOS program scientists. HITRAN itself is the database of high-resolution line parameters of gaseous species expected to be observed by the EOS program in its remote sensing activities. The database is part of a larger compilation that includes IR cross-sections, aerosol indices of refraction, and software for filtering and plotting portions of the database. These properties have also been improved. The software has been advanced in order to work on multiple platforms. Besides the delivery of the compilation on CD-ROM, the effort has been directed toward making timely access of data and software on the world wide web.
Author
Aerosols; Gas Composition; High Resolution; Refraction; Remote Sensing; Spectroscopy

19990008176 NASA Goddard Space Flight Center, Greenbelt, MD USA
Global Seismicity: Three New Maps Compiled with Geographic Information Systems
Lowman, Paul D., Jr., NASA Goddard Space Flight Center, USA; Montgomery, Brian C., Uniformed Services Univ. of Health Sciences, USA; 1996; 16p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents three new maps of global seismicity compiled from NOAA digital data, covering the interval 1963-1998, with three different magnitude ranges (mb): greater than 3.5, less than 3.5, and all detectable magnitudes. A commercially available geographic information system (GIS) was used as the database manager. Epicenter locations were acquired from a CD-ROM supplied by the National Geophysical Data Center. A methodology is presented that can be followed by general users. The implications of the maps are discussed, including the limitations of conventional plate models, and the different tectonic behavior of

continental vs. oceanic lithosphere. Several little-known areas of intraplate or passive margin seismicity are also discussed, possibly expressing horizontal compression generated by ridge push.
Author
Geographic Information Systems; Geophysics; Lithosphere; Magnitude; Seismology; Tectonics

19990008399 Helsinki Univ. of Technology, Lab. of Space Technology, Espoo, Finland
Helsinki University of Technology, Laboratory of Space Technology ***Annual Report***
Hallikainen, Martti, Editor, Helsinki Univ. of Technology, Finland; May 1998; ISSN 0786-8154; 56p; In English
Report No.(s): PB99-108607; REPT-34; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

The activities of the Laboratory of Space Technology in 1997 are described. The Laboratory is responsible for teaching space technology at the University. Two Master of Science in Technology degrees and two Licentiate in Technology degrees were awarded. The main area in research is spaceborne and airborne remote sensing, including instrumentation, measurements and development of geophysical inversion algorithms. Six projects are funded by the European Commission and European Space Agency. The further developed HUTRAD airborne microwave radiometer system is accommodated onboard the Laboratory's Skyvan research aircraft. The aircraft was operated in several research projects. The main applications were forest inventory, snow mapping, sea ice research, water quality monitoring, and atmospheric research. Martti Hallikainen served in 1997 as President of the IEEE Geoscience and Remote Sensing Society.
NTIS
Aerospace Engineering; Research Projects; Education; Geophysics; Research Aircraft

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ENERGY PRODUCTION AND CONVERSION

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

19990008072 NASA Goddard Space Flight Center, Greenbelt, MD USA
EOS-AM1 Nickel Hydrogen Cell ***Interim Report***
Bennett, Charles W., Lockheed Martin Missiles and Space, USA; Keys, Denney J., NASA Goddard Space Flight Center, USA; Rao, Gopalakrishna M., NASA Goddard Space Flight Center, USA; Wannemacher, Hari E., Jackson and Tull, Inc., USA; Vaidyanathan, Harry, Communications Satellite Corp., USA; 1997; 27p; In English; Aerospace Battery, 1997, Huntsville, AL, USA
; NAS5-32500; NAS5-32600; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper reports the interim results of the Earth Observing System AM-1 project (EOS-AM-1) nickel hydrogen cell life test being conducted under contract to National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) at the Lockheed Martin Missile and Space (LMMS) facility in East Windsor, NJ; and at COMSAT Labs., Clarksburg, MD. The purpose of die tests is to verify that the EOS-AM-1 cell design can meet five years of real-time Low Earth Orbit (LEO) cycling. The tests include both real-time LEO and accelerated stress tests. At LMMS, the first real-time LEO simulated 99 minute orbital cycle started on February 7, 1994 and the test has been running continuously since that time, with 18,202 LEO cycles completed as of September 1, 1997. Each cycle consists of a 64 minute charge (VT at 1.507 volts per cell, 1.06 C/D ratio, followed by 0.6 ampere trickle charge) and a 35 minute constant power discharge at 177 watts (22.5% DOD). At COMSAT, the accelerated stress test consists of 90 minute orbital cycles at 60% DOD with a 30 minute discharge at 60 amperes and a 60 minute charge at 40 amperes (VT at 1.54 volts per cell to 1.09 C/D ratio, followed by 0.6 ampere trickle charge). The real-time LEO life test battery consists of seven, 50AH (nameplate rating) Eagle-Picher, Inc. (EPI) Mantech cells manufactured into three, 3-cell pack assemblies (there are two place holder cells that are not part of the life test electrical circuit). The test pack is configured to simulate the conductive thermal design of the spacecraft battery, including: conductive aluminum sleeves, 3-cell pack aluminum baseplate, and honeycomb panel all mounted to a liquid (-5 C) cold plate. The entire assembly is located in a thermal chamber operating at +30 C. The accelerated stress test unit consists of five cells mounted in machined aluminum test sleeves and is operating at +10 C. The real-time LEO life test battery has met all performance requirements through the first 18,202 cycles, including: end of charge mid discharge cell voltages and voltage gradients; end of charge and discharge cell pressures; within cell and between cell temperature gradients; discharge capacity; current and power levels; and all charge parameters. The accelerated stress test battery has completed 11,998 cycles when the test was terminated. The stress test unit met all test parameters. This paper reports battery perfortnances as a funcfion of cycle life for both the real-time LEO and the accelerated life test regimes.

Author
Nickel Hydrogen Batteries; COMSAT Program; Electric Batteries; Electrolytic Cells; Low Earth Orbits; Accelerated Life Tests; Earth Observing System (EOS)

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ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990004132 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Ambient Monitoring of Formaldehyde with the Methanalyzer
McClenny, W. A., Environmental Protection Agency, USA; 1998; 20p; In English
Report No.(s): PB99-102212; EPA/600/A-98/116; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. EPA is investigating real-time monitoring techniques for formaldehyde. One of these is the Methanalyzer, Model 9801P, produced as a commercial prototype formaldehyde monitor at AnalTech, Inc. The instrument response to formaldehyde is linear with a method detection limit of 0.2 ppbV. The instrument is operated in a cyclic mode alternately sampling zero air (7 min) and ambient air (3 min) in order to account for a zero drift that amounts to 0.3 ppbV/deg C.
NTIS
Real Time Operation; Formaldehyde; Air Pollution; Pollution Monitoring; Air Sampling

19990004133 ETS, Inc., Roanoke, VA USA
Baghouse Filtration Products Verification
Mycock, J. C., ETS, Inc., USA; Turner, J. H., Research Triangle Inst., USA; VanOsdell, D. W., Research Triangle Inst., USA; Farmer, J. R., Research Triangle Inst., USA; Brna, T. G., Environmental Protection Agency, USA; 1998; 94p; In English, 23-25 Sep. 1998, Toronto, Ontario, Canada
Report No.(s): PB99-102196; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The paper introduces EPA's Air Pollution Control Technology Verification (APCT) program and then focuses on the immediate objective of the program: laboratory performance verification of cleanable filter media intended for the control of fine particulate emissions. Data collected during the laboratory verification testing, which simulates operation in full-scale fabric filters, will be used to show expected performance for collection of particles = or
NTIS
Air Pollution; Pollution Control; Particulates

19990004378 NASA Goddard Space Flight Center, Greenbelt, MD USA
Impact of Tropospheric Aerosol Absorption on Ozone Retrieval from buv Measurements
Torres, O., Raytheon STX Corp., USA; Bhartia, P. K., NASA Goddard Space Flight Center, USA; Oct. 27, 1998; 28p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The impact of tropospheric aerosols on the retrieval of column ozone amounts using spaceborne measurements of backscattered ultraviolet radiation is examined. Using radiative transfer calculations, we show that uv-absorbing desert dust may introduce errors as large as 10% in ozone column amount, depending on the aerosol layer height and optical depth. Smaller errors are produced by carbonaceous aerosols that result from biomass burning. Though the error is produced by complex interactions between ozone absorption (both stratospheric and tropospheric), aerosol scattering, and aerosol absorption, a surprisingly simple correction procedure reduces the error to about 1%, for a variety of aerosols and for a wide range of aerosol loading. Comparison of the corrected TOMS data with operational data indicates that though the zonal mean total ozone derived from TOMS are not significantly affected by these errors, localized affects in the tropics can be large enough to seriously affect the studies of tropospheric ozone that are currently undergoing using the TOMS data.
Author
Tropospheric Scattering; Aerosols; Ultraviolet Radiation; Backscattering; Radiative Transfer; Biomass

19990004382 Environmental Protection Agency, Emission Standards Div., Research Triangle Park, NC USA
National Emission Standards for Hazardous Air Pollutants (NESHAP) for the Aerospace Manufacturing and Rework Industry. Background Information for Promulgated Standards. Addendum ***Final Report***
Jul. 1998; 34p; In English
Report No.(s): PB99-104655; EPA/453/R-98/009D; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On September 1, 1995, the U.S. Environmental Protection Agency (EPA) promulgated national emission standards for hazardous air pollutant (HAP) emissions from major sources in the aerospace industry (60 FR 45948). These final standards implemented Section 112(d) of the Clean Air Act as amended in 1990 (the Act). Amendments to the final rule were promulgated on March 27, 1998 (63 FR 15006). Also on March 27, 1998, the EPA proposed additional amendments to the final rule (63 FR 15034). Nineteen comment letters were submitted by representatives from fifteen companies or organizations, consisting of general aviation rework and manufacturing facilities, paint arrestor and filtration product manufacturers, filter testing laboratories, major aerospace (equipment) manufacturers, and industry trade associations. This document is an addendum to volume II of 'National Emission Standard for Hazardous Air Pollutants (NESHAP) for the Aerospace Industry - Background Information for Promulgated Standards,' July 1995, EPA Document No. EPA/R-98-003b.
NTIS
Pollution Control; Aerospace Industry; Standards; Air Pollution; Hazardous Wastes

19990004386 Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Total Risk Integrated Methodology: Technical Support Document for the TRIM.FaTE Module
Mar. 1998; 362p; In English
Report No.(s): PB98-145527; EPA/452/D-98/001; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

The Total Risk Integrated Methodology (TRIM) is a modeling system for the assessment of human health and ecological risk resulting from exposure to hazardous and criteria air pollutants. The report describes the first phase of development of the TRIM.FaTE module (the environmental fate, transport, and exposure module of TRIM) and provides detailed information (mathematical derivations, data inputs, justifications) supporting the testing and implementation of the TRIM.FaTE module.
NTIS
Procedures; Models; Assessments; Health; Ecology; Environmental Chemistry

19990004388 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Urban Air Quality Simulation with Community Multi-Scale Air Quality (CMAQ) Modeling System
Byun, D., National Oceanic and Atmospheric Administration, USA; Young, J., National Oceanic and Atmospheric Administration, USA; Gipson, G., Environmental Protection Agency, USA; Schere, K., National Oceanic and Atmospheric Administration, USA; Godowitch, J., National Oceanic and Atmospheric Administration, USA; 1998; 8p; In English
Report No.(s): PB99-102246; EPA/600/A-98/115; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In an effort to provide a state-of-the-science air quality modeling capability, U.S. EPA has developed a new comprehensive and flexible Models-3 Community Multi-scale Air Quality (CMAQ) modeling system. The authors demonstrate CMAQ simulations for a high ozone episode in the northeastern U.S. during 12-15 July 1995 and discuss meteorological issues important for modeling of urban air quality.
NTIS
Air Quality; Cities; Meteorological Parameters

19990004632 Institute for Global Change Research and Education, Huntsville, AL USA
Global Change Research Related to the Earth's Energy and Hydrologic Cycle, ***1 Sep. 1993 - 28 Feb. 1998***
1998; 176p; In English
Contract(s)/Grant(s): NCC8-22; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

The Institute for Global Change Research and Education (IGCRE) is a joint initiative of the Universities Space Research Association (USRA) and the University of Alabama in Huntsville (UAH) for coordinating and facilitating research and education relevant to global environmental change. Created in 1992 with primary support from the National Aeronautics and Space Administration (NASA), IGCRE fosters participation by university, private sector and government scientists who seek to develop long-term collaborative research in global change science, focusing on the role of water and energy in the Earth's atmosphere and physical climate system. IGCRE is also chartered to address educational needs of Earth system and global change science, including the preparation of future scientists and training of primary and secondary education teachers.
Derived from text
Climate; Hydrological Cycle; Research; Education

19990005956 Norwegian Defence Research Establishment, Kjeller, Norway

Consequences of Catastrophic Release of Chlorine from Storage Tanks ***Konsekvenser av Katastrofeutslipp av Klor Fram Lagertanker***

Blanch, Jan, Norwegian Defence Research Establishment, Norway; Mar. 25, 1998; 13p; In Norwegian

Report No.(s): FFI/RAPPORT-98/01663; FFITOX/Oppdr-297001/138.2; ISBN 82-464-0242-0; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Chlorine is widely used both in Norway and neighboring countries. It is highly toxic, and as it is stored liquefied under pressure in large amounts, accidents or sabotage may potentially create situations endangering large numbers of people. The seriousness of such situations depend on a number of factors, of which the most important are the size and duration of the release, weather conditions, how quickly people are warned as well as protective measures and available means of evacuation. Planning and implementation of effective countermeasures can, however, only be carried out with the knowledge of the behaviour of the chlorine clouds arising from potential release scenarios. In this report, all examples are centered upon a storage tank containing 40000 kg liquid chlorine. Using a model developed at FFI, several scenarios ranging from a small hole in the tank to a catastrophic tank rupture has each been analysed for weather situations with different wind speed and atmospheric stability.

Author

Chlorine; Storage Tanks; Toxicity; Liquefied Gases; Hazards

19990006001 Environmental Protection Agency, Office of Pollution, Prevention, and Toxics, Washington, DC USA

Lead-Based Paint Abatement and Repair and Maintenance Study in Baltimore: Findings Based on Two Years of Follow-up

Dec. 1997; 150p; In English

Report No.(s): PB99-101453; EPA/747/R-97/005; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report presents two years of follow-up of the Lead-Based Paint Abatement and Repair and Maintenance (R&M) Study in Baltimore. The study was designed to characterize and compare the short-term (two months to six months) and longer-term (12 months to 24 months) effectiveness of three levels in interim control interventions (R&M 1-3) in structurally sound housing where children were at risk of exposure to lead in settled house dust and paint. R&M I included wet scraping of peeling and flaking lead-based paint on interior surfaces; limited repainting of scraped surfaces; wet cleaning with a trisodium phosphate (TSP) detergent and vacuuming with a higher efficiency particulate air (HEPA) vacuum to the extent possible in an occupied house; the provision of an entryway mat and information to occupants; and stabilization of lead-based paint on exterior surfaces to the extent possible, given the budget cap.

NTIS

Lead (Metal); Maintenance; Pollution; Buildings; Paints

19990007762 Istituto Superiore di Sanita, Rome, Italy

Advice of the Italian CCTN on the Health Risk Assessment Relative to Exposure to Automobile Emissions

Camoni, Ivano, Editor, Istituto Superiore di Sanita, Italy; Mucci, Nicolina, Editor, Istituto Superiore di Sanita, Italy; Foa, Vito, Editor, Milan Univ., Italy; Mar. 1998; ISSN 0394-9311; 109p; In English

Report No.(s): Series-Rept-98/3; Copyright; Avail: Issuing Activity (Istituto Superiore di Sanita, Viale Regina Elena, 299-00161 Rome, Italy), Hardcopy, Microfiche

Three recommendations expressed by the Italian National Toxicological Committee (CCTN) in the period 1990-1995 are reported; they concern the health impact of exposure to benzene and polycyclic aromatic hydrocarbons (PAHs), resulting from automobile exhaust products, for Italian general and occupationally exposed populations. The first recommendation takes into consideration the possible long-term effects of the unleaded gasoline, recently introduced in Italy. The latter two recommendations concern the quantitative evaluation of the risk of leukemia and of the risk of lung cancer from exposure to benzene and PAHs, resulting from automobile exhaust.

Author

Benzene; Polycyclic Aromatic Hydrocarbons; Exhaust Emission; Exposure; Health; Combustion Products

19990007805 NASA Goddard Space Flight Center, Greenbelt, MD USA

Simulation of Long Lived Tracers Using an Improved Empirically Based Two-Dimensional Model Transport Algorithm

Fleming, E. L., Meyers (Steve) and Associates Corp., USA; Jackman, C. H., NASA Goddard Space Flight Center, USA; Stolarski, R. S., NASA Goddard Space Flight Center, USA; Considine, D. B., Maryland Univ., USA; 1998; 142p; In English; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

We have developed a new empirically-based transport algorithm for use in our GSFC two-dimensional transport and chemistry model. The new algorithm contains planetary wave statistics, and parameterizations to account for the effects due to gravity waves and equatorial Kelvin waves. As such, this scheme utilizes significantly more information compared to our previous algorithm which was based only on zonal mean temperatures and heating rates. The new model transport captures much of the qualitative structure and seasonal variability observed in long lived tracers, such as: isolation of the tropics and the southern hemisphere winter polar vortex; the well mixed surf-zone region of the winter sub-tropics and mid-latitudes; the latitudinal and seasonal variations of total ozone; and the seasonal variations of mesospheric H2O. The model also indicates a double peaked structure in methane associated with the semiannual oscillation in the tropical upper stratosphere. This feature is similar in phase but is significantly weaker in amplitude compared to the observations. The model simulations of carbon-14 and strontium-90 are in good agreement with observations, both in simulating the peak in mixing ratio at 20-25 km, and the decrease with altitude in mixing ratio above 25 km. We also find mostly good agreement between modeled and observed age of air determined from SF6 outside of the northern hemisphere polar vortex. However, observations inside the vortex reveal significantly older air compared to the model. This is consistent with the model deficiencies in simulating CH4 in the northern hemisphere winter high latitudes and illustrates the limitations of the current climatological zonal mean model formulation. The propagation of seasonal signals in water vapor and CO2 in the lower stratosphere showed general agreement in phase, and the model qualitatively captured the observed amplitude decrease in CO2 from the tropics to midlatitudes. However, the simulated seasonal amplitudes were attenuated too rapidly with altitude in the tropics. Overall, the simulations with the new transport formulation are in substantially better agreement with observations compared with our previous model transport.
Author
Annual Variations; Climatology; Gravity Waves; Mesosphere; Oscillations; Parameterization; Planetary Waves; Polar Regions; Southern Hemisphere; Strontium 90; Sulfur Hexafluoride; Two Dimensional Models; Water Vapor

19990007806 Hampton Univ., Dept. of Physics, VA USA
Development of a Portable, Ground-Based Ozone Lidar Instrument for Tropospheric Ozone Research and Educational Training ***Progress Report No. 1, 1 Jul. 1997 - 30 Jun. 1998***
Chyba, Thomas, Hampton Univ., USA; Zenker, Thomas, Hampton Univ., USA; 1998; 26p; In English
Contract(s)/Grant(s): NAG1-1949; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project is to develop a portable, eye-safe, ground-based ozone lidar instrument specialized for ozone differential absorption lidar (DIAL) measurements in the troposphere. This prototype instrument is intended to operate at remote field sites and to serve as the basic unit for monitoring projects requiring multi-instrument networks, such as that discussed in the science plan for the Global Tropospheric Ozone Project (GTOP). This instrument will be based at HU for student training in lidar technology as well as atmospheric ozone data analysis and interpretation. It will be also available for off-site measurement campaigns and will serve as a test bed for further instrument development. Later development beyond this grant to extend the scientific usefulness of the instrument may include incorporation of an aerosol channel and upgrading the laser to make stratospheric ozone measurements. Undergraduate and graduate students have been and will be active participants in this research effort.
Derived from text
Optical Radar; Radar Measurement; Atmospheric Composition; Differential Absorption Lidar; Absorption Spectroscopy; Ozone

19990008053 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Particle Scattering in the Resonance Regime: Full-Wave Solution for Axisymmetric Particles with Large Aspect Ratios
Zuffada, Cinzia, Jet Propulsion Lab., California Inst. of Tech., USA; Crisp, David, Jet Propulsion Lab., California Inst. of Tech., USA; Journal of the Optical Society of America; Feb. 1997; ISSN 0740-3232; Volume 14, No. 2, pp. 459-469; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Reliable descriptions of the optical properties of clouds and aerosols are essential for studies of radiative transfer in planetary atmospheres. The scattering algorithms provide accurate estimates of these properties for spherical particles with a wide range of sizes and refractive indices, but these methods are not valid for non-spherical particles (e.g., ice crystals, mineral dust, and smoke). Even though a host of methods exist for deriving the optical properties of nonspherical particles that are very small or very large compared with the wavelength, only a few methods are valid in the resonance regime, where the particle dimensions are comparable with the wavelength. Most such methods are not ideal for particles with sharp edges or large axial ratios. We explore the utility of an integral equation approach for deriving the single-scattering optical properties of axisymmetric particles with large axial ratios. The accuracy of this technique is shown for spheres of increasing size parameters and an ensemble of randomly oriented prolate spheroids of size parameter equal to 10.079368. In this last case our results are compared with published results obtained with the T-matrix approach. Next we derive cross sections, single-scattering albedos, and phase functions for cylinders, disks, and spheroids of ice with dimensions extending from the Rayleigh to the geometric optics regime. Compared with

those for a standard surface integral equation method, the storage requirement and the computer time needed by this method are reduced, thus making it attractive for generating databases to be used in multiple-scattering calculations. Our results show that water ice disks and cylinders are more strongly absorbing than equivalent volume spheres at most infrared wavelengths. The geometry of these particles also affects the angular dependence of the scattering. Disks and columns with maximum linear dimensions larger than the wavelength scatter much more radiation in the forward and backward directions and much less radiation at intermediate phase angles than equivalent volume spheres.
Author
Optical Properties; Aerosols; Clouds (Meteorology); Algorithms; Matrices (Mathematics); Scattering Functions; Scattering Cross Sections

19990008137 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA
Development of a Hazardous Waste Incinerator Target Analyte List of Products of Incomplete Combustion ***Final Report, Jan. 1995 - Oct. 1996***
Lemieux, Paul M., Environmental Protection Agency, USA; Ryan, Jeffrey V., Environmental Protection Agency, USA; Jul. 1998; 63p; In English
Report No.(s): PB99-102618; EPA-600/R-98-076; 68-D4-0005; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The report gives results of pilot-scale incineration testing to develop a comprehensive list of products of incomplete combustion (PICs) from hazardous waste combustion (HWC) systems. Project goals were to: (1) identify the total mass of organic compounds sufficiently to estimate the toxicity of the complex mixture; (2) serve as the target analyte list for Omnibus risk assessments and, possibly, for the risk-check element of the yet-to-be-proposed rule on HWC; and (3) enable EPA's Office of Solid Waste to assess the relative importance of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans to other PICs. The tests were performed under varied combustion conditions feeding a mixed surrogate waste, resulting in the generation of many PICs. While many of the PICs were identified as target analytes using standardized sampling and analytical methods, most of the PICs in the incineration emissions were not target analytes. It can be concluded from these experiments that the current sampling and analytical schemes for characterizing HWC emissions provide an incomplete picture of the emission profile.
NTIS
Incinerators; Targets; Combustion; Hazardous Wastes; Combustion Products

19990008139 Environmental Protection Agency, Office of Research and Development, Research Triangle Park, NC USA
SCOS97 Radiocarbon Experiment
Lewis, C. W., Environmental Protection Agency, USA; Klouda, G. A., Environmental Protection Agency, USA; Marolf, J. L., ManTech Environmental Technology, Inc., USA; Stiles, D. C., Environmental Protection Agency, USA; Kronmiller, K. G., ManTech Environmental Technology, Inc., USA; 1998; 14p; In English; Air Toxics, 1-3 Sep. 1998, Cary, NC, USA; Sponsored by Environmental Protection Agency, USA
Contract(s)/Grant(s): 68-D5-0049; IAG DW13937923
Report No.(s): PB99-105652; EPA/600/A-98/126; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
One of the objectives of the 1997 Southern California Ozone Study (SCOS97) was to provide an up-to-date assessment of the importance of biogenic emissions for tropospheric ozone production in the South Coast Air Basin. To this end ambient air samples were collected during September 1997 at the Azusa air monitoring station, for subsequent measurement of their radiocarbon C-14 content. The radiocarbon sampling conducted during SCOS97 was unique in that all three phases of atmospheric organic matter (volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), and aerosol) were simultaneously and separately collected. This article summarizes progress to date in analyzing the vegetative, gasoline, and ambient CO2 and VOC samples.
NTIS
Ozone; Troposphere; Gasoline; Ambience; Carbon Dioxide; Environmental Monitoring; Vegetation; Atmospheric Chemistry; Air Pollution

19990008225 Delaware Univ., Coll. of Marine Studies, Newark, DE USA
Transmission of Atmospherically Deposited Trace Elements through an Undeveloped, Forested Maryland Watershed ***Final Report***
Church, Thomas M., Delaware Univ., USA; Scudlark, Joseph R., Delaware Univ., USA; Conko, Kathryn M., Delaware Univ., USA; Bricker, Owen P., Geological Survey, USA; Rice, Karen C., Geological Survey, USA; 1997; 104p; In English
Report No.(s): PB99-103699; CBWP-MANTA-AD-98-2; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Retention and transmission of atmospherically-derived major (H(+), Na(+), K(+), Ca(2+), Mg(2+), HCO3(-), NO3(-), SO4(-2), Cl(-), SiO2) and trace (Al, As, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Se, and Zn) species were evaluated in an undeveloped forested watershed underlain by a rather inert quartzite lithology (Bear Branch, Catoctin State Forest, Thrumont, Maryland). These comparisons were based on atmospheric input to stream export over a period of 16 months. Both wet (precipitation) and total (bulk, including vegetative throughfall) atmospheric loading to the catchment were determined. Stream export was gauged based on systematic sampling of the stream under varied flow regimes. Additionally, watershed export of both dissolved and particulate trace element phases was examined during three high run-off intensives associated with summer storms.
NTIS
Forests; Trace Elements; Watersheds; Ecology

19990008254 Atmospheric and Environmental Research, Inc., Cambridge, MA USA
Trifluoroacetic Acid from Degradation of HCFCs and HFCs: A Three-Dimensional Modeling Study
Kotamarthi, V. R., Atmospheric and Environmental Research, Inc., USA; Rodriquez, J. M., Atmospheric and Environmental Research, Inc., USA; Ko, M. K. W., Atmospheric and Environmental Research, Inc., USA; Tromp, T. K., Atmospheric and Environmental Research, Inc., USA; Sze, N. D., Atmospheric and Environmental Research, Inc., USA; Journal of Geophysical Research; Mar. 20, 1998; ISSN 0148-0227; Volume 103, No. D5, pp. 5747-5758; In English; Sponsored in part by the Alternative Fluorocarbon Environmental Acceptability Study (AFEAS), and Atmospheric Research Council of Chemical Manufacturing Association
Contract(s)/Grant(s): NAS5-97039
Report No.(s): Paper-97JC02988; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Trifluoroacetic acid (TFA; CF3COOH) is produced by the degradation of the halocarbon replacements HFC-134a, HCFC-124, and HCFC-123. The formation of TFA occurs by HFC/HCFC reacting with OH to yield CF3COX (X = F or CI), followed by in-cloud hydrolysis of CF3COX to form TFA. The TFA formed in the clouds may be reevaporated but is finally deposited onto the surface by washout or dry deposition. Concern has been expressed about the possible long-term accumulation of TFA in certain aquatic environments, pointing to the need to obtain information on the concentrations of TFA in rainwater over scales ranging from local to continental. Based on projected concentrations for HFC-134a, HCFC-124, and HCFC-123 of 80, 10, and 1 pptv in the year 2010, mass conservation arguments imply an annually averaged global concentration of 0.16 micro g/L if washout were the only removal mechanism for TFA. We present 3-D simulations of the HFC/HCFC precursors of TFA that include the rates of formation and deposition of TFA based on assumed future emissions. An established (GISS/Harvard/ UCI) but coarse-resolution (8 deg latitude by 10 deg longitude) chemical transport model was used. The annually averaged rainwater concentration of 0.12 micro g/L (global) was calculated for the year 2010, when both washout and dry deposition are included as the loss mechanism for TFA from the atmosphere. For some large regions in midnorthern latitudes, values are larger, 0.15-0.20 micro g/L. The highest monthly averaged rainwater concentrations of TFA for northern midlatitudes were calculated for the month of July, corresponding to 0.3-0.45 micro g/L in parts of North America and Europe. Recent laboratory experiments have suggested that a substantial amount of vibrationally excited CF3CHFO is produced in the degradation of HFC-134a, decreasing the yield of TFA from this compound by 60%. This decrease would reduce the calculated amounts of TFA in rainwater in the year 2010 by 26%, for the same projected concentrations of precursors.
Author
Degradation; Halocarbons; Hydrolysis; Deposition

19990008259 Academy of Natural Sciences, estuarine Research Center, Saint Leonard, MD USA
Effects of Power-Plant Generated Contaminants on Trophic Relationships in Chesapeake Bay *Final Report*
Sanders, James G., Academy of Natural Sciences, USA; Riedel, Gerhardt F., Academy of Natural Sciences, USA; Connell, Deborah B., Academy of Natural Sciences, USA; Sep. 1997; 78p; In English
Report No.(s): PB99-102097; CBWP-MANTA-TR-97-6; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This project tested the hypothesis that shifts in phytoplankton species composition that occur when Chesapeake Bay phytoplankton communities are chronically exposed to low levels of toxic trace metals can lead to altered (reduced) flow of carbon to higher trophic levels of the ’conventional’ food web and increased movement of carbon through microbial food chains and degradation pathways.
NTIS
Hypotheses; Phytoplankton; Toxicity; Metals; Carbon; Microorganisms; Power Plants

19990008395 Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Clean Air Act: Confidential Business Information Security Manual
Toomer, M. W., Environmental Protection Agency, USA; Aug. 1998; 144p; In English
Report No.(s): PB99-104663; EPA/450/B-98/001-Rev; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The procedures in this manual provide Federal, contractor, and subcontractor employees with the information necessary to utilize Confidential Business Information to perform their assigned duties without violating applicable Federal regulations protecting the rights of its owners.
NTIS
Regulations; Air Quality; Security; Manuals; Procedures

19990008397 Environmental Protection Agency, Office of Research and Development, Research Triangle Park, NC USA
Briefings and Pre-Meeting Materials for the National Academy of Sciences- National Research Council Committee on Research Priorities for Airborne Particulate Matter ***Final Report***
Dreher, K. L., Environmental Protection Agency, USA; Vandenberg, J. J., Environmental Protection Agency, USA; Jun. 1998; 408p; In English
Report No.(s): PB99-104689; EPA/600/R-98/085; MS-98-178; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

The U.S. Environmental Protection Agency (EPA) prepared the enclosed briefings and compiled the research program descriptions, abstracts and ancillary information in response to a request for such information from the National Academy of Sciences, National Research Council. Committee on Research Priorities for Airborne Particulate Matter. This information and that gathered elsewhere by the Committee, will support the Committee's development of recommendations for particulate matter research. The EPA has an extensive research program and is in the process of developing a greatly expanded ambient monitoring program. The briefing materials included herein represent summaries of these programs, which are elaborated upon in the research program descriptions and other information provided as pre-meeting materials to the Committee.
NTIS
Air Pollution; Environment Protection; Research; Documents

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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.

19990004173 Bogazici Univ., Istanbul, Turkey
Seismic Characterization Using the Belbasi Array ***Final Report***
Kuleli, Sadi; Jun. 1998; 32p; In English
Report No.(s): AD-A353485; EOARD-SPC-97-4013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Kandilli Observatory and Earthquake Research Institute as follows: The contractor will characterize the seismic structure and behavior of the Anatolian region using data from the Belbasi and Keskin arrays near Ankara, Turkey. The research will include studies to understand the amplitude and phase behavior of seismic signals received at Belbasi and other regional stations operated by KOERI. It will also include studies of the regional seismic velocity structure and tectonic features which affect the signals seen at the array.
DTIC
Characterization; Arrays

19990004613 NASA Langley Research Center, Hampton, VA USA
Tunable Far Infrared Studies in Support of Stratospheric Measurements ***Final Report, 1 Jun. 1988 - 30 Sep. 1997***
Chance Kelly, Smithsonian Astrophysical Observatory, USA; Park, K., Oregon Univ., USA; Nolt, I. G., NASA Langley Research Center, USA; Evenson, K. M., National Inst. of Standards and Technology, USA; Sep. 1998; 10p; In English
Contract(s)/Grant(s): NAGw-1292; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research performed during this reporting period has been a collaboration between institutions including the Smithsonian Astrophysical Observatory, the National Institute of Standards and Technology, the University of Oregon, and the NASA Langley Research Center. The program has included fully line-resolved measurements of submillimeter and far infrared spectroscopic line parameters (pressure broadening coefficients and their temperature dependences, and fine positions) for the analysis of field measurements of stratospheric constituents, far infrared database improvements, and studies for improved satellite measurements of

the Earth's atmosphere. This research program is designed to enable the full utilization of spectra obtained in far infrared/submillimeter field measurements, such as FIRS-2, FILOS, IBEX, SLS, EOSMLS, and proposed NASA and European Space Agency measurements of ClO and OH (e.g., PIRAMHYD) for the retrieval of accurate stratospheric altitude profiles of key trace gases involved in ozone layer photochemistry.
Author
Submillimeter Waves; Stratosphere; Spectroscopy; Pressure Broadening; Photochemical Reactions; Ozonosphere; Infrared Spectroscopy; Far Infrared Radiation; Earth Atmosphere; Atmospheric Composition; Astrophysics

19990006015 NASA Goddard Space Flight Center, Greenbelt, MD USA
Decadal Air-Sea Interaction in the North Atlantic Based on Observations and Modeling Results
Hakkinen, Sirpa, NASA Goddard Space Flight Center, USA; Sep. 1998; 59p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The decadal, 12-14 year, cycle observed in the North Atlantic SST and tide gauge data was examined using the NCEP/NCAR reanalyses, COADS data and an ocean model simulation. Besides this decadal mode, a shorter, subdecadal period of about 8 years exists in tide gauge data north of 40N, in the subpolar SST and in the winter North Atlantic Oscillation (NAO) index and in subpolar winter heat flux values. The decadal cycle is a well separated mode in a singular spectrum analysis (SSA) for a time series of SST EOF mode 1 with a center over the Gulf Stream extension. Tide gauge and SST data are consistent in that both show a significant subdecadal periodicity exclusively in the subpolar gyre, but in subtropics the 12-14 year period is the prominent, but nonstationary, decadal signal. The main finding of this study is that this 12-14 year cycle can be constructed based on the leading mode of the surface heat flux. This connection to the surface heat flux implicates the participation of the thermohaline circulation in the decadal cycle. During the cycle starting from the positive index phase of NAO, SST and oceanic heat content anomalies are created in subtropics due to local heat flux and intensification of the thermohaline circulation. The anomalies advect to the subpolar gyre where they are amplified by local heat flux and are part of the negative feedback of thermohaline circulation on itself. Consequently the oceanic thermohaline circulation slows down and the opposite cycle starts. The oscillatory nature would not be possible without the active atmospheric participation in the cycle, because it provides the unstable interaction through heat flux, without it, the oceanic mode would be damped. This analysis suggests that the two principal modes of heat flux variability, corresponding to patterns similar to North Atlantic Oscillation (NAO) and Western Atlantic (WA), are part of the same decadal cycle and an indirect measure of the north-south movement of the storm tracks.
Author
Air Water Interactions; Time Series Analysis; Periodic Variations; Ocean Models; Heat Flux

19990007779 NASA, Washington, DC USA
Composition Measurements at the Magnetopause and in the Plasma Mantle ***Final Report, 15 Aug. 1994 - 31 Jan. 1998***
Gary, S. P., NASA, USA; 1998; 98p; In English
Contract(s)/Grant(s): NAGw-4049
Report No.(s): NASA/CR-1998-207699; NAS 1.26:207699; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

This final report describes activities under NASA grant NAGW-4049 to Lockheed Missiles and Space Company. The report covers the entire period of the grant from 15 August 1994 to 31 January 1998. The original grant was for 3 years ending in August 1997; however the grant was extended 6 months to accomodate additional data analysis that added significantly to the scientific results. This is a grant under the NASA Supporting Research and Technology Program for the analysis and interpretation of the combined scientific data from the ISEE-1 Plasma Composition Experiment and the AMPTE/CCE Hot Plasma Composition Experiment. These combined data sets were used in a study of the Earth's magnetopause to develop a fundamental understanding of plasma entry and dynamics at the boundary and formation and maintenance of the low latitude boundary layer under a variety of solar wind and magnetospheric conditions and at a wide range of local times.
Derived from text
Plasma Dynamics; Magnetopause; Boundary Layers; Plasma Composition; Plasmas (Physics); Solar Wind

19990007902 NASA Marshall Space Flight Center, Huntsville, AL USA
Ring Current Modeling in a Realistic Magnetic Field Configuration
Fok, M.-C., Universities Space Research Association, USA; Moore, T. E., NASA Marshall Space Flight Center, USA; Geophysical Research Letters; Jul. 15, 1997; ISSN 0094-8534; Volume 24, No. 14, pp. 1775-1778; In English; Original contains color illustrations
Report No.(s): Paper-97GL01255; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A 3-dimensional kinetic model has been developed to study the dynamics of the storm time ring current in a dipole magnetic field. In this paper, the ring current model is extended to include a realistic, time-varying magnetic field model. The magnetic field is expressed as the cross product of the gradients of two Euler potentials and the bounce-averaged particle drifts are calculated in the Euler potential coordinates. A dipolarization event is modeled by collapsing a tail-like magnetosphere to a dipole-like configuration. Our model is able to simulate the sudden enhancements in the ring current ion fluxes and the corresponding ionospheric precipitation during the substorm expansion.
Author
Magnetic Field Configurations; Ring Currents; Three Dimensional Models; Fabrication

19990007911 Iowa State Univ. of Science and Technology, Dept. of Mechanical Engineering, Ames, IA USA
Propagation and Breaking at High Altitudes of Gravity Waves Excited by Tropospheric Forcing
Prusa, Joseph M., Iowa State Univ. of Science and Technology, USA; Smolarkiewicz, Piotr K., National Center for Atmospheric Research, USA; Garcia, Rolando R., National Center for Atmospheric Research, USA; Journal of the Atmospheric Sciences; Aug. 01, 1996; Volume 53, No. 15, pp. 2186-2216; In English
Contract(s)/Grant(s): NASA Order L-99120-C; NAGw-4060; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An anelastic approximation is used with a time-variable coordinate transformation to formulate a two-dimensional numerical model that describes the evolution of gravity waves. The model is solved using a semi-Lagrangian method with monotone (nonoscillatory) interpolation of all advected fields. The time-variable transformation is used to generate disturbances at the lower boundary that approximate the effect of a traveling line of thunderstorms (a squall line) or of flow over a broad topographic obstacle. The vertical propagation and breaking of the gravity wave field (under conditions typical of summer solstice) is illustrated for each of these cases. It is shown that the wave field at high altitudes is dominated by a single horizontal wavelength; which is not always related simply to the horizontal dimension of the source. The morphology of wave breaking depends on the horizontal wavelength; for sufficiently short waves, breaking involves roughly one half of the wavelength. In common with other studies, it is found that the breaking waves undergo ”self-acceleration,” such that the zonal-mean intrinsic frequency remains approximately constant in spite of large changes in the background wind. It is also shown that many of the features obtained in the calculations can be understood in terms of linear wave theory. In particular, linear theory provides insights into the wavelength of the waves that break at high altitudes, the onset and evolution of breaking. the horizontal extent of the breaking region and its position relative to the forcing, and the minimum and maximum altitudes where breaking occurs. Wave breaking ceases at the altitude where the background dissipation rate (which in our model is a proxy for molecular diffusion) becomes greater than the rate of dissipation due to wave breaking, This altitude, in effect, the model turbopause, is shown to depend on a relatively small number of parameters that characterize the waves and the background state.
Author
Propagation (Extension); Gravity Waves; Troposphere; Anelasticity; Two Dimensional Models; Numerical Analysis; High Altitude

19990008051 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Demonstration of Precise Calibration of Tropospheric Delay Fluctuations with Water Vapor Radiometers
Teitelbaum, L. P., Jet Propulsion Lab., California Inst. of Tech., USA; Keihm, S. J., Jet Propulsion Lab., California Inst. of Tech., USA; Linfield, R. P., Jet Propulsion Lab., California Inst. of Tech., USA; Mahoney, M. J., Jet Propulsion Lab., California Inst. of Tech., USA; Resch, G. M., Jet Propulsion Lab., California Inst. of Tech., USA; Geophysical Research Letters; Dec. 15, 1996; ISSN 0094-8534; Volume 23, No. 25, pp. 3719-3722; In English
Report No.(s): Paper-96GL03309; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The ability of water vapor radiometers (WVRs) to calibrate changes in tropospheric delay was demonstrated during very long baseline radio interferometer (VLBI) observations at Goldstone, California. WVR measurements reduced the observed VLBI delay variations over a 13 hr period by a factor of approx. = 2.5. When applied to shorter time scales, a approx. = 50% reduction in 100-700 s delay variations was achieved during conditions of high tropospheric activity. Thermal WVR noise precluded calibration of short time scale delay fluctuations during quiet tropospheric conditions.
Author
Calibrating; Troposphere; Radiometers; Water Vapor

19990008052 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Balloon-Borne Measurements of Stratospheric Radicals and their Precursors: Implications for the Production and Loss of Ozone

Osterman, G. B., Jet Propulsion Lab., California Inst. of Tech., USA; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Sen, B., Jet Propulsion Lab., California Inst. of Tech., USA; Toon, G. C., Jet Propulsion Lab., California Inst. of Tech., USA; Stachnik, R. A., Jet Propulsion Lab., California Inst. of Tech., USA; Pickett, H. M., Jet Propulsion Lab., California Inst. of Tech., USA; Margitan, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; Blavier, J.-F., Jet Propulsion Lab., California Inst. of Tech., USA; Peterson, D. B., Jet Propulsion Lab., California Inst. of Tech., USA; Geophysical Research Letters; May 01, 1997; ISSN 0094-8534; Volume 24, No. 9, pp. 1107-1110; In English

Report No.(s): Paper-97GL00921; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Measurements of hydrogen, nitrogen and chlorine radicals from a balloon flight on 25 September 1993 from Ft. Sumner, NM provide an opportunity to quantify photochemical production and loss of stratospheric ozone. Ozone loss rates determined using measured radical concentrations agree fairly well with loss rates calculated using a photochemical model. Catalytic cycles involving OH and HO2 are shown to dominate photochemical loss of ozone for altitudes between 44 and 50 km. Reactions involving NO and NO2 are the dominant sink for ozone between 25 and 38 km. The total ozone loss rate determined from the measurements balances calculated production rates for altitudes between 30 and 40 km. However, loss of ozone exceeds production by -35% between 42 and 50 km. The imbalance between production and loss of ozone above 42 km is larger than the uncertainty of any one of the critical kinetic parameters or species concentrations. No single adjustment to any of these parameters can simultaneously resolve the imbalance and satisfy constraints imposed by measured OH, HO2, NO2 and ClO. Our results are consistent with an additional mechanism for ozone production above 40 km other than photolysis of ground state O2.

Author

Balloon Flight; Chemical Analysis; Chlorine; Hydrogen; Ozone; Nitrogen; Losses

19990008061 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Transient Creep of a Composite Lower Crust, 1, Constitutive Theory

Ivins, Erik R., Jet Propulsion Lab., California Inst. of Tech., USA; Sammis, Charles G., University of Southern California, USA; Journal of Geophysical Research; Dec. 10, 1996; ISSN 0148-0227; Volume 101, No. B12, pp. 27,981-28,004; In English

Report No.(s): Paper-96JB02847; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A composite model is proposed to describe the time-dependent response of the Earth's lower crust. The motivation for such it model is twofold: First, new observations of widespread postseismic deformation indicate that the deep continental crust responds viscoelastically, having both long-and short-term decay times. Second, by any number of observationally based rationales, the lower crust is compositionally and structurally heterogeneous over many length scales. For heterogeneities that have much smaller characteristic lengths than the minimum deformation wavelength of interest, the aggregate rheology can be described by composite media theory. For wavelengths of the order of the thickness of the lower crust (approx. = 25-40 km) and larger, composite theory may be applied to heterogeneities that are smaller than about several hundred meters, or equivalent to the vertical extent of a thick lower crustal mylonitic shear zone. The composite media theory developed here is constructed using both Eshelhy-Mori-Tanaka theory for aligned generalized spheroidal inclusions and a generalized self-consistent method. The inclusions and matrix are considered to be Maxwellian viscoelastic: a rheology that is consistent with past homogeneous models of postseismic stress relaxation. The composite theory presented here introduces a transient response to a suddenly imposed stress field which does not appear in homogeneous Maxwell models. Analytic expressions for the amplitude and duration of the transient and for the effective long-and short-term viscosities of the composite are given which describe the sensitivity to inclusion concentration (phi), to shape, and to ratio of inclusion-to-matrix viscosity (R).

Author

Creep Properties; Models; Time Dependence; Seismology; Deformation; Transient Response; Earth Crust

19990008062 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Transient Creep of a Composite Lower Crust, 2, A Polymineralic Basis for Rapidly Evolving Postseismic Deformation Modes

Ivins, Erik R., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Dec. 10, 1996; ISSN 0148-0227; Volume 101, No. B12, pp. 28,005-28,028; In English

Contract(s)/Grant(s): NAS7-100

Report No.(s): Paper-96JB02846; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Postseismic horizontal strain and displacement following the June 28, 1992, Landers, California, earthquake (M(sub W) 7.3) is broad scale and cannot be explained solely by delayed afterslip located at the rupturing fault trace. Both the observed strain at

Pifion Flat Observatory (PFO) and observed Global Positioning System receiver velocities evolve rapidly after the Landers-Big Bear earthquake sequence. The observed exponential decay of these motions, with timescales of 4-34 days, may reflect a soft creep rheology in the lower crust and brittle-ductile transition zone or even within the seismogenic crust itself. Here a simple model of a two-dimensional screw dislocation in a layered Maxwell viscoelastic Earth is employed in conjunction with a composite rheology to demonstrate that the short timescale transient response modes (approx. = 4-34 days) are consistent with the behavior of a biviscous lower crust. The lowest viscosity of this system is derivable from laboratory experimental data on the long-term creep of natural quarztites, and the highest viscosity is consistent with isostasy-related lower crustal flow in a continental extensional tectonic environment. The model predicts significant stress relaxation at the base of the seismogenic crust. Near the base of the seismogenic zone, and about 4 km away from the mainshock, the rate of predicted relaxation is of the order of 0.01 MPa/ d during the first 20 days of postseismic flow. Oblate spheroidal inclusions at 5% concentration levels that are both aligned and fairly flat in shape and that have a viscosity of 3-4 x 10(exp 15) Pa s are consistent with both the amplitude and decay time of horizontal crustal strain observed at PFO after the Landers mainshock. It is speculated that the structures exposed in cross sections and in seismic reflection profiles of the lower crust that have mylonitic associations are, in part, the cause of such rapid postseismic evolution in southeastern California. Unmylonitized quartz-rich rock at sufficiently elevated temperatures could also contribute to the rapid decay modes.
Author
Earth Crust; Displacement; Earthquakes; Creep Properties; Observatories; Rheology; Screw Dislocations; Transient Response; Viscoelasticity

19990008069 NASA, Washington, DC USA
Magnetic and Ionospheric Disturbances: Collected Articles Pertaining to Sections 3 and 5 of the IGY Program (Geomagnetism and Earth Currents, Ionosphere)
Kalinin, Y. D., Editor, Academy of Sciences (USSR), USSR; Jan. 1961; 100p; Repr. from IGY Program (Moscow, Russia, Academy of Sciences), no. 1, 1959; In English; 5th; International Geophysical Year, Jul. - Aug. 1958, Moscow, Russia
Report No.(s): NASA-TT-F-49; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

During the Fifth Assembly of the Special Committee for the International Geophysical Year, convened in July - August, 1958, in Moscow, several symposia were held in different disciplines of the IGY program. On August 7, 1958, a symposium on geomagnetic and ionospheric disturbances was held. At that symposium, 18 reports were read by Soviet and foreign scientists. This booklet presents 12 reports of Soviet scientists, somewhat abbreviated for print. The titles of these reports are: Diurnal Distribution of Active Periods of Magnetic Disturbances at High Latitudes Preliminary Results of the Study of Magnetic storms During the First Months of the IGY Program; Magnetic Field of Magnetic Disturbances in the Arctic and Antarctic Regions; Preliminary Results Obtained During A Study of the Microstructure of the Most Violent Magnetic Storms, Based on Short-Period Oscillations; Concerning Methods Used in Effecting A Comparison of Magnetic Disturbances in the Arctic and Antarctic Regions; Ionospheric Disturbances at Medium Latitudes; Connection Between Ionospheric and Magnetic Disturbances at High Latitudes; Certain Types of Pulsations of the Geomagnetic Field and Earth Currents Occurring Simultaneously on the Territory of the USSR; Excitation of Short-Period Oscillations of the Geomagnetic Field During the Sudden Onset of Magnetic Storms; Certain Peculiarities of A Variable Geomagnetic Field in the Region of the Mirnyy South Pole Observatory; Behavior of the Ionosphere During Sudden Ionospheric Disturbances; and Calendar of Geomagnetic Activity in the USSR.
Derived from text
Magnetic Disturbances; Sudden Ionospheric Disturbances; Geomagnetism; International Geophysical Year; Ionospheric Currents; Magnetic Storms

19990008253 Lunar and Planetary Inst., Houston, TX USA
Comment on "Isotopic Evidence for Distinct Crustal Sources of North and South Range Ores, Sudbury Igneous Complex"
Dressler, B. O., Lunar and Planetary Inst., USA; Sharpton, V. L., Lunar and Planetary Inst., USA; Geochimica et Cosmochimica Acta; 1998; ISSN 0016-7037; Volume 62, No. 2, pp. 315-317; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In their recent paper on the isotopic evidence for distinct crustal sources of Fe-Cu-Ni sulphide ores and associated silicate phases from several mines of the Sudbury Igneous Complex (SIC), Dickin, et al. (1996) compare the lead isotope compositions of the Sublayer norite-gabbro ore and silicate phase with the lead isotope compositions of the country rocks and Sudbury Breccias north and south of the Sudbury Igneous Complex. They show that there is a close correspondence of lead signatures of the Igneous Complex with that of the country rocks and Sudbury Breccias. They maintain that this suggests an origin for the SIC by shock melting of distinct and different crustal units north and south of the SIC. All the data presented by the authors, however, were obtained from ores and feldspar phase of the Sublayer and norite of the SIC only. No quartz gabbro and granophyre data are

presented. Hence, the data of Dickin et al. (1996) would support the interpretations, if correct, only for the Sublayer and norite and not for the SIC as a whole. We agree with the authors that the lead isotope compositions of the investigated North and South range units are related to the target rocks, however, not necessarily through impact melting.
Author
Isotopes; Crusts; Sulfides; Minerals; Lead Isotopes; Gabbro

19990008385 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Lagrangian Transport Calculations Using UARS Data, Part 2, Ozone
Manney, Gloria L., Jet Propulsion Lab., California Inst. of Tech., USA; Zurek, R. W., Jet Propulsion Lab., California Inst. of Tech., USA; Froidevaux, L., Jet Propulsion Lab., California Inst. of Tech., USA; Waters, J. W., Jet Propulsion Lab., California Inst. of Tech., USA; ONeill, A., Centre for Global Atmospheric Modelling, UK; Swinbank, R., Meteorological Office, UK; Journal of the Atmospheric Sciences; Sep. 01, 1995; Volume 52, No. 17, pp. 3069-3081; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Trajectory calculations are used to examine ozone transport in the polar winter stratosphere during periods of the Upper Atmosphere Research Satellite (UARS) observations. The value of these calculations for determining mass transport was demonstrated previously using UARS observations of long-lived tracers, In the middle stratosphere, the overall ozone behavior observed by the Microwave Limb Sounder in the polar vortex is reproduced by this purely dynamical model. Calculations show the evolution of ozone in the lower stratosphere during early winter to be dominated by dynamics in December 1992 in the Arctic. Calculations for June 1992 in the Antarctic show evidence of chemical ozone destruction and indicate that approx. 50% of the chemical destruction may be masked by dynamical effects, mainly diabatic descent, which bring higher ozone into the lower-stratospheric vortex. Estimating differences between calculated and observed fields suggests that dynamical changes masked approx. 20% - 35% of chemical ozone loss during late February and early March 1993 in the Arctic. In the Antarctic late winter, in late August and early September 1992, below approx. 520 K, the evolution of vortex-averaged ozone is entirely dominated by chemical effects; above this level, however, chemical ozone depletion can be partially or completely masked by dynamical effects. Our calculations for 1992 showed that chemical loss was nearly completely compensated by increases due to diabatic descent at 655 K.
Author
Lagrangian Function; Data Bases; Ozone Depletion; Chemical Effects; Estimating; Mass Transfer

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990004081 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Radar Determination of Turbulence Exceedance Probability
Snow, J. William, Massachusetts Inst. of Tech., USA; Burke, Hsiao-hua K., Massachusetts Inst. of Tech., USA; Peduzzi, Daniel C., Massachusetts Inst. of Tech., USA; Upham, Carolyn A., Massachusetts Inst. of Tech., USA; Jordan, Michael P., Massachusetts Inst. of Tech., USA; Sep. 25, 1998; 41p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A354047; LRP-TR-1049; ESC*-TR-97-116; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modern high power Doppler VHF radar wind profilers are a valuable source of upper tropospheric turbulence intensity information. These radars can provide more comprehensive characterization of turbulence statistics than any in-situ measurement database, or even models developed from such databases. Sample data sets from two high power radar profilers, located at WSMR, New Mexico, and KSC, Florida, were obtained. The physical processes involved in turbulence production, maintenance, and dissipation were reviewed along with the phenomenology of its detection using radar. Subsequently, methodologies were developed for the retrieval of turbulence intensity statistics, or the so-called Turbulence Exceedance Probabilities (TEP), from such data. The WSMR data analysis shows that, in the 8 to 20 km altitude region, the median turbulence intensity was less than or equal 0.5 m/s. In more turbulent conditions, the 90% and 95% TEP, turbulence intensities were observed to be close to, or slightly in excess of 1.0 m/s, and 1.5 m/s, respectively. The KSC turbulence data analysis resulted in the median close to 1.0 m/s, the 90% TEP near 1.5 m/s, and the maximum 95% TEP of 1.7 m/s. Also considered are the capabilities of a recently developed Clear Air Turbulence (CAT) forecast product. The conclusion is that available TEP guidance could be validated and extended by analysis of data from high power radars.
DTIC
Meteorological Radar; Weather Forecasting; Clear Air Turbulence; Doppler Radar; Data Acquisition

19990004337 NASA Marshall Space Flight Center, Huntsville, AL USA

Total Lightning and Radar Storm Characteristics Associated with Severe Storms in Central Florida

Goodman, Steven J., NASA Marshall Space Flight Center, USA; Raghavan, Ravi, NASA Marshall Space Flight Center, USA; Ramachandran, Rahul, NASA Marshall Space Flight Center, USA; Buechler, Dennis, NASA Marshall Space Flight Center, USA; Hodanish, Stephen, National Weather Service, USA; Sharp, David, National Weather Service, USA; Williams, Earle, Massachusetts Inst. of Tech., USA; Boldi, Bob, Massachusetts Inst. of Tech., USA; Matlin, Anne, Massachusetts Inst. of Tech., USA; Weber, Mark, Massachusetts Inst. of Tech., USA; 1998; 4p; In English; 19th; Severe Storms, 14-18 Sep. 1998, Minneapolis, MN, USA Report No.(s): FA14.4; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A number of prior studies have examined the association of lightning activity with the occurrence of severe weather and tornadoes, in particular. High flash rates are often observed in tornadic storms (Taylor, 1973; Johnson, 1980; Goodman and Knupp, 1993) but not always. Taylor found that 23% of nontornadic storms and 1% of non-severe storms had sferics rates comparable to the tornadic storms. MacGorman (1993) found that storms with mesocyclones produced more frequent intracloud (IC) lightning than cloud-to-ground (CG) lightning. MacGorman (1993) and others suggest that the lightning activity accompanying tomadic storms will be dominated by intracloud lightning-with an increase in intracloud and total flash rates as the updraft increases in depth, size, and velocity. In a recent study, Perez et al. (1998) found that CG flash rates alone are too variable to be a useful predictor of (F4, F5) tornado formation. Studies of non-tomadic storms have also shown that total lightning flash rates track the updraft, with rates increasing as the updraft intensities and decreasing rapidly with cessation of vertical growth or downburst onset (Goodman et al., 1988; Williams et al., 1989). Such relationships result from the development of mixed phase precipitation and increased hydrometer collisions that lead to the efficient separation of charge. Correlations between updraft strength and other variables such as cloud-top height, cloud water mass, and hail size have also been observed.

Author

Lightning; Meteorological Radar; Storms (Meteorology); Tornadoes; Vertical Air Currents; Atmospherics

19990004376 NASA Goddard Space Flight Center, Greenbelt, MD USA

Internal Dynamics and Boundary Forcing Characteristics Associated with Interannual Variability of the Asian Summer Monsoon

Lau, K.- M., NASA Goddard Space Flight Center, USA; Kim, K.-M., Universities Space Research Association, USA; Yang, S., General Sciences Corp., USA; Oct. 1998; 59p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In this paper, we present a description of the internal dynamics and boundary forcing characteristics of two major components of the Asian summer monsoon (ASM), i.e., the South Asian (SAM) and the Southeast-East Asian monsoon (SEAM). The description is based on a new monsoon-climate paradigm in which the variability of ASM is considered as the outcome of the interplay of a ”fast” and an ”intermediate” monsoon subsystem, under the influenced of the ”slow” varying external forcings. Two sets of regional monsoon indices derived from dynamically consistent rainfall and wind data are used in this study. For SAM, the internal dynamics is represented by that of a ”classical” monsoon system where the anomalous circulation is governed by Rossby-wave dynamics, i.e., generation of anomalous vorticity induced by an off-equatorial heat source is balanced by planetary vorticity advection. On the other hand, the internal dynamics of SEAM is characterized by a ”hybrid” monsoon system featuring multi-cellular meridional circulation over the East Asian section, extending from the deep tropics to midlatitudes. These meridional-cells link tropical heating to extratropical circulation system via the East Asian jetstream, and are responsible for the characteristic occurrences of zonally oriented anomalous rainfall patterns over East Asian and the subtropical western Pacific. In the extratropical regions, the major upper level vorticity balance is by anomalous vorticity advection and generation by the anomalous divergent circulation. A consequence of this is that compared to SAM, the SEAM is associated with stronger teleconnection patterns to regions outside the ASM. A strong SAM is linked to basin-scale sea surface temperature (SST) fluctuation with significant signal in the equatorial eastern Pacific. During the boreal spring SST warming in the Arabian Sea and the subtropical western Pacific may lead to a strong SAM. For SEAM, interannual variability is tied to SSTA over the Sea of Japan and the South China Sea regions, while the linkage to equatorial basin-scale SSTA is weak at best. A large scale SSTA dipole with warming (cooling) in the subtropical central (eastern) Pacific foreshadows a strong SEAM.

Author

Monsoons; Wind Measurement; Temperate Regions; Sea Surface Temperature; Fluid Dynamics; Climate; Arabian Sea; Sea of Japan

19990005094 Mesoscale Environmental Simulations and Operations, Inc., Troy, NY USA

Development of Methods to Generate High Resolution Climatological Databases to Support DoD Modeling and Simulation Programs

Zack, John W., Mesoscale Environmental Simulations and Operations, Inc., USA; Van Knowe, Glenn E., Mesoscale Environmental Simulations and Operations, Inc., USA; Price, Pamela E., Mesoscale Environmental Simulations and Operations, Inc., USA; Bousquet, Mary D., Mesoscale Environmental Simulations and Operations, Inc., USA; Young, Steve, Mesoscale Environmental Simulations and Operations, Inc., USA; Jun. 15, 1998; 52p; In English

Contract(s)/Grant(s): F196828-97-C-0025

Report No.(s): AD-A353343; AFRL-VS-HA-TR-98-0047; SCIENTIFIC REPT-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project focuses on developing methods to estimate climate statistics at high resolution in data sparse and data rich locations. The method, given the name Dynamical MoDel (CLIMOD), is based on the use of a numerical-dynamical atmospheric model executed in data assimilation mode to generate a ten year sample of simulated data from which climatological statistics are computed. The major objectives of the project are to: (1) demonstrate the robustness and general applicability of the method; (2) refine the CLIMOD technique to optimally blend available observations and numerically simulated climate data; (3) extend the method to complex derived climate variables; and (4) construct an integrated software package that can be used anywhere in the world. The work during this first year included: (1) the development of a method to optimally blend the available observations and model generated data into a seamless regional climatology; (2) development of a method to objectively assess the quality of the simulated climate statistics in both data rich and data sparse regions; and (3) the generation of three-dimensional simulated climate statistics for all seasons of the year over a 10-year period for two different regions of the world: Korea and the Middle East.

DTIC

High Resolution; Climatology; Data Bases; Climate; Computerized Simulation

19990005998 Applied Research Labs., State College, PA USA

LAPS Lidar Measurements at the ARM Alaska Northslope Site (Support to FIRE Project)

Philbrick, C. Russell, Applied Research Labs., USA; Lysak, Daniel B., Jr., Applied Research Labs., USA; Petach, Tomas M., Applied Research Labs., USA; Esposito, Steven T., Applied Research Labs., USA; Mulik, Karoline R., Applied Research Labs., USA; Sep. 1998; 76p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2074; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report consists of data summaries of the results obtained during the May 1998 measurement period at Barrow Alaska. This report does not contain any data interpretation or analysis of the results which will follow this activity. This report is forwarded with a data set on magnetic media which contains the reduced data from the LAPS lidar in 15 minute intervals. The data was obtained during the period 15-30 May 1998. The measurement period overlapped with several aircraft flights conducted by NASA as part of the FIRE project. The report contains a summary list of the data obtained plus figures that have been prepared to help visualize the measurement periods. The order of the presentation is as follows: Section 1. A copy of the Statement of Work for the planned activity of the second measurement period at the ARM Northslope site is provided. Section 2. A list of the data collection periods shows the number of one minute data records stored during each hour of operation and the corresponding size (Mbytes) of the one hour data folders. The folder and file names are composed from the year, month, day, hour and minute. The date/time information is given in UTC for easier comparison with other data sets. Section 3. A set of 4 comparisons between the LAPS lidar results and the sondes released by the ARM scientists from a location nearby the lidar. The lidar results show the +/- 1 sigma statistical error on each of the independent 75 m altitude bins of the data. This set of 4 comparisons was used to set and validate the calibration value which was then used for the complete data set. Section 4. A set of false color figures with up to 10 hours of specific humidity measurements are shown in each graph. Two days of measurements are shown on each page. These plots are crude representations of the data and permit a survey which indicates when the clouds were very low or where interesting events may occur in the results. These plots are prepared using the real time sequence plot program which has no smoothing in either the altitude or time (except that you are allowed to pick the integration time and time step. All of these plots were prepared with 15 minute integration and 5 minute time step. Section 5. A set of time sequence data for all of the extended observation periods are shown with a smoothing algorithm from the Matlab plotting library. Most of these data are integrated for 5 minutes and stepped at I minute intervals but several plots are shown with both 15 minute integration and 5 minute steps. The upper level on these data was selected and converted to the white background where the error in the specific humidity reached 25%. Section 6. The set of one hour integrated plots shown with up to 4 hours per page are provided- from the real time analysis snapshot program. The only

difference in these plots and the real time display is that the plots are stopped at an altitude where the error appears to be too large for the data to contain any meaningful information.
Derived from text
Data Acquisition; Data Reduction; Optical Radar; Radar Measurement; Humidity Measurement

19990007795 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Climatic Patterns of Upper Level Cyclonic Vortex Over Northeast Brazil ***Padroes Climaticos dos Vortices Ciclonicos em Altos Niveis no Nordeste do Brasil***
Ramirez, Maria Cleofe Valverde, Instituto Nacional de Pesquisas Espacias, Brazil; Dec. 1996; 131p; In Portuguese
Report No.(s): INPE-6408-TDI/618; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In this work the circulation patterns associated with upper level cyclonic vortices (VCAN's) over the Northeast Brazil and Tropical South Atlantic have been studied. Results from the synoptic climatology for the period January 1980 - December 1989 confirm that VCAN's form in the upper troposphere, with maximum cyclonic vorticity at 200 hPa and a cold core at 300 hPa. Most of the VCAN's originate over Tropical Atlantic, and they are more frequent during the summer months. In general the VCAN's extend downward to 500 hPa and rarely they reach 700 hPa. They have westward inclination with height and the cold core is located to the east or southeast of their center. The average life time is 7.1 days. During El Nino years, the VCAN's are deeper in the vertical, while during La Nina years they are confined at upper levels. It has been confirmed that VCAN's originate from the amplification of the ridge associated with the Bolivian high (BH). Such amplification can be caused by the incursion of the midlatitude frontal systems, or by troughs in the North Pacific or in the North Atlantic aligned with BH in NW-SE or NE-SW directions. The VCAN's can present regular or irregular displacements. Midlatitude trough associated with frontal systems and an interhemispheric bifurcation at the northwest of the South America can cause irregular displacement. For VCAN's with regular displacement it was common to observe the presence of a South Atlantic upper level anticyclone which is related to the South Atlantic Convergence Zone. The first mode of the empirical orthogonal function analysis of the relative vorticity at 200 hPa presents a wave like pattern extending from the South American eastern coast towards the South Atlantic with a SW-NE orientation. This mode represents the midlatitude trough, the amplified ridge and the VCAN suggesting that occur momentum and energy propagation in the SW-NE direction. For a small area within the study domain, the first mode represents the VCAN over the ocean and the second mode, the VCAN over Northeast. Maps of correlations between the amplitudes of these modes and the filtered time series of the relative vorticity for the whole area of study indicate a relationship between the South Pacific trough (120 deg W - 140 deg W) and the wave like pattern over eastern South America. Thus, the presence of this trough might have some contribution on the VCAN formation.
Author
Climatology; Cyclones; Pattern Method (Forecasting); Vortices

19990007912 Iowa State Univ. of Science and Technology, Dept. of Agronomy, Ames, IA USA
Solar Eclipse Effect on Shelter Air Temperature
Segal, M., Iowa State Univ. of Science and Technology, USA; Turner, R. W., Iowa State Univ. of Science and Technology, USA; Prusa, J., Iowa State Univ. of Science and Technology, USA; Bitzer, R. J., Iowa State Univ. of Science and Technology, USA; Finley, S. V., Colorado State Univ., USA; Bulletin of the American Meteorological Society; Jan. 1996; Volume 77, No. 1, pp. 89-99; In English
Contract(s)/Grant(s): NAGw-4060; NSF ATM-93-19455; Proj. 3245; Proj. 3153
Report No.(s): J-16391; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Decreases in shelter temperature during eclipse events were quantified on the basis of observations, numerical model simulations, and complementary conceptual evaluations. Observations for the annular eclipse on 10 May 1994 over the USA are presented, and these provide insights into the temporal and spatial changes in the shelter temperature. The observations indicated near-surface temperature drops of as much as 6 C. Numerical model simulations for this eclipse event, which provide a complementary evaluation of the spatial and temporal patterns of the temperature drops, predict similar decreases. Interrelationships between the temperature drop, degree of solar irradiance reduction, and timing of the peak eclipse are also evaluated for late spring, summer, and winter sun conditions. These simulations suggest that for total eclipses the drops in shelter temperature in midlatitudes can be as high as 7 C for a spring morning eclipse.
Author
Solar Eclipses; Atmospheric Temperature; Mathematical Models; Temperate Regions; Spatial Distribution; Solar Radiation; Shelters

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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.

19990004095 NASA Goddard Space Flight Center, Greenbelt, MD USA
Lunar and Solar Torques on the Oceanic Tides
Ray, Richard D., NASA Goddard Space Flight Center, USA; Bills, Bruce G., NASA Goddard Space Flight Center, USA; Chao, Benjamin Fong, NASA Goddard Space Flight Center, USA; 1998; 24p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A general framework for calculating lunar and solar torques on the oceanic tides is developed in terms of harmonic constituents. Axial torques and their associated angular momentum and earth-rotation variations are deduced from recent satellite-altimeter and satellite-tracking tide solutions. Torques on the prograde components of the tide produce the familiar secular braking of the rotation rate. The estimated secular acceleration is approximately -1300 sec/century(sup 2) (less 4% after including atmospheric tides); the implied rate of change in the length of day is 2.28 milliseconds/century. Torques on the retrograde components of the tide produce periodic rotation variations at twice the tidal frequency. Interaction torques, e.g. solar torques on lunar tides, generate a large suite of rotation-rate variations at sums and differences of the original tidal frequencies. These are estimated for periods from 18.6 years to quarter-diurnal. At subdaily periods the angular momentum variations are 5 to 6 orders of magnitude smaller than the variations caused by ocean tidal currents.
Author
Lunar Tides; Angular Momentum; Diurnal Variations; Ocean Currents; Periodic Variations; Torque; Earth Rotation

19990004131 Mississippi State Univ., Center for Air Sea Technology, Bay Saint Louis, MS USA
Barotropic Tidal Predictions and Validation in a Relocatable Modeling Environment
Mehra, Avichal, Mississippi State Univ., USA; Passi, Ranjit, Mississippi State Univ., USA; Kantha, Lakshmi, Mississippi State Univ., USA; Payne, Steven, Mississippi State Univ., USA; Brahmachari, Shuvobroto, Mississippi State Univ., USA; May 20, 1998; 25p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS13-564; N00014-95-I-0203
Report No.(s): CAST-TR-1098/REV; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Under funding from the Office of Naval Research (ONR), and the Naval Oceanographic Office (NAVOCEANO), the Mississippi State University Center for Air Sea Technology (CAST) has been working on developing a Relocatable Modeling Environment(RME) to provide a uniform and unbiased infrastructure for efficiently configuring numerical models in any geographic/oceanic region. Under Naval Oceanographic Office (NAVO-CEANO) funding, the model was implemented and tested for NAVOCEANO use. With our current emphasis on ocean tidal modeling, CAST has adopted the Colorado University's numerical ocean model, known as CURReNTSS (Colorado University Rapidly Relocatable Nestable Storm Surge) Model, as the model of choice. During the RME development process, CURReNTSS has been relocated to several coastal oceanic regions, providing excellent results that demonstrate its veracity. This report documents the model validation results and provides a brief description of the Graphic user Interface (GUI).
Derived from text
Graphical User Interface; Ocean Models; Mathematical Models; Tides; Storm Surges; Research; Oceanography

19990004141 NASA Goddard Space Flight Center, Greenbelt, MD USA
SeaWiFS Technical Report Series, Volume 43, SeaWiFS Prelaunch Technical Report Series Final Cumulative Index
Firestone, Elaine R., Editor, General Sciences Corp., USA; Hooker, Stanford B., Editor, NASA Goddard Space Flight Center, USA; Apr. 1998; 76p; In English
Report No.(s): NASA/TM-1998-104566/VOL43; Rept-98B00047/VOL43; NAS 1.26:104566/VOL43; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) is the follow-on ocean color instrument to the Coastal Zone Color Scanner (CZCS), which ceased operations in 1986, after an eight-year mission. SeaWiFS was launched on I August 1997, on the SeaStar satellite, built by Orbital Sciences Corporation (OSC). The SeaWiFS Project at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC), undertook the responsibility of documenting all aspects of this mission, which is critical to the ocean color and marine science communities. All reports published are volumes within the series. This particular volume, which is the last of the so-called Prelaunch Series serves as a reference, or guidebook, to the previous 42

volumes and consists of 6 sections including: an addenda, an errata, an index to key words and phrases, lists of acronyms and symbols used, and a list of all references cited. The editors have published a cumulative index of this type after every five volumes.
Author
Ocean Data Acquisitions Systems; Coastal Zone Color Scanner; Ocean Color Scanner; Remote Sensing; Sea Surface Temperature

19990004142 Oregon Univ., College of Oceanic and Atmospheric Sciences, Portland, OR USA
[MODIS Investigation] ***Semiannual Report***
Abbott, Mark R., Oregon Univ., USA; Jan. 1996; 7p; In English
Contract(s)/Grant(s): NAS5-31360; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objectives of the last six months were: (1) Complete sensitivity analysis of fluorescence; line height algorithms (2) Deliver fluorescence algorithm code and test data to the University of Miami for integration; (3) Complete analysis of bio-optical data from Southern Ocean cruise; (4) Conduct laboratory experiments based on analyses of field data; (5) Analyze data from bio-optical mooring off Hawaii; (6) Develop calibration/validation plan for MODIS fluorescence data; (7) Respond to the Japanese Research Announcement for GLI; and (8) Continue to review plans for EOSDIS and assist ECS contractor.
Derived from text
Algorithms; Fluorescence; Remote Sensing; Turbidity; Calibrating

19990004167 Washington Univ., Applied Physics Lab., Seattle, WA USA
CTD Observations of the Arctic Ocean Halocline ***Final Report, Mar. 1995 - Feb. 1998***
Steele, Michael, Washington Univ., USA; Aug. 1998; 2p; In English
Contract(s)/Grant(s): N00014-95-1-0437
Report No.(s): AD-A352979; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The grant sponsored research on large-scale hydrographic changes that have occurred in the upper few hundred meters of the Arctic Ocean. We used data collected by US Navy submarines during 1993 and 1995 Scientific Ice Expeditions (SCICEX), by European icebreakers, and compared these data with a new climatology compiled using formerly classified data from Western and Russian sources.
DTIC
Climatology; Hydrography

19990004185 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Coherent Spatial Patterns and Material Transport in Oceanic Flows ***Annual Report, 1 Nov. 1997 - 31 Oct. 1998***
McWilliams, James C.; Oct. 31, 1998; 7p; In English
Contract(s)/Grant(s): N00014-98-1-0165
Report No.(s): AD-A353916; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is a grant for a theoretical and computational research program on the nonlinear dynamics of ocean currents. Its particular targets are the coherent patterns of flow which emerge in turbulence, and the mechanisms they provide for the transport and mixing of material properties in the fluid. This type of behavior is believed to occur quite generally, and this belief is tested by focusing on four oceanic regimes: (1) mid-latitude, wind-driven gyres and mesoscale eddies in bounded ocean basins, (2) coastal currents near irregular topography and coastlines and the eddies they generate, (3) plumes, vortices, and Langmuir cells in marine planetary boundary layers, in both the lower atmosphere and upper ocean, and (4) the dynamical influences of surface gravity waves on upper ocean currents and eddies through the vortex force proportional to their Stokes drift and other time-averaged effects, both in deep water and in the littoral zone. As a general framework for these particular topics, research also is being done on the general theory of vortices, geophysical turbulence, and Lagrangian dynamics, as well as on improvements in computational methods. The methodology in each regime is to obtain accurate computational solutions of canonical examples of the phenomena using a collection of (mostly) previously developed numerical models, to reduce the dominant coherent structures and analyze their space-time behavior and governing dynamical processes, and to integrate families of parcel trajectories in the velocity fields they provide to determine their mechanisms for Lagrangian transports.
DTIC
Ocean Currents; Surface Waves; Deep Water; Coastal Currents; Geophysics; Mesoscale Phenomena; Ocean Dynamics

19990004896 Mississippi State Univ., Mississippi State, MS USA

Knowledge Discovery in an Object-Oriented Oceanographic Database System ***Annual Report, 1 Sep. 1997 - 31 Aug. 1998***

Hodges, Julia; Bridges, Susan; Sep. 30, 1998; 14p; In English

Contract(s)/Grant(s): N00014-96-1-1276; Proj. 96PRO7924-00

Report No.(s): AD-A354411; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The rate at which scientific data is collected today has overwhelmed the ability of scientists to store and analyze the data. Current research in knowledge discovery in databases is addressing this problem by developing techniques that can automatically extract knowledge of interest in a particular problem domain. This report describes the results of the second year's efforts in the development of a knowledge discovery system for use by oceanographers at the Naval Oceanographic Office (NAVOCEANO) at the Stennis Space Center in the identification of certain oceanographic features. The system is composed of a knowledge discovery component built to interact with a database system currently in use at Stennis Space Center. The database system will be extended to store metadata and knowledge extracted by the knowledge discovery component. Working with scientists at NAVOCEANO, we determined that the focus of our work is the identification and characterization of regions of sand waves in acoustic imagery data.

DTIC

Data Bases; Oceanographic Parameters; Data Acquisition; Object-Oriented Programming; Oceanography

19990005043 Woods Hole Oceanographic Inst., MA USA

Vorticity Measurements within the Bottom Boundary Layer in the Strait of Juan De Fuca

Fredericks, J. J., Woods Hole Oceanographic Inst., USA; Trowbridge, John H., Woods Hole Oceanographic Inst., USA; Williams, A. J., III, Woods Hole Oceanographic Inst., USA; Jul. 1998; 76p; In English

Contract(s)/Grant(s): N00014-94-1-0436

Report No.(s): AD-A353369; WHOI-98-13; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Electromagnetic fluctuations and turbulent vorticity fluctuations were measured over a nine month period in the strong tidal flows of the Strait of Juan De Fuca off the coast of the Olympic Peninsula of Washington. A collaborative experiment was designed to test the hypothesis that electromagnetic fluctuations at the sea floor are forced by turbulent vorticity fluctuations in the bottom boundary layer. This report describes the measurement of turbulent vorticity fluctuations and the associated analysis which focuses on testing existing theoretical predictions for the inertial subrange and on characterizing spectra at frequencies below the inertial subrange.

DTIC

Vorticity; Boundary Layers; Straits; Ocean Bottom

19990005103 NASA Goddard Space Flight Center, Greenbelt, MD USA

Surface Heat Budgets and Sea Surface Temperature in the Pacific Warm Pool During TOGA COARE

Chou, Shu-Hsien, NASA Goddard Space Flight Center, USA; Zhao, Wenzhong, Space Applications Corp., USA; Chou, Ming-Dah, NASA Goddard Space Flight Center, USA; Sep. 1998; 39p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The daily mean heat and momentum fluxes at the surface derived from the SSM/I and Japan's GMS radiance measurements are used to study the temporal and spatial variability of the surface energy budgets and their relationship to the sea surface temperature during the COARE intensive observing period (IOP). For the three time legs observed during the IOP, the retrieved surface fluxes compare reasonably well with those from the IMET buoy, RV Moana Wave, and RV Wecoma. The characteristics of surface heat and momentum fluxes are very different between the southern and northern warm pool. In the southern warm pool, the net surface heat flux is dominated by solar radiation which is, in turn, modulated by the two Madden-Julian oscillations. The surface winds are generally weak, leading to a shallow ocean mixed layer. The solar radiation penetrating through the bottom of the mixed layer is significant, and the change in the sea surface temperature during the IOP does not follow the net surface heat flux. In the northern warm pool, the northeasterly trade wind is strong and undergoes strong seasonal variation. The variation of the net surface heat flux is dominated by evaporation. The two westerly wind bursts associated with the Madden-Julian oscillations seem to have little effect on the net surface heat flux. The ocean mixed layer is deep, and the solar radiation penetrating through the bottom of the mixed layer is small. As opposed to the southern warm pool, the trend of the sea surface temperature in the northern warm pool during the IOP is in agreement with the variation of the net heat flux at the surface.

Author

Heat Flux; Sea Surface Temperature; Solar Radiation; Microwave Imagery; Surface Energy; Energy Budgets

19990006021 Naval Research Lab., Oceanography Div., Stennis Space Center, MS USA

Use of Coupled Numerical Wave and Surf Models to Simulate the Littoral Environment from Deep Water to the Beach ***Final Report***

Allard, Richard A., Naval Research Lab., USA; Hsu, Y. Larry, Naval Research Lab., USA; Collins, Mona J., Naval Research Lab., USA; Smith, Jane McKee, Corps of Engineers, USA; Earle, Marshall, Neptune Sciences, Inc., USA; Aug. 20, 1998; 49p; In English

Report No.(s): AD-A353224; NRL/FR/7322--98-9688; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Development of numerical wave prediction models for purposes of wave forecasting and hind casting has been a key part of wave research for several decades. Models generally address particular wave processes such as wave generation and propagation (in deep and/or shallow water), wave refraction/ diffraction, or wave breaking. Each of these processes involves different physics, spatial scales, and numerical approaches. New types of amphibious systems and strategies require an integrated suite of models that provide predictive capability over a large region from deep water to the beach and along the coast. Several state-of-the-art models have been developed to the point that they can be implemented operationally or are already used operationally.

DTIC

Wave Generation; Wave Diffraction; Coupling; Numerical Analysis; Deep Water; Casting; Forecasting; Models; Water Waves; Wave Propagation

19990007793 Norwegian Defence Research Establishment, Kjeller, Norway

A Semi-Implicit Method for Compressible Isentropic Ocean Dynamics, Part 2, A Spectral Collocation Formulation

Bjorhus, Morten, Norwegian Defence Research Establishment, Norway; Lie, Ivar, Norwegian Defence Research Establishment, Norway; 19980603; 32p; In English

Contract(s)/Grant(s): FFIVM Proj. 670/170

Report No.(s): FFI/RAPPORT-98/02872; ISBN 82-464-0269-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this second part, we present a fully discrete version of the semi-implicit method. The spatial derivatives are discretized using a spectral collocation approach. The advection part is integrated in time using a second order Runge-Kutta method with step size control. We present the derivation and an interpretation of the finite element preconditioned spectral collocation method used to solve the Helmholtz equation of the pressure correction step. Some comments of more technical nature, as on which scaling we use and the choice of linear algebra software, are presented in the Appendix.

Author

Procedures; Finite Element Method; Ocean Dynamics

19990007916 Norwegian Defence Research Establishment, Kjeller, Norway

Multidomain Solution of the Internal Wave Model

Lie, Ivar, Norwegian Defence Research Establishment, Norway; Mar. 25, 1998; 28p; In English

Contract(s)/Grant(s): FFI Proj. FFIVM/670/170

Report No.(s): FFI/RAPPORT-98/01714; ISBN 82-464-0259-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the details in the multidomain algorithms used in the internal wave model. Interface conditions and subdomain iteration techniques are discussed in detail. We also discuss general principles of construction of interface conditions, including the use of Neumann operators and Calderon projectors.

Author

Partial Differential Equations; Internal Waves; Problem Solving; Algorithms

19990007922 Norwegian Defence Research Establishment, Kjeller, Norway

Some Aspects of a Model for Internal Wave Interaction

Lie, Ivar, Norwegian Defence Research Establishment, Norway; Mar. 26, 1998; 17p; In English

Contract(s)/Grant(s): FFI Proj. FFIVM/670/170

Report No.(s): FFI/RAPPORT-98/01715; ISBN 82-464-0258-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the details of some of the capabilities of the internal wave model: Dynamic boundary conditions at the sea surface, the use of Smagorinsky type of turbulent viscosity and the use of spectral filtering of some of the prognostic variables in the model.

Author

Partial Differential Equations; Internal Waves; Viscosity; Mathematical Models; Wave Interaction

19990008060 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Global Geodetic Signatures of the Antarctic Ice Sheet

James, Thomas S., Geological Survey of Canada, Canada; Ivins, Erik R., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Jan. 10, 1997; ISSN 0148-0227; Volume 102, No. B1, pp. 605-633; In English

Contract(s)/Grant(s): NAG5-1940

Report No.(s): Paper-96JB02855; CONTRIB-1996107; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Four scenarios of present day Antarctic ice sheet mass change are developed from comprehensive reviews of the available glaciological and oceanographic evidence. The gridded scenarios predict widely varying contributions to secular sea level change xi ranging from -1.1 to 0.45 mm/yr, and predict polar motion m and time-varying low-degree gravitational coefficients J(sub l) that differ significantly from earlier estimates. A reasonably linear relationship between the rate of sea level change from Antarctica xi(sub A) and the predicted Antarctic J(sub l) is found for the four scenarios. This linearity permits a series of forward models to be constructed that incorporate the effects of ice mass changes in Antarctica, Greenland, and distributed smaller glaciers, as well as postglacial rebound (assuming the ICE-3G deglaciation history), with the goal of obtaining optimum reconciliation between observed constraints on J(sub l) and sea level rise xi. Numerous viable combinations of lower mantle viscosity and hydrologic sources are found that safely ”observed” in the range of 1 to 2-2.5 mm/yr and observed J(sub l) for degrees 2, 3, and 4. In contrast, rates of global sea level rise above 2.5 mm/yr are inconsistent with available J(sub l) observations. The successful composite models feature a pair of lower mantle viscosity solutions arising from the sensitivity of J(sub l) to glacial rebound. The paired values are well separated at xi = 1 mm/yr, but move closer together as xi is increased, and, in fact, merge around xi = 2 - 2.5 mm/yr, revealing an intimate relation between xi and preferred lower mantle viscosity. This general pattern is quite robust and persists for different J(sub l) solutions, for variations in source assumptions, and for different styles of lower mantle viscosity stratification. Tighter J(sub l) constraints for l greater than 2 may allow some viscosity stratification schemes and source assumptions to be excluded in the future. For a given total observed xi the sea level rise from Antarctica xi(sub A) is tightly constrained and ranges from 0 to + 1 mr/yr (corresponding to an ablating ice sheet) as estimates of xi are raised from 1 to 2.5 mm/yr. However, when the degree 3 zonal harmonic constraint is removed, the solutions show little sensitivity to Antarctic mass balance, emphasizing the need for a well determined odd-degree secular zonal harmonic for determining polar ice mass balance.

Author

Antarctic Regions; Ice; Glaciology; Signatures; Polar Wandering (Geology); Glaciers

19990008191 Oregon State Univ., College of Oceanic and Atmospheric Sciences, Corvallis, OR USA

[MODIS Investigation] ***Progress Report***

Abbott, Mark R., Oregon State Univ., USA; Jul. 1998; 13p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-31360; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives of the last six months were: Continue analysis of Hawaii Ocean Time-series (HOT) bio-optical mooring data, Recover instrumentation from JGOFS cruises in the Southern Ocean and analyze data Maintain documentation of MOCEAN algorithms and software for use by MOCEAN and GLI teams Continue chemostat experiments on the relationship of fluorescence quantum yield to environmental factors. Continue to develop and expand browser-based information system for in situ bio-optical data Work Analysis of Field Data from Hawaii We are continuing to analyze bio-optical data collected at the Hawaii Ocean Time Series mooring. The HOT bio-optical mooring was recovered in May 1998. After retrieving the data, the sensor package was serviced and redeployed. We now have over 18 months of data. These are being analyzed as part of a larger study of mesoscale processes at this JGOFS time series site. We have had some failures in the data logger which have affected the fluorescence channels. These are being repaired. We also had an instrument housing failure, and minor modifications have been made to avoid subsequent problems. In addition, Ricardo Letelier is funded as part of the SeaWiFS calibrator/validation effort (through a subcontract from the University of Hawaii, Dr. John Porter), and he is collecting bio-optical and fluorescence data as part of the HOT activity.

Author

Ocean Data Acquisitions Systems; Imaging Spectrometers; Information Systems; Ocean Color Scanner; Remote Sensing; Sea Surface Temperature; Time Series Analysis

19990008224 Maryland Univ., Dept. of Chemistry and Biochemistry, College Park, MD USA

Geochemical Methods for Investigating Past Changes in Chesapeake Bay

Helz, George R., Maryland Univ., USA; Adelson, Jordan M., Maryland Univ., USA; Aug. 1997; 46p; In English

Report No.(s): PB99-103681; CBWP-MANTA-AD-98-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The trace metals, Cu, Mo and Re have been measured in a number of sediment cores from the main stem of Chesapeake Bay and from the adjacent Patuxent estuary. The cores were dated with Pb-210, supplemented by C-14, pollen and Pu(239, 240). Mo and Re were measured by an isotope dilution method. Reconnaissance data on OS-187/OS-188 ratios were obtained by thermal

ionization mass spectrometry. The data are used to investigate two questions: (1) what is the origin of the pervasive Cu contamination in the Chesapeake system, and (2) can profiles of these metals in cores provide information on the history of sulfidic conditions in the water column.
NTIS
Geochemistry; Water Pollution; Ecology

51
LIFE SCIENCES (GENERAL)

19990004115 Scripps Institution of Oceanography, Marine Biology Research Div., La Jolla, CA USA
An Experimental-Numerical Study of Small Scale Flow Interaction with Bioluminescent Plankton ***Final Report, 1 Oct. 1994 - 31 Mar 1998***
Latz, Michael I.; Sep. 04, 1998; 8p; In English
Contract(s)/Grant(s): N00014-95-1-0001
Report No.(s): AD-A353907; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Numerical and experimental approaches were used to investigate the effects of quantified flow stimuli on bioluminescence stimulation at the small length and time scales appropriate for individual plankton. Bioluminescence was used as a sensitive tool for examining essentially instantaneous organism response. Based on laboratory work with defined flow fields, a consistent picture of organism response emerges. There is a response threshold in laminar flow at a shear stress level of approximately 0.1 N/sq m. Increasing shear stress levels lead to increased population response due to more organisms being stimulated, and to a lesser extent increases in the magnitude of the individual response, which is maximized in high laminar flow. Responsiveness is a function of shear stress, not the laminar or turbulent nature of the flow. The boundary layers of most moving objects of Naval interest contain stimulatory levels of shear stress. The present results indicate that their bioluminescence signature will depend on boundary layer thickness and the amount of flow separation. Project findings are relevant to the concerns of nighttime covert operations, and relate to recent interest in applying hyperspectral and multispectral technologies to ocean surveillance.
DTIC
Plankton; Laminar Flow; Pipe Flow; Bioluminescence; Oceans; Separated Flow; Shear Stress; Stimulation

19990008036 NASA Marshall Space Flight Center, Huntsville, AL USA
Crystallization of Chicken Egg-White Lysozyme from Ammonium Sulfate
Forsythe, Elizabeth L., Universities Space Research Association, USA; Snell, Edward H., NASA Marshall Space Flight Center, USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; Acta Crystallographica Section D; 1997; ISSN 0907-4449; Volume D53, pp. 795-797; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Chicken egg-white lysozyme was crystallized from ammonium sulfate over the pH range 4.0-7.8, with protein concentrations from 100 to 150 mg/ml. Crystals were obtained by vapor-diffusion or batch-crystallization methods. The protein crystallized in two morphologies with an apparent morphology dependence on temperature and protein concentration. In general, tetragonal crystals could be grown by lowering the protein concentration or temperature. Increasing the temperature or protein concentration resulted in the growth of orthorhombic crystals. Representative crystals of each morphology were selected for X-ray analysis. The tetragonal crystals belonged to the P4(sub 3)2(sub 1)2 space group with crystals grown at ph 4.4 having unit-cell dimensions of a = b = 78.7 1, c=38.6 A and diffracting to beyond 2.0 A. The orthorhombic crystals, grown at pH 4.8, were of space group P2(sub 1)2(sub 1)2 and had unit-cell dimensions of a = 30.51, b = 56.51 and c = 73.62 A.
Author
Eggs; Lysozyme; Crystallization; Crystal Growth; Proteins

19990008129 Norwegian Defence Research Establishment, Div. for Environmental Toxicology, Kjeller, Norway
Several Oximes (TOXOGONIN, Hi-6 HLO-7, P2S and 2-PAM) Effect on Potassium Evoked Release of [H-3]-Acetylcholine and Liberation of [H-3]-Choline from Rat Hippocampii: The Search for a Therapeutic Agent Against Soman (GD) Poisoning
Oydvin, Ole Kristian, Norwegian Defence Research Establishment, Norway; Jun. 15, 1998; 106p; In English
Contract(s)/Grant(s): FFITOX Proj. 718/137
Report No.(s): FFI/RAPPORT-98/04243; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The work in this investigation was performed to compare the ability of different oximes to alter the release of acetylcholine from nervous tissue both previous to, and after, inhibition with the cholinesterase inhibitor soman. The aim was to find out which

of the oximes used that had the best potential as an antidote against nerve agent intoxication in spite of the absence of reactivation properties of the oximes. The tissue used was rat hippocampii, and the potassium (51 mM) evoked release [H-3]-ACh and the liberation of [H-3]-Ch were measured. The recently developed oxime HLo-7 exerted the strongest effect in the absence of soman closely followed by toxogonin. HI-6 also significantly elevated the stimulated release of[H-3]-ACh, although much less than HLo-7 and toxogonin. Experiments performed following complete inhibition of the cholinesterases showed that HLo-7 induced a significant decrease [H-3] in the amount of released [H-3]-ACh, and an even larger significant increase in the amount of liberated HI-Ch. HI-6 were also shown to exert a quite significant effect although this was only seen in an increased amount of liberated [3-H]-Ch. Toxogonin gave, as for HI-6, some effect on the amount of [H-3]-Ch detected, although this effect was much less pronounced. The pralidoximes (P2S and 2-PAM) showed in all experiments only marginal effects. According to this work, the oxime which seems to have the best potential as an antidote against soman poisoning (due to the significant decrease in amount of stimulated release of [H-3] ACh observed) is HLo-7. HI-6 also seems to have promise. Toxogonin, and the pralidoximes P2S and 2-PAM, did not show any effects comparable to the effects of the two previously mentioned oximes.
Author
Potassium Isotopes; Hydrogen Ions; Research; Acetyl Compounds

19990008371 Meiji Univ., School of Science and Technology, Kawasaki
On the Origin of a Split EPR Signal from a Modified S3'(sub 3)-State of Ca(2+)-Depleted Photosystem II in Plants
Kusunoki, Masami, Meiji Univ.; Research Reports of the School of Science and Technology, Meiji University; 1996; ISSN 0916-4944, No. 14(70), pp. 51-76; In English
Report No.(s): VII-2; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An effective spin hamiltonian that can properly describe the isotropic exchange and magnetic dipolar interactions between a Mn-tetramer with total spin S(sub 1) = 1/2 and its ligand radical with spin S(sub 2) = 1/2, i.e., J(sub 12)S(sub 1) central dot S(sub 2)I and S(sub 1) central dot D(sub 12) central dot S(sub 2) respectively, has been quantum-mechanically derived to elucidate the origin of a new type of EPR signals from the modified-S(sub 3)(S'(sub 3) state of Ca(2+)-depleted photosystem II (PS II) membranes. This signal, called "S'(sub 3) signal", is centered at g = 2.004 and notably consists of a main doublet component having a near-symmetric lineshape with the linewidth of 100- 200 G and a secondary wing component asymmetrically extending over approx. = 910 G without any hyperfine structure. From results of computer simulation of the S'(sub 3) signal, combined with the pulsed EPR data, it follows: (1) the Mn4-radical complexes in the S'(sub 3) state must be highly inhomogeneous; (2) the majority (approx. = 77 %) would be EPR-silent possibly because of no detectable magnetic moment due to J(sub 12) much greater than k(sub B)T (temperature), and (3) the minority would exhibit an EPR signal mainly contributing to the doublet (approx. 15 %) or wing (approx. 8 %) component in the S'(sub 3) signal according as absolute value of J(sub 12) approx. = 100- 200 G or absolute value of J(sub 12) much greater than 100-200 G (together with an additional condition, J(sub 12) less than k(sub B)T, when J(sub 12) greater than 0), respectively, indicating the radical could be neither an oxidized histidine nor tyrozine Y(sub Z, sup +) but some bridging ligand; (5) the doublet component can arise only from the weakly-coupled Mn4-radical complexes satisfying the conditions for a small near-isotropic interaction (absolute value of J(sub 12) approx = 100-200 G much greater than absolute value of D(sub 12) and having the tetrameric effective Mn-spins with appreciable hyperfine coupling constants, indicating the radical must form the third asymmetrically-bfidging ligand between di(mu-oxo) bridged Mn(a)(Ill) and Mn(b)(IV) ions on the opposite side of the other pair of Mn(c)(IV) and Mn(d)(IV) ions in an asymmetric Mn-tetramer whose spin state is approximately given by psi(sub 1)(1/2 M) = cos theta(sub 0)/S(sub ab)(11/2) M greater than + sin theta(sub 0)/S(sub ab)(1/2)S(sub cd)(1)S(sub 1)(1/2) M greater than with theta(sub 0) approx. = -62 deg approx. 65 deg, and (7) the radical takes the g-value of ca. 2.011, which is much larger than the free electron g-value (g(sub e) = 2.0023), nearly equal to that of OH center dot (approx. = 2.011) and slightly less than that of O2(-) (approx = 2.015),indicative of an oxygen-rich moiety rather than an aromatic amino acid. These findings, together with the reported stoichiometry of protons released during the normal S-state cycle, evidently suggest that the radical as the primary water-oxidation product would be most likely (HO(-))(HO(sup .)) or (HOOH(sup .))(-), being bound on the catalytic microsurface of the di(mu-oxo)Mn2(III,IV) subunit in both the normal and the modified S(sub 3) states.
Author
Amino Acids; Computerized Simulation; Hamiltonian Functions; Hyperfine Structure; Magnetic Effects

52
AEROSPACE MEDICINE

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

19990004068 Army Aeromedical Research Lab., Fort Rucker, AL USA
The Effects of Exercise as a Countermeasure for Fatigue in Sleep Deprived Aviators ***Final Report***
LeDuc, Patricia A., Army Aeromedical Research Lab., USA; Caldwell, John A., Jr., Army Aeromedical Research Lab., USA; Ruyak, Peggy S., Army Aeromedical Research Lab., USA; Prazinko, Brian, Army Aeromedical Research Lab., USA; Gardner, Susan, Army Aeromedical Research Lab., USA; Aug. 1998; 39p; In English
Contract(s)/Grant(s): Proj-30162787A879
Report No.(s): AD-A354133; USAARL-98-35; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study was designed to examine the efficacy of a nonpharmacological intervention, exercise, for sustaining performance despite a moderate amount of sleep loss. Twelve subjects were individually tested during two, 40-hour periods of sleep deprivation. Volunteers engaged in 10-minute bouts of exercise during one period and rested for an equivalent amount of time during the other period. Data included electroencephalography, Repeated Tests of Sustained Wakefulness, and Visual Analog Scale. Subjective changes in mood were examined using the Profile of Mood States. Cognitive evaluations were measured using the Multi Attribute Task Battery and Synthetic Work Battery. Flight performance was measured using the MINISIM, a flight simulation task. The results of this study indicate that exercise does have short-term alerting effects in sleep deprived subjects. Subjects were more alert immediately following exercise as evidenced by longer latencies to stage 2 sleep than when they did not exercise during sleep deprivation. However, the alerting effects of exercise were very short lived. EEG data collected 50 minutes following exercise or rest showed that exercise facilitated increases in slow-wave activity (signs of decreased alertness) above those seen during rest. Cognitive deficits and slowed reaction times associated with sleep loss were equivalent in both the exercise and rest conditions. Taken together, the results from this study suggest that exercise may ameliorate some of the increases in sleepiness and fatigue associated with sleep loss for a short period of time (30 min) but will not prevent performance decrements. Additionally, less than one hour following exercise, significant increases in fatigue and sleepiness may occur.
DTIC
Sleep Deprivation; Physical Exercise; Alertness; Electroencephalography; Wakefulness; Performance Tests

19990004898 Medical Coll. of Georgia, Augusta, GA USA
Chronic Organophosphorus Exposure and Cognition ***Annual Report, 15 Apr. 1996 - 14 Apr 1997***
Buccafusco, Jerry J.; May 1997; 25p; In English
Contract(s)/Grant(s): DAMD17-95-1-5036
Report No.(s): AD-A354416; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Protracted exposure to low levels of organophosphorus (OP) compounds impairs acetylcholine degradation by acetylcholinesterase (AChE) and, in humans, may produce lasting neurotoxicity affecting cognitive function. The present studies examined the ability of such exposure to impair performance of novel or well-learned cognitive-related tasks in rats. Withdrawal from the chronic exposure to a low-dose regimen of diisopropyl- fluorophosphate (DFP, 0.25 mg day/14 days) impaired novel navigational learning acquisition, but did not impair performance of a RE-learning phase of the same task. The DFP regimen also did not significantly impair performance of rats who were well-trained in a delayed discrimination task. These data indicate that performance of memory tasks dependent upon reference concepts is not impaired by OP exposure regimens shown to impair acquisition of novel cognitive tasks prior to the onset of overt toxicity. to help explain the protracted impairment observed during the acquisition of a novel cognitive related task, brains were harvested 7 or 16 days after completion of the DFP or saline (control) regimen and coronal sections were subjected to quantitative muscarinic and nicotinic cholinergic receptor autoradiography. Both and nicotinic densities were decreased in several regions in the 7 day sections. by 16 days all differences had resolved except for a continued 42% decrease in hippocampal dentate nicotinic receptor expression. Thus, OP AChE inhibitors may, after chronic low-level exposure, produce a degree of subtle brain damage underlying impaired working memory and reduced expression of hippocampal nicotinic receptor expression.
DTIC
Organic Phosphorus Compounds; Brain Damage; Physiological Effects; Cognition; Acetyl Compounds; Cholinesterase; Degradation; Toxicity

19990005982 Institute for Human Factors TNO, Soesterberg, Netherlands

Motion Sickness: Only One Provocative Conflict? ***Interim Report Bewegingsziekte: Slechts een Oorzakelijk Conflict?***

Bles, W., Institute for Human Factors TNO, Netherlands; Bos, J. E., Institute for Human Factors TNO, Netherlands; deGraaf, B., Institute for Human Factors TNO, Netherlands; Groen, E., Institute for Human Factors TNO, Netherlands; Wertheim, A. H., Institute for Human Factors TNO, Netherlands; May 27, 1998; 19p; In English

Contract(s)/Grant(s): A92/KLu/331; TNO Proj. 789.3

Report No.(s): TNO-98-A033; TD98-0242; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 de Soesterberg, The Netherlands), Hardcopy, Microfiche

In reviewing the various forms of motion sickness the classical sensory rearrangement theory has been redefined by demonstrating that only one type of conflict is necessary and sufficient to explain all different kinds of motion sickness. A mathematical description is provided from the summarizing statement that ”All situations which provoke motion sickness are characterized by a condition in which the sensed vertical as determined on the basis of integrated information from the eyes, the vestibular system and the non-vestibular proprioceptors is at variance with the subjective vertical as expected from previous experience”.

Author

Motion Sickness; Proprioceptors; Mathematical Models

19990005983 Institute for Human Factors TNO, Soesterberg, Netherlands

Coriolis Effects and Motion Sickness Modelling ***Interim Report Coriolis Effecten en het Modelleren van Bewegingsziekte***

Bles, W., Institute for Human Factors TNO, Netherlands; Mar. 03, 1998; 19p; In English

Contract(s)/Grant(s): A92/KLu/331; TNO Proj. 789.3

Report No.(s): TNO-TM-98-A034; TD98-0243; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 De Soesterberg, The Netherlands), Hardcopy, Microfiche

Coriolis effects are notorious in relation to disorientation and motion sickness in aircrew. A review is provided of experimental data on these Coriolis effects, including the modulatory effects of adding visual or somatosensory rotatory motion information. A vector analysis of the consequences of head movements during somatosensory, visual and/or vestibular rotatory motion stimulation revealed that the more the sensed angular velocity vector after the head movements is aligned with the gravito-inertial force vector, the less nauseating effects are experienced. It is demonstrated that this is a special case of the Subjective Vertical conflict theory on motion sickness which assumes that motion sickness may be provoked if a discrepancy is detected between the subjective vertical and the sensed vertical as determined on the basis of incoming sensory information.

Derived from text

Motion Sickness; Sensory Perception; Vertical Motion; Disorientation; Coriolis Effect; Flight Crews; Angular Velocity

19990007752 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

Physical Work and Cognitive Function During Acute Heat Exposure Before and After Heat Acclimation

Patterson, Mark J., Defence Science and Technology Organisation, Australia; Taylor, Nigel A. S., Defence Science and Technology Organisation, Australia; Amos, Denys, Defence Science and Technology Organisation, Australia; Jun. 1998; 39p; In English

Report No.(s): DSTO-TR-0683; DODA-AR-010-569; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Australia), Hardcopy, Microfiche

Eight physically active males, without a history of heat acclimation were studied during heat exposure for 22 consecutive days. Physiological adaptation and cognitive function were evaluated during heat stress tests. Four cognitive function tests were administered at intervals during the study. These tests involved assessment of perceptual function, spatial orientation, temporal orientation and vigilance. The observations show that heat acclimation improves the capacity to perform physical work in the heat. However, neither unfamiliar nor habitual heat strain appear to induce attentional disturbances, temporal or spatial disorientation, or altered visual perception, as quantified within this experimental design. While these data indicate that cognitive function is not affected by heat, it is possible that the cognitive function tests used were not sufficiently sensitive to quantify heat-induced impairment. It is also possible that changes may only appear in more complex cognitive tasks.

Author

Heat Tolerance; Heat Acclimatization; Physical Work; Physiological Responses; Disorientation; Work Functions; Temperature Effects; Stress Measurement; Mental Performance

19990007943 Civil Aeromedical Inst., Oklahoma City, OK USA

The Aeromedical Certification of Photorefractive Keratectomy in Civil Aviation: A Reference Guide ***Final Report***

Nakagawara, Van B., Civil Aeromedical Inst., USA; Wood, Kathryn J., Civil Aeromedical Inst., USA; Sep. 1998; 54p; In English

Contract(s)/Grant(s): AM-B-98-TOX-203

Report No.(s): DOT/FAA/AM-98/25; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The use of surgery to correct refractive errors continues to evolve at a significant pace. Radial keratotomy (RK), the first widely accepted refractive surgical procedure, involves making radial incisions on the peripheral cornea. These incisions weaken the cornea and allow intraocular pressure to push the peripheral cornea out, flattening the apex and reducing refractive power. There are many disadvantages with RK that raise concerns regarding its use in the aviation environment. These include: progressive hyperopic shifts, reduced corneal strength, fluctuation of vision, glare, poor refractive predictability and altitude-induced corneal changes. In October 1995, the Food and Drug Administration approved the use of the excimer laser to perform photorefractive keratectomy (PRK) to reshape the anterior curvature of the cornea. Since that time, PRK has become the refractive surgical procedure of choice. It has been reported that for low to moderate levels of myopia there is greater predictability, no fluctuation of vision or reduction in corneal strength, and about 85% of patients have uncorrected visual acuity of 20/40 or better. As with RK, there are aspects of PRK that raise concerns about its use in the aviation environment. Some of these include: night vision problems (e.g., glare, halos around lights, haze, starbursts, and dim lighting difficulties), reduced contrast sensitivity, stability of refraction, reduced best-corrected visual acuity, and induced anisometropia. Using a mathematical model, it was estimated that by the year 2000 there may be over 1,200 civil airmen who elect to have PRK performed. to provide the aeromedical community with information to formulate administrative decisions and policies associated with this new refractive surgical procedure, this paper reviews the results of clinical trials on PRK and discusses its applicability in aviation.

Author

Aerospace Medicine; Refractivity; Surgery; Excimer Lasers; Refraction; Cornea

19990008171 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering (Hangtian Yixue yu Yixue Gongcheng)

Wei, Jinhe, Editor, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 1998; ISSN 1002-0837; Volume 11, No. 1; 88p; In English

Report No.(s): PB99-109100; CN 11-2774/R; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche

Partial contents: Effect of Hypoxia on Motion Sickness Induced by Optokinetic Stimulation (In English); A study on EEG - Encephalofluctuographic Characteristics in alpha Frequency Band in Pilots; Studies on the Solvent Structure in Protein Crystals Grown in Microgravity; Application of the Sphygmogram in Evaluation of Pilots Cardiovascular Function in Resting Condition; Analysis of Heart Rate Variability in Chinese Healthy Pilot; Reliability Design and Analysis of Man - Machine Performance of Display and Illumination System in Cockpit.

NTIS

Aerospace Medicine; Hypoxia; Electroencephalography; Solvents; Heart Rate; Reliability

19990008218 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering (Hangtian Yixue yu Yixue Gongcheng)

Wei, Jinhe, Editor, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Dec. 1997; ISSN 1002-0837; Volume 10, No. 6, pp. 390-468; In English

Report No.(s): PB99-108987; CN 11-2774/R; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche

Partial contents: Dual Reciprocity Boundary Element Method for Solving Thermal Wave Model of Bioheat Transfer (In English); An Analysis of Radiation Risk for Manned Space Flight in Low - earth Orbits with Medium Inclination; Observation of EGG Parameters during - 6(sup astr.) Head - down Bedrest for 21 Days; Simulation of a Decoupling Generalized Predictive Control Algorithm for Temperature-humidity System; A Study on Three Dimensional Modeling of Human Body in Man - machine System Simulation.

NTIS

Aerospace Medicine; Boundary Element Method

19990008220 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering (Hangtian Yixue yu Yixue Gongcheng)

Wei, Jinhe, Editor, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 1998; ISSN 1002-0837; Volume 11, No. 2, pp. 79-156; In English

Report No.(s): PB99-109092; CN 11-2774/R; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche

Partial contents: Alteration of Vasoreactivity of Mesenteric Arteries in Rats after Two-Week Simulated Weightlessness (In English); An Internet Based Medical Communication Server; Bispectral Analysis of EEG Signal during Focal Cerebral Ischemia; Study on Comprehensive Assessment in Selection of Special Work Personnel; Effects of Hypoxia and Quigong on Urine Malondialdehyde, Superoxide Dismutase and Circulating Endothelial Cell in Humans during Simulated Weightlessness.
NTIS
Aerospace Medicine; Arteries; Internets

53
BEHAVIORAL SCIENCES

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

19990004134 Texas Univ., Center for Vision and Image Sciences, Austin, TX USA
Local Spatio-Temporal Analysis in Vision Systems ***Final Report, 1 May 1993 - 31 May 1998***
Geisler, W. S.; Bovik, A. C.; Cormack, L. K.; Gilden, D. L.; Super, B. J.; Sep. 1998; 29p; In English
Contract(s)/Grant(s): F49620-9301-03O7
Report No.(s): AD-A353750; AFRL-SR-BL-TR-98-0641; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the final progress report of teh vision group at the University of Texas under support of AFOSR URI grant F4962O-93-1-O3O7. In this report we will attempt to summarize the major accomplishments over the previous 5 years. Aim 1: to develop a mathematical model of the initial stages of visual processing (the front end mechanisms), based upon a wide range of physiological and psychophysical data. Aim 2: to develop new methods and models of local frequency coding. Aim 3: to develop new mathematical models and computer-vision algorithms for performing complex visual tasks that are based upon local frequency coding representations. Aim 4: to develop models for human performance in complex visual tasks that build upon current understanding of the front-end mechanisms. Aim 5: to develop a computational testbed for implementing, comparing, integrating and visualizing the different models and modules developed during the project, using a massively parallel machine and graphics workstation front-end.
DTIC
Mathematical Models; Visual Perception; Computer Vision; Parallel Processing (Computers); Physiology; Visual Tasks

19990004630 Civil Aeromedical Inst., Oklahoma City, OK USA
Summative Evaluation of the Collegiate Training Initiative for Air Traffic Control Specialists Program: Progress of Minnesota Air Traffic Control Training Center Graduates in En Route Field Training ***Final Report***
Broach, Dana, Civil Aeromedical Inst., USA; Aug. 1998; 70p; In English
Contract(s)/Grant(s): FAA-AAM-97-B-HRR-133
Report No.(s): DOT/FAA/AM-98/22; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This summative evaluation of the Collegiate Training Initiative for Air Traffic Control Specialists focused on the progress of the Minnesota Air Traffic Control Training Center (MnATCTC) graduates in en route field training. The evaluation compared 136 MnATCTC graduates with 157 FAA Academy graduates on 4 classes of measures: (a) diversity; (b) progress in training at the first assigned field facility; (c) attrition from the first assigned field facility; and (d) performance ratings at the first assigned facility. A cost-benefit analysis for the MnATCTC program was also conducted. There were significantly more women in the MnATCTC (40%) than in the FAA Academy group (17%); there were no significant differences in minority representation. Just 17% of the MnATCTC had achieved full performance level (FPL) certification as of June 1995, compared with 69% of the FAA Academy group. However, time to FPL and attrition rates were similar. MnATCTC graduates were rated significantly lower than FAA Academy graduates by supervisors in teamwork, technical skill, technical knowledge, and overall potential to succeed in the ATCS occupation. Cost analysis found that MnATCTC per-hire costs would be competitive with FAA Academy costs-per-student by FYI 998-2000. Cost-benefit analysis found that the MnATCTC would begin returning about $1.45 in avoided costs and savings to the agency for every $1 invested by FY1998-2001, even with continued FAA financial support. However, with a maximum capacity of about 100 graduates per year, the MnATCTC can provide only a small fraction of the FAA controller workforce. In summary, this evaluation found that the MnATCTC program appears to be achieving its stated goals.
Author
Training Evaluation; Air Traffic Controllers (Personnel); Students; Education; Certification

19990007903 NASA Ames Research Center, Moffett Field, CA USA

Rotational Translational Components of Motion Parallax: Observers' Sensitivity and Implications for Three-Dimensional Computer Graphics

Kaiser, Mary K., NASA Ames Research Center, USA; Montegut, Michael J., NASA Ames Research Center, USA; Proffitt, Dennis R., Virginia Univ., USA; Journal of Experimental Psychology: Applied; 1995; Volume 1, No. 4, pp. 321-331; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The motion of objects during motion parallax can be decomposed into 2 observer-relative components: translation and rotation. The depth ratio of objects in the visual field is specified by the inverse ratio of their angular displacement (from translation) or equivalently by the inverse ratio of their rotations. Despite the equal mathematical status of these 2 information sources, it was predicted that observers would be far more sensitive to the translational than rotational component. Such a differential sensitivity is implicitly assumed by the computer graphics technique billboarding, in which 3-dimensional (3-D) objects are drawn as planar forms (i.e., billboards) maintained normal to the line of sight. In 3 experiments, observers were found to be consistently less sensitive to rotational anomalies. The implications of these findings for kinetic depth effect displays and billboarding techniques are discussed.

Author

Parallax; Translational Motion; Visual Fields; Computer Graphics

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

19990004380 Colorado Univ., Boulder, CO USA

Modeling, Monitoring and Fault Diagnosis of Spacecraft Air Contaminants *Final Report*

Ramirez, W. Fred, Colorado Univ., USA; Skliar, Mikhail, Colorado Univ., USA; Narayan, Anand, Colorado Univ., USA; Morgenthaler, George W., Colorado Univ., USA; Smith, Gerald J., Colorado Univ., USA; 1998; 160p; In English

Contract(s)/Grant(s): NAGw-4585; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Control of air contaminants is a crucial factor in the safety considerations of crewed space flight. Indoor air quality needs to be closely monitored during long range missions such as a Mars mission, and also on large complex space structures such as the International Space Station. This work mainly pertains to the detection and simulation of air contaminants in the space station, though much of the work is easily extended to buildings, and issues of ventilation systems. Here we propose a method with which to track the presence of contaminants using an accurate physical model, and also develop a robust procedure that would raise alarms when certain tolerance levels are exceeded. A part of this research concerns the modeling of air flow inside a spacecraft, and the consequent dispersal pattern of contaminants. Our objective is to also monitor the contaminants on-line, so we develop a state estimation procedure that makes use of the measurements from a sensor system and determines an optimal estimate of the contamination in the system as a function of time and space. The real-time optimal estimates in turn are used to detect faults in the system and also offer diagnoses as to their sources. This work is concerned with the monitoring of air contaminants aboard future generation spacecraft and seeks to satisfy NASA's requirements as outlined in their Strategic Plan document (Technology Development Requirements, 1996).

Derived from text

Simulation; Models; Air Pollution; Monitors; Space Stations; Air Quality

19990004396 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA

Design Review of the Controller-Pilot Data Link Communications: Build 1 (CPDLC-1) Functionality and Computer-Human Interface for the Display System Replacement *Final Report*

Darby, Evan R., Jr.; Shingledecker, Clark; Aug. 1998; 52p; In English

Report No.(s): AD-A353997; DOT/FAA/CT-98/16; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the results of a controller design review of the proposed functionality and computer-human interface for Controller-Pilot Data Link Communications Build 1 (CPDLC-I) planned for implementation on the Display System Replacement (DSR).

DTIC

Human Factors Engineering; Data Links; Controllers; Human-Computer Interface

19990004399 Analytic Sciences Corp., San Antonio, TX USA

Analysis of CARDlab Data for Interpupillary and Vertex Distance: Notes on the Construction of an "Eye-box" ***Final Report, Aug. 1997 - Feb. 1998***

Schmeisser, Elmar T.; Maier, Dennis A.; Jul. 1998; 17p; In English

Contract(s)/Grant(s): F41624-97-D-9000; AF Proj. 7757

Report No.(s): AD-A354014; AFRL-HE-BR-TR-1998-0047; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Data was obtained from the Wright-Patterson Air Force Base Computerized Anthropometric Research and Design lab (CARDLab) describing the quantitative three dimensional location of various facial landmarks. This data was compared to a set of similar measurements made in clinical optometric practice. The values obtained were analyzed for their statistical distribution. These values can be used to predict the fit of eye centered protective eyeware designs.

DTIC

Anthropometry; Computer Programs; Ear Protectors

19990005986 Institute for Human Factors TNO, Soesterberg, Netherlands

A Digital Visual Distinctness Metric ***Interim Report Een Digitale Visuele Opvallendheidsmaat***

Toet, A., Institute for Human Factors TNO, Netherlands; Martinez-Beana, J., Granada Univ., Spain; Jun. 08, 1998; 32p; In English; Original contains color illustrations

Contract(s)/Grant(s): A98/KL/316; TNO Proj. 786.1

Report No.(s): TNO-TM-98-A037; TD98-0246; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 De Soesterberg, The Netherlands), Hardcopy, Microfiche

This report presents a new computational visual distinctness metric based on principles of the early human visual system. The metric is applied to quantify (a) the visual distinctness of targets in complex natural scenes, and (b) the perceptual differences between compressed and uncompressed images. The new metric is shown (i) to predict human observer performance in search and detection tasks on complex natural imagery, (ii) to correlate with visual target distinctness estimated by human observers, and (iii) to correlate with the quality factor of JPEG compressed imagery.

Author

Human Performance; Estimating; Imagery

19990007754 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

Electrostatic Properties of the Army Combat Soldier Ensemble Garments

Billon, H., Defence Science and Technology Organisation, Australia; Bajinskis, G., Defence Science and Technology Organisation, Australia; Apr. 1998; 44p; In English

Report No.(s): DSTO-TR-0664; DODA-AR-010-531; Copyright; Avail: Issuing Activity (DSTO, Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The electrostatic properties of the combat ensemble worn by Australian soldiers have been assessed. The resistance-to-ground, capacitance-to-ground, peak potential, peak energy and decay times were measured for a subject wearing various garment combinations. It was found that under favourable conditions a subject wearing the garments can generate sufficient energy to initiate electro-explosive devices, damage electronic devices and ignite fuel/air mixtures. However the threat level is dependent on the operational scenario and a threat analysis is required to determine the hazard for any given situation.

Author

Electrostatics; Garments; Assessments; Potential Energy; Combat

19990007858 FGAN, Research Inst. for Electronics and Mathematics, Wachtberg-Werthhoven, Germany

Investigation of Human Performance Monitoring an IR-Camera View from an Unmanned Tactical Aircraft

Gaertner, Klaus-Peter, FGAN, Germany; Krueger, Walther, FGAN, Germany; Jul. 1998; 6p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Man-machine system performance on target designation and tracking tasks can be influenced by the design of the manual control subsystem including characteristics of the control device. An experimental set-up simulates the control station of a human operator monitoring a computer display which shows the stabilized TV-camera view out of an unmanned aerial vehicle flying at low altitude. Using a hand-grip controlstick the operator can control the direction of the missile's camera to facilitate the designation of a target. After "lock on", further tracking of the target is made by an automatic tracking system. The operator has to monitor the tracker function and to make corrections if necessary. Target designation by the operator becomes a critical task because the camera system has a narrow field of view to enhance good recognition. Thus target images move towards display edges in a short time. So the target designation task has to be fast and reliable. to achieve near optimum operator performance three different types

of control sticks are used and compared in an experiment: (1) a moveable stick (displacement), (2) a stiff stick (hybrid force), and (3) an unmoveable stick (pure force). Additionally the sensitivity, i.e. the gain of the control signal, is being varied including a non-linear relationship. Results of a test series conducted comparing linear and non-linear control gain showed no significant differences on performing the target acquisition task.
Author
Control Systems Design; Man Machine Systems; Manual Control; Operator Performance; Human-Computer Interface; Control Simulation; Control Sticks

19990007886 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
Alternative Control Technologies: Human Factors Issues ***Techniques de Pilotage Alternatives: Le Facteur Humain***
Oct. 1998; 116p; In English; Alternative Control Technologies: Human Factors Issues, 7-8 Oct. 1998, Bretigny, Wright-Patterson AFB, OH, France, USA; Also announced as 19990007887 through 19990007895
Report No.(s): RTO-EN-3; AC/323(HFM)TP/1; ISBN 92-837-1003-7; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche

With the increasing intelligence of computer systems, it is becoming more desirable to have an operator communicate with machines rather than simply operate them. In combat aircraft, this need to communicate is made quite crucial due to high temporal pressure and workload during critical phases of the flight (ingress, engagement, deployment of self-defence). The HOTAS concept, with manual controls fitted on the stick and throttle, has been widely used in modem fighters such as F16, F18, EFA and Rafale. This concept allows pilots to input real time commands to the aircraft system. However, it increases the complexity of the pilot task due to inflation of real time controls, with some controls being multifunction. It is therefore desirable, in the framework of ”ecological interfaces”, to introduce alternative input channels in order to reduce the complexity of manual control in the HOTAS concept and allow more direct and natural access to the aircraft systems. Control and display technologies are the critical enablers for these advanced interfaces. There are a variety of novel alternative control technologies that when integrated usefully with critical mission tasks can make natural use of the innate potential of human sensory and motor systems. Careful design and integration of candidate control technologies will result in human-machine interfaces which are natural, easier to learn, easier to use, and less prone to error. Significant progress is being made on using signals from the brain, muscles, voice, lip, head position, eye position and gestures for the control of computers and other devices. Judicious application of alternative control technologies has the potential to increase the bandwidth of operator-system interaction, improve the effectiveness of military systems, and realise cost savings. Alternative controls can reduce workload and improve efficiency within the cockpit, directly supporting the warfighter. by the end of 1997, WG 25 had extensively reviewed human factor aspects of current and prospective alternative technologies along with operational needs and integration issues. Dissemination of the knowledge among Engineering and Human Factor communities has to be made as early as possible to facilitate implementation of these new technologies in future projects.
Author
Human Factors Engineering; Man Machine Systems; Manual Control; Artificial Intelligence; Control Equipment; Automatic Control; Control Systems Design; Real Time Operation

19990007887 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK
Operational Rationale and Related Issues for Alternative Control Technologies
Rood, G. M., Defence Evaluation Research Agency, UK; Alternative Control Technologies: Human Factors Issues; Oct. 1998; 8p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The demanding operations in the current generations of fixed and rotary wing aircraft, particularly at night and in poor weather, have increased the need for more ’eyes-out’ operations, which decreases the time for’head down’ or ’head in’ viewing time, both for switching operations and for assimilation of information from head down displays. Similarly the speed of operations has led to less time being available for these two operations. Progress has been made towards the assimilation of visual display data through the move towards Helmet Mounted Displays and the time reductions in switching have been achieved through ensuring that the pilot has no need to move his hands from the primary aircraft controls during high workload periods by the use of the Hands On Throttle And Stick (HOTAS) concept. Using Fitts Law, namely that the time to move the hand to a target (in this case a switch or button) depends only upon the relative precision required, indicates that the movement time - a summed combination of perceptual processing, cognitive processing and motor processing - is in the region of 250 ms (an aircraft moving at 500 knots travels in the region of 80 metres in this time). Thus a time saving of around 250 msec is achievable by minimising the hand movements.

This generally involves the provision of all of the necessary manual switches on either the throttle top or the control column (stick) top, (HOTAS) or Hands On Collective and Cyclic (HOCAC) - for helicopters - during all critical flight operations.
Derived from text
Aircraft Control; Helmet Mounted Displays; Workloads (Psychophysiology); Flight Operations; Control Systems Design; Human Factors Engineering

19990007888 Air Force Research Lab., Information Analysis and Exploitation Branch, Wright-Patterson AFB, OH USA
The Technology of Speech-Based Control
Anderson, Timothy R., Air Force Research Lab., USA; Oct. 1998; 10p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This lecture will present an overview of current speech recognition/control technology being utilized for aerospace applications. Common approaches in the areas of signal acquisition, signal processing, and pattern matching will be presented. Pattern matching algorithms for speech recognition/control can be characterized as pattern recognition approaches and acoustic phonetic approaches. The most common pattern recognition approaches used today are the hidden Markov model (HMM) and neural network. The strengths and weakness of the various approaches will be examined.
Author
Speech Recognition; Control Systems Design; Neural Nets; Control Equipment; Voice Control; Artificial Intelligence

19990007889 Applied Science Labs., Bedford, MA USA
Technology and Application of Gaze Based Control
Borah, Joshua, Applied Science Labs., USA; Oct. 1998; 10p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This lecture reviews the potential use of gaze measurement as a means of human interaction with computers and other systems, especially in the military aerospace environment. It addresses the reasons for considering gaze control, reviews techniques for measuring gaze; and discusses physiological, behavioral, and practical considerations for design of gaze based controls.
Author
Control Systems Design; Human-Computer Interface; Eye Movements; Control Equipment; Active Control; Vision

19990007890 Air Force Research Lab., Wright-Patterson AFB, OH USA
The Technology and Applications of Gesture-Based Control
McMillan, Grant R., Air Force Research Lab., USA; Oct. 1998; 12p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This lecture reviews the technology for using hand, body and facial gestures as a means for interacting with computers and other physical devices. It discusses the rationale for gesture-based control technology, methods for acquiring and processing such signals from human operators, applications of these control technologies, and anticipated future developments.
Author
Control Equipment; Technology Utilization; Human-Computer Interface; Human Body; Control Systems Design

19990007891 Air Force Research Lab., Information Analysis and Exploitation Branch, Wright-Patterson AFB, OH USA
Applications of Speech-Based Control
Anderson, Timothy R., Air Force Research Lab., USA; Oct. 1998; 10p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This lecture will examine many applications of speech based control in aerospace environments. Applications of speech recognition in fixed and rotary wing aircraft as well as in space and command and control will be discussed. Current performance of the technology and application problems will be presented. The lecture concludes with a discussion of required enhancements for aerospace applications.
Author
Speech Recognition; Voice Control; Control Systems Design; Control Equipment; Command and Control; Man Machine Systems

19990007892 Applied Science Labs., Bedford, MA USA
Technology and Application of Head Based Control
Borah, Joshua, Applied Science Labs., USA; Oct. 1998; 12p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This lecture reviews the use of head position and orientation as a means for human interaction with computers and other systems, especially in the military aerospace environment. It addresses the reasons for using head based control, current measurement technology, relevant physiological and behavioral factors, and the uses of head based control to date.
Author
Aircraft Control; Control Equipment; Control Systems Design; Automatic Control; Head Movement; Human-Computer Interface

19990007893 Air Force Research Lab., Wright-Patterson AFB, OH USA
The Technology and Applications of Biopotential-Based Control
McMillan, Grant R., Air Force Research Lab., USA; Oct. 1998; 12p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This lecture reviews the technology for using electrical signals from the muscles and brain as a means for interacting with computers and other physical devices. It discusses the rationale for biopotential-based control technology, methods for acquiring and processing such signals from human operators, applications of these control technologies, and anticipated future developments.
Author
Brain; Muscles; Control Equipment; Human-Computer Interface; Control Systems Design; Electric Pulses

19990007894 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK
Human Factors Issues for the Integration of Alternative Control Technologies
Rood, G. M., Defence Evaluation Research Agency, UK; Oct. 1998; 8p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The introduction of Alternative Control Technologies (ACTs), and their closer links with human natural behaviour, will require a better balance between the human factors requirements and the aircraft integration engineering issues. Successful integration of ACTs into aircraft systems should provide significant operational advantages, and the following paragraphs discuss an approach for the necessary balance of human factors and engineering.
Author
Human Factors Engineering; Aircraft Control; Control Systems Design; Human-Computer Interface; Automatic Control

19990007895 Sextant Avionique, Saint Medard en Jalles, France
Synthesis- and Expected Benefit Analysis
Leger, Alain, Sextant Avionique, France; Oct. 1998; 10p; In English; Also announced as 19990007886; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

A synthetic approach of the various Alternative Control Technologies is proposed, taking into account advantages and inconveniences for military aircraft applications. Operational rationale, classification of technologies following capabilities and degree of maturity, summary of main functional characteristics and integration issues are critically reviewed. A brief presentation of multimodal dialog issues is also presented. Finally, a tentative investigation of potential areas of benefits for military aircraft design and operation is conducted.
Author
Control Systems Design; Human-Computer Interface; Human Factors Engineering; Aircraft Control; Automatic Control

55
SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

19990004118 Sulfonics, Inc., Alachua, FL USA
Reconstructing Ancient Forms of Life *Quarterly Report*
Benner, Steven A., Sulfonics, Inc., USA; Mar. 10, 1998; 43p; In English; Sponsored in part by the Deutsche Akademische Austauschdienst
Contract(s)/Grant(s): NAS5-97210
Report No.(s): NASA/CR-1998-208599; NAS 1.26:208599; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Progress in the past three months has occurred in two areas, reconstruction of ancestral proteins and improved understanding of chemical features that are likely to be universal in generic matter regardless of its genesis. Ancestral ribonucleases have been reconstructed, and an example has been developed that shows how physiological function can be assigned to in vitro behaviors

observed in biological systems. Sequence data have been collected to permit the reconstruction of src homology 2 domains that underwent radiative divergence at the time of the radiative divergence of chordates. New studies have been completed that show how genetic matter (or its remnants) might be detected on Mars (or other non-terrean locations.) Last, the first in vitro selection experiments have been completed using a nucleoside library carrying positively charged functionality, illustrating the importance of non-standard nucleotides to those attempting to obtain evidence for an ”RNA world” as an early episode of life on earth.
Author
Life Sciences; Ribonucleic Acids; Nucleosides; Physiology; Genetics; Nucleotides

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

19990008403 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette, France
Higher Eta Invariants and the Novikov Conjecture on Manifolds with Boundary I
Leichtnam, Eric, Ecole Normale Superieure, France; Piazza, Paolo, Rome Univ., Italy; Dec. 1997; 22p; In English
Report No.(s): PB99-104820; IHES/M/97/89; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Let M be an oriented even-dimensional manifold with boundary. We assume that pi(sub 1)(M) is the product of a finite group F and of a group T which is either of polynomial growth or Gromov hyperbolic. We fix a non-trivial representation rho: F approaches U(l) and let E(sub rho) be the associated unitary flat bundle on M. We consider the T-Galois covering pi: M/F approaches M, the lifted flat bundle E(sub rho) = phi(E(sub rho)) and the associated twisted signature operator. Under the additional assumption that the induced odd twisted signature operator on the boundary of M/F is L(exp 2)-invertible we define higher signatures on M and prove their homotopy invariance, the establishing a form of Novikov conjecture on manifolds with boundary.
NTIS
Invariance; Manifolds (Mathematics); Boundaries

60
COMPUTER OPERATIONS AND HARDWARE

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

19990004172 Sarnoff Corp., National Information Display Lab., Princeton, NJ USA
Evaluation of the AmPro 7400 CRT Light Valve Projector
Jun. 19, 1998; 30p; In English
Report No.(s): AD-A353483; NIDL-Publ-0211-98-059; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present study evaluates a production unit of the AmPro 7400 high resolution color Cathode Ray Tubes (CRT) addressed LCD light valve projector and Stewart Studiotek 130 projection screen. Only photometric measurements were performed on this system. The primary emphasis of the measurements is the determination of the contrast modulation of the display for on/off grille patterns. In turn, the contrast modulation measurements provide an estimate of the number of resolvable pixels that are displayed on the projection screen. The number of resolvable pixels is typically less than the addressability of the display, which is the number of positions that are electronically addressed. We provide below a description of the display that was evaluated and the details of the setup procedures used to prepare the display for measurement.
DTIC
Cathode Ray Tubes; Projectors; Color; Light Valves

19990008350 Meiji Univ., School of Science and Technology, Kawasaki Japan
Research on Trace Characteristics of a Mouse Pointing Device
Kasuya, ShinIichi, Meiji Univ., Japan; Mukaidono, Masao, Meiji Univ., Japan; Research Reports of the School of Science and Technology, Meiji University; 1996; ISSN 0916-4944, No. 14(70), pp. 43-50; In English
Report No.(s): V-6; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

It is not easy for us to use a computer because it was created only for high speed calculator. Operations of a computer are not standardized, and we can say that it is unusable if there is no ’manual’ besides. In other words, there is no ”manner’ for using a computer. When only an expert uses computers it will be forgiven, but at the present age that anybody uses computers it doesn’t allowed. First, in this research, we inspect characteristics of an important pointing device for Graphical User Interface (GUI). We

produce one game to look at trace characteristics and reaction speed of ”mouse” which is one of pointing devices, and we consider the reactions according to directions and analysis of the trace patterns of a pointer. Furthermore, we change the size of goal step-by-step and consider the reaction speeds to examine a characteristic of pointer more well, and inspect the difference of the reaction speeds according to distances. Finally, we pay attention to over running of mouse pointer and suggest a new slowdown mouse pointer, and inspect the effectiveness. We consider reaction speeds and courses of a mouse pointer in this research to improve of GUI in Human Interface, and give a new direction for the development of future pointing devices and for the design of GUI by these results.
Author
Research; Computer Components; Graphical User Interface; Computers

61
COMPUTER PROGRAMMING AND SOFTWARE

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

19990004069 Army Construction Engineering Research Lab., Champaign, IL USA
Simulating Mobile Objects in Dynamic Processes ***Final Report***
Westervelt, James D., Army Construction Engineering Research Lab., USA; Jul. 1998; 158p; In English
Report No.(s): AD-A354116; CERL-TR-98/94; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Geographical Modeling Systems (GMSs) are computer-based, dynamic landscape simulation tools. As computing power continues to become cheaper and faster, GMSs will become increasingly important for the intelligent management of landscapes. However, a number of technical challenges must be met before GMS capabilities are widely accepted, several of which are addressed in this research. First, because landscape processes occur and are modeled at a variety of spatio-temporal scales, it is necessary to support simultaneous simulation of disparate scales. Second, current landscape decision support systems lack the ability to simulate the behavior of individuals. Simulation modeling of populations is unsuitable for very low population densities where the location of individuals on a large, diverse, and fragmented terrain are important. Finally, in a management setting, techniques for linking distinct landscape models to run simultaneously are necessary. All of these capabilities should run on a common platform with a consistent user interface. More importantly, each submodel should relax its requirement to hold the landscape constant and instead share dynamically varying states between submodels. This effort develops fundamental approaches with prototypes for the simulation of mobile entities within dynamic landscapes.
DTIC
Terrain; Computerized Simulation; Topography; Management Methods; Dynamic Models

19990004082 Maryland Univ., Office of Research Administration and Advancement, College Park, MD USA
Asynchronous Distributed, Scalable Algorithms for Intelligent Reasoning with Geographically Dispersed, Hybrid Knowledge Bases ***Final Report, Sep. 1993 - Sep. 1997***
Subrahmanian, V. S.; Jul. 1998; 30p; In English
Contract(s)/Grant(s): F30602-93-C-0241; AF Proj. A716
Report No.(s): AD-A352988; AFRL-IF-RS-TR-1998-140; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Integrating data and knowledge from multiple heterogeneous sources, each one possibly with a different underlying data model, is not only an important aspect of automated reasoning, but also of retrieval systems where queries can span such multiple sources. These sources can be as different as relational or deductive databases, object bases, constrained data (e.g., knowledge bases), structured files (e.g., spreadsheets), or even arbitrary program packages encapsulating specific knowledge, often in a hard wired form accessible only through function calls. Many queries can only be answered if data and knowledge from these different sources are available. In 1991-92, Gio Wiederhold proposed the pioneering concept of a mediator; a program that integrates multiple databases. The principal goal of this project was to develop a platform for the creation of mediated applications. Such a platform would provide a mechanism within which mediators may be developed for a variety of applications. The platform itself would be application independent, and would provide a variety of underlying technology and services that would be critical to the success of any specific application involving the use of mediation technology. The product of this research is a system called WebHERMES (Heterogeneous Reasoning and Mediation System).
DTIC
Algorithms; Synchronism; Knowledge Based Systems

19990004086 Drexel Univ., Center for Formultidisciplinary Information Systems, Philadelphia, PA USA

Knowledge-Based User-Computer Interface Design, Prototyping and Evaluation - the DesignPro Advisory System ***Final Report, Aug. 1992 - Sep. 1995***

Andriole, Stephen J., Drexel Univ., USA; Monsanto, Charlton A., Air Force Research Lab., USA; Ehrhart, Lee S., Drexel Univ., USA; Jul. 1998; 144p; In English

Contract(s)/Grant(s): F30602-92-C-0119; AF Proj. 5581

Report No.(s): AD-A353010; AFRL-IF-RS-TR-1998-142; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report details the development of the DesignPro interactive computer-based advisory system for user-computer interface (UCI) design, prototyping and evaluation. DesignPro permits designers of user computer interfaces to represent requirements, to build prototypes, and to evaluate their impact - all via a ”workbench” of user accessible functions. DesignPro supports the UCI designer; it does not call for the replacement of human UCI expertise in the design process. The methodology assumes that commercial-off-the-shelf (COTS) software can be used to create an integrated environment for designing, prototyping and evaluating interactive user computer interaction routines. The overall process includes interaction among knowledge templates to develop a requirements model that, in turn, helps yield displays and UCI routines which, in turn, suggest a prototyping strategy which, in turn, identifies evaluation tactics. Anchored in the systems engineering approach to interactive systems design and development, an initial prototype of DesignPro was released in January 1993; refinements were made to the prototype with a final prototype released in August 1995. The prototypes were used to validate workstation requirements and to communicate what the system does, as well as permitted the integration of concepts, tools, and COTS software programs into the design.

DTIC

Human-Computer Interface; Computer Programs; Computers; Prototypes; Knowledge Based Systems; Computer Aided Design; Design

19990004087 Office of Management and Budget, Washington, DC USA

Progress on Year 2000 Conversion ***Quarterly Report***

Aug. 15, 1998; 28p; In English

Report No.(s): AD-A353011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is the sixth in a series of quarterly summary reports to Congress on the Administration’s progress in fixing the year 2000 (Y2K) computer problem in Federal systems. It outlines the continuing work to avert the problems that could occur if systems are not able to correctly process the year 2000. This summarizes data received from the 24 agencies that make up the Federal Chief Information Officers’ (CIO) Council and from nine small and independent agencies. These data were due to 0MB on August 15, 1998. It also describes the status of government wide activities underway.

DTIC

Progress; Management; Congressional Reports; Information Systems

19990004113 NASA Lewis Research Center, Cleveland, OH USA

User Manual for Beta Version of TURBO-GRD: A Software System for Interactive Two-Dimensional Boundary/ Field Grid Generation, Modification, and Refinement

Choo, Yung K., NASA Lewis Research Center, USA; Slater, John W., NASA Lewis Research Center, USA; Henderson, Todd L., Raytheon Systems Co., USA; Bidwell, Colin S., NASA Lewis Research Center, USA; Braun, Donald C., NASA Lewis Research Center, USA; Chung, Joongkee, Ohio Aerospace Inst., USA; Oct. 1998; 66p; In English

Contract(s)/Grant(s): RTOP 548-20-23

Report No.(s): NASA/TM-1998-206631; NAS 1.15:206631; ICOMP-98-02; E-11082; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

TURBO-GRD is a software system for interactive two-dimensional boundary/field grid generation. modification, and refinement. Its features allow users to explicitly control grid quality locally and globally. The grid control can be achieved interactively by using control points that the user picks and moves on the workstation monitor or by direct stretching and refining. The techniques used in the code are the control point form of algebraic grid generation, a damped cubic spline for edge meshing and parametric mapping between physical and computational domains. It also performs elliptic grid smoothing and free-form boundary control for boundary geometry manipulation. Internal block boundaries are constructed and shaped by using Bezier curve. Because TURBO-GRD is a highly interactive code, users can read in an initial solution, display its solution contour in the background of the grid and control net, and exercise grid modification using the solution contour as a guide. This process can be called an interactive solution-adaptive grid generation.

Author

Grid Generation (Mathematics); Computational Fluid Dynamics; Spline Functions; Cubes (Mathematics); Computational Grids; Applications Programs (Computers)

19990004160 NASA Lewis Research Center, Cleveland, OH USA
CAPRI (Computational Analysis PRogramming Interface): A Solid Modeling Based Infra-Structure for Engineering Analysis and Design Simulations
Haimes, Robert, Massachusetts Inst. of Tech., USA; Follen, Gregory J., NASA Lewis Research Center, USA; 1998; 3p; In English; 6th; Numerical Grid Generation in Computational Field Simulation, 6 Jul. 1998, London, UK; Sponsored by Greenwich Univ., UK
Contract(s)/Grant(s): RTOP 509-10-31; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

CAPRI is a CAD-vendor neutral application programming interface designed for the construction of analysis and design systems. by allowing access to the geometry from within all modules (grid generators, solvers and post-processors) such tasks as meshing on the actual surfaces, node enrichment by solvers and defining which mesh faces are boundaries (for the solver and visualization system) become simpler. The overall reliance on file 'standards' is minimized. This 'Geometry Centric' approach makes multi-physics (multi-disciplinary) analysis codes much easier to build. by using the shared (coupled) surface as the foundation, CAPRI provides a single call to interpolate grid-node based data from the surface discretization in one volume to another. Finally, design systems are possible where the results can be brought back into the CAD system (and therefore manufactured) because all geometry construction and modification are performed using the CAD system's geometry kernel.
Derived from text
Computerized Simulation; Applications Programs (Computers); Analysis (Mathematics); Computer Aided Design; Design Analysis

19990004176 Maryland Univ., Center for Automation Research, College Park, MD USA
Knowledge-Based Control of Vision Systems
Shekhar, Chandra; Moisan, Sabine; Vincent, Regis; Burlina, Philippe; Chellappa, Rama; Aug. 1997; 34p; In English
Contract(s)/Grant(s): N00014-95-1-0521
Report No.(s): AD-A353865; CAR-TR-867; CS-TR-3824; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose a framework for the development of vision systems that incorporate, along with the executable programs, the syntactic, semantic and strategic knowledge required to obtain optimal performance. In this approach, the user provides the input data, specifies the vision task to be performed, and then provides feedback in the form of qualitative evaluations of the result(s) obtained. These assessments are interpreted in a knowledge based framework to automatically select algorithms and set parameters until results of the desired quality are obtained. In this manner the vision system is given the capacity to tune itself for optimal performance. A system thus trained on a small subset of the input data can then be run autonomously on the remaining data in a batch mode. This approach is illustrated on two real applications, analysis of Synthetic Aperture Radar (SAR) imagery, and detection of vehicles in aerial photographs.
DTIC
Visual Tasks; Synthetic Aperture Radar; Image Processing; Systems Engineering; Vision; Expert Systems

19990004181 Porto Univ., Faculty of Engineering, Portugal
VECPAR 1998: 3rd International Meeting on Vector and Parallel Processing, Part 3
Jun. 1998; 352p; In English; Vector and Parallel Processing, 21-23 Jun. 1998, Porto, Portugal
Contract(s)/Grant(s): F6170-89-W-20009
Report No.(s): AD-A353938; CSP-98-1006-Pt-3; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

The Final Proceedings for VECPAR 98 3rd International Meeting on Vector and Parallel Processing, 21 June 1998-23 June 1998. This 15 an Interdisciplinary conference. Topics Include parallel and distributed computing, image processing and synthesis. real-time and embedded systems.
DTIC
Conferences; Parallel Processing (Computers); Image Processing; Computer Programs; Distributed Processing

19990004182 Porto Univ., Faculty of Engineering, Portugal
VECPAR 1998: 3rd International Meeting on Vector and Parallel Processing, Part 2
Jun. 1998; 460p; In English; 3rd; Vector and Parallel Processing, 21-23 Jun. 1998, Porto, Portugal
Contract(s)/Grant(s): F6170-89-W-0009
Report No.(s): AD-A353937; CSP-98-1006-Pt-2; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

The Final Proceedings for VECPAR 983rd International Meeting on Vector and Parallel Processing, 21 June 1998 -23 June 1998. This is an interdisciplinary conference. Topics include parallel and distributed computing, image processing and synthesis, real-time and embedded systems.
DTIC
Conferences; Distributed Processing; Image Processing; Parallel Processing (Computers)

19990004183 Porto Univ., Faculty of Engineering, Portugal
VECPAR 1998: 3rd International Meeting on Vector and Parallel Processing, Part 1
Jun. 1998; 320p; In English; 3rd; Vector and Parallel Processing, 21-23 Jun. 1998, Porto, Portugal
Contract(s)/Grant(s): F61708-92-W-0009
Report No.(s): AD-A353936; CSP-98-1006-Pt-1; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche
The Final Proceedings for VECPAR 983rd International Meeting on Vector and Parallel Processing, 21 June 1998 -23 June 1998 This is an interdisciplinary conference. Topics include parallel and distributed computing, image processing and synthesis. mal-time and embedded systems.
DTIC
Conferences; Distributed Processing; Image Processing; Parallel Processing (Computers)

19990004344 Woodside Summit Group, Inc., Mountain View, CA USA
Conversion from Engineering Units to Telemetry Counts on Dryden Flight Simulators
Fantini, Jay A., Woodside Summit Group, Inc., USA; Oct. 1998; 14p; In English; 34th; International Telemetry Conference, 26-28 Oct. 1998, San Diego, CA, USA
Contract(s)/Grant(s): RTOP 314-02-00
Report No.(s): NASA/CR-1998-206563; NAS 1.26:206563; H-2272; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Dryden real-time flight simulators encompass the simulation of pulse code modulation (PCM) telemetry signals. This paper presents a new method whereby the calibration polynomial (from first to sixth order), representing the conversion from counts to engineering units (EU), is numerically inverted in real time. The result is less than one-count error for valid EU inputs. The Newton-Raphson method is used to numerically invert the polynomial. A reverse linear interpolation between the EU limits is used to obtain an initial value for the desired telemetry count. The method presented here is not new. What is new is how classical numerical techniques are optimized to take advantage of modem computer power to perform the desired calculations in real time. This technique makes the method simple to understand and implement. There are no interpolation tables to store in memory as in traditional methods. The NASA F-15 simulation converts and transmits over 1000 parameters at 80 times/sec. This paper presents algorithm development, FORTRAN code, and performance results.
Author
Flight Simulators; F-15 Aircraft; Polynomials; Newton-Raphson Method; Applications Programs (Computers); FORTRAN; Pulse Code Modulation; Real Time Operation; Pcm Telemetry

19990004635 NASA Langley Research Center, Hampton, VA USA
On Managing the Use of Surrogates in General Nonlinear Optimization and MDO
Alexandrov, Natalia M., NASA Langley Research Center, USA; 1998; 10p; In English; 7th; Multidisciplinary Analysis and Optimization, 2-4 Sep. 1998, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 98-4798; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
This paper is concerned with a trust-region approximation management framework (AMF) for solving the nonlinear programming problem, in general, and multidisciplinary optimization problems, in particular. The intent of the AMF methodology is to facilitate the solution of optimization problems with high-fidelity models. While such models are designed to approximate the physical phenomena they describe to a high degree of accuracy, their use in a repetitive procedure, for example, iterations of an optimization or a search algorithm, make such use prohibitively expensive. An improvement in design with lower-fidelity, cheaper models, however, does not guarantee a corresponding improvement for the higher-fidelity problem. The AMF methodology proposed is based on a class of multilevel methods for constrained optimization and is designed to manage the use of variable-fidelity approximations or models in a systematic way that assures convergence to critical points of the original, high-fidelity problem.
Author
Optimization; Nonlinear Programming; Critical Point; Approximation

19990005051 College of William and Mary, Dept. of Computer Science, Williamsburg, VA USA
Information-Adaptive Image Encoding and Restoration
Park, Stephen K., College of William and Mary, USA; Rahman, Zia-ur, College of William and Mary, USA; Oct. 19, 1998; 90p; In English
Contract(s)/Grant(s): NAG1-1847; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The multiscale retinex with color restoration (MSRCR) has shown itself to be a very versatile automatic image enhancement algorithm that simultaneously provides dynamic range compression, color constancy, and color rendition. A number of algorithms exist that provide one or more of these features, but not all. In this paper we compare the performance of the MSRCR with techniques that are widely used for image enhancement. Specifically, we compare the MSRCR with color adjustment methods such as gamma correction and gain/offset application, histogram modification techniques such as histogram equalization and manual histogram adjustment, and other more powerful techniques such as homomorphic filtering and 'burning and dodging'. The comparison is carried out by testing the suite of image enhancement methods on a set of diverse images. We find that though some of these techniques work well for some of these images, only the MSRCR performs universally well oil the test set.
Author
Image Enhancement; Restoration; Homomorphisms; Color

19990005096 Carnegie Group, Inc., Pittsburgh, PA USA
Application of AHP to Requirements Analysis ***Final Report, Feb. 1993 - Sep. 1996***
Kott, Alexander, Carnegie Group, Inc., USA; Boag, William, Carnegie Group, Inc., USA; Vargas, Luis, Pittsburgh Univ., USA; Apr. 1998; 35p; In English
Contract(s)/Grant(s): F41624-92-C-5001; AF Proj. 1710
Report No.(s): AD-A353173; AFRL-HE-WP-TR-1998-0037; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe a group of related approaches to quantitative evaluation and prioritization of system requirements and proposals. In formulating requirements for new systems, analysts face difficult tasks of selecting between alternative requirement decompositions, identifying questionable or low priority requirements, eliminating requirements that add unnecessary costs, projecting cost impact of the requirements and then evaluating alternative system design proposals against the stated requirements. We seek approaches that require modest investments of time and can be applied even at the early stages of the requirements formulation process. We show that the Analytical Hierarchy Process can be applied to provide such evaluation mechanisms and illustrate our approach with a detailed example.
DTIC
Systems Engineering; Decision Support Systems; Project Management

19990005099 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Hughes Aircraft's Widespread Deployment of a Continuously Improving Software Process ***Final Report***
Willis, R. R.; Rova, R. M.; Scott, M. D.; Johnson, M. I.; Ryskowski, J. F.; May 1998; 102p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A353168; CMU/SEI-98-TR-006; ESC*-TR-98-006; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report describes the software improvement activities of Hughes Aircraft Company over the last 25 years. The focus is on continuous improvement of the software development process and the deployment of that process from a single organization at Fullerton, California, to virtually all the 5000 software engineers of Hughes Aircraft. For this achievement, the widespread deployment of a continuously improving software process, Hughes Aircraft was awarded the 1997 IEEE Computer Society Software Process Achievement Award.
DTIC
Hughes Aircraft; Deployment; Software Engineering; Aircraft Industry

19990005980 Hampton Univ., Dept. of Computer Science, VA USA
Parallelization of Rocket Engine Simulator Software (PRESS), ***19 Oct. 1995 - 18 Oct. 1999***
Cezzar, Ruknet, Hampton Univ., USA; Oct. 18, 1998; 24p; In English
Contract(s)/Grant(s): NAG3-1792; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have outlined our work in the last half of the funding period. We have shown how a demo package for RESSAP using MPI can be done. However, we also mentioned the difficulties with the UNIX platform. We have reiterated some of the suggestions made during the presentation of the progress of the at Fourth Annual HBCU Conference. Although we have discussed, in some detail, how TURBDES/PUMPDES software can be run in parallel using MPI, at present, we are unable to experiment any further

with either MPI or PVM. Due to X windows not being implemented, we are also not able to experiment further with XPVM, which it will be recalled, has a nice GUI interface. There are also some concerns, on our part, about MPI being an appropriate tool. The best thing about MPr is that it is public domain. Although and plenty of documentation exists for the intricacies of using MPI, little information is available on its actual implementations. Other than very typical, somewhat contrived examples, such as Jacobi algorithm for solving Laplace's equation, there are few examples which can readily be applied to real situations, such as in our case. In effect, the review of literature on both MPI and PVM, and there is a lot, indicate something similar to the enormous effort which was spent on LISP and LISP-like languages as tools for artificial intelligence research. During the development of a book on programming languages [12], when we searched the literature for very simple examples like taking averages, reading and writing records, multiplying matrices, etc., we could hardly find a any! Yet, so much was said and done on that topic in academic circles. It appears that we faced the same problem with MPI, where despite significant documentation, we could not find even a simple example which supports course-grain parallelism involving only a few processes. From the foregoing, it appears that a new direction may be required for more productive research during the extension period (10/19/98 - 10/18/99). At the least, the research would need to be done on Windows 95/Windows NT based platforms. Moreover, with the acquisition of Lahey FORTRAN package for PC platform, and the existing Borland C + + 5. 0, we can do work on C + + wrapper issues. We have carefully studied the blueprint for Space Transportation Propulsion Integrated Design Environment for the next 25 years [13] and found the inclusion of HBCUs in that effort encouraging. Especially in the long period for which a map is provided, there is no doubt that HBCUs will grow and become better equipped to do meaningful research. In the shorter period, as was suggested in our presentation at the HBCU conference, some key decisions regarding the aging FORTRAN based software for rocket propellants will need to be made. One important issue is whether or not object oriented languages such as C + + or Java should be used for distributed computing. Whether or not "distributed computing" is necessary for the existing software is yet another, larger, question to be tackled with.
Derived from text
Parallel Processing (Computers); Space Transportation; Rocket Engines; Rocket Propellants; Artificial Intelligence; Algorithms; Computerized Simulation

19990007734 Universitaet der Bundeswehr, Mess- und Informationstechnik, Hamburg, Germany
Approaches to Pattern Recognition
Rothe, Hendrik, Universitaet der Bundeswehr, Germany; Sep. 1998; 29p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

A short introduction to pattern recognition has been presented. It has been shown that powerful methods exist, however, care has to be taken to build robust and consistent classifiers. The best approach for the inexperienced user seems to be the use of classical statistical tools, since "plug and play" works in this case. Otherwise a profound background knowledge on the behavior of the methods used is needed, since mis-classification or overfitting may occur without notice.
Derived from text
Pattern Recognition; Image Classification; General Overviews; Algorithms; Image Processing

19990007766 NASA Goddard Space Flight Center, Greenbelt, MD USA
Closed Loop Software Control of the MIDEX Power System
Castell, Karen, NASA Goddard Space Flight Center, USA; Hernandez-Pellerano, Amri, NASA Goddard Space Flight Center, USA; Wismer, Margaret, Bucknell Univ., USA; 1998; 13p; In English; Aerospace Conference, 21-28 Mar. 1998, Aspen, CO, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Microwave Anisotropy Probe (MAP) is a follow-on to the Differential Microwave Radiometer (DMR) instrument on the Cosmic Background Explorer (COBE) spacecraft. The design and analysis of the MAP attitude control system (ACS) have been refined since work previously reported. The full spacecraft and instrument flexible model was developed in NASTRAN, and the resulting flexible modes were plotted and reduced with the Modal Significance Analysis Package (MSAP). The reduced-order model was used to perform the linear stability analysis for each control mode, the results of which are presented in this paper. Although MAP is going to a relatively disturbance-free Lissajous orbit around the Earth-Sun L2 Lagrange point, a detailed disturbance-torque analysis is required because there are only a small number of opportunities for momentum unloading each year. Environmental torques, including solar pressure at L2, and aerodynamic and gravity gradient during phasing-loop orbits, were calculated and simulated. A simple model of fuel slosh was derived to model its effect on the motion of the spacecraft. In addition, a thruster mode linear impulse controller was developed to meet the accuracy requirements of the phasing loop burns. A dynamic

attitude error limiter was added to improve the performance of the ACS during large attitude slews. The result of this analysis is a stable ACS subsystem that meets all of the mission's requirements.
Author
Applications Programs (Computers); Spacecraft Motion; Spacecraft Instruments; Nastran; Feedback Control; Explorer Satellites; Cosmic Background Explorer Satellite

19990007807 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
Parallel Directionally Split Solver Based on Reformulation of Pipelined Thomas Algorithm ***Final Report***
Povitsky, A., Institute for Computer Applications in Science and Engineering, USA; Oct. 1998; 28p; In English
Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01
Report No.(s): NASA/CR-1998-208733; NAS 1.26:208733; ICASE-98-45; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this research an efficient parallel algorithm for 3-D directionally split problems is developed. The proposed algorithm is based on a reformulated version of the pipelined Thomas algorithm that starts the backward step computations immediately after the completion of the forward step computations for the first portion of lines This algorithm has data available for other computational tasks while processors are idle from the Thomas algorithm. The proposed 3-D directionally split solver is based on the static scheduling of processors where local and non-local, data-dependent and data-independent computations are scheduled while processors are idle. A theoretical model of parallelization efficiency is used to define optimal parameters of the algorithm, to show an asymptotic parallelization penalty and to obtain an optimal cover of a global domain with subdomains. It is shown by computational experiments and by the theoretical model that the proposed algorithm reduces the parallelization penalty about two times over the basic algorithm for the range of the number of processors (subdomains) considered and the number of grid nodes per subdomain.
Author
Algorithms; Matrices (Mathematics); Parallel Computers; Mathematical Models; Mechanics (Physics)

19990007834 Rutherford Appleton Lab., Chilton, UK
AD01, a FORTRAN 90 Code for Automatic Differentiation
Pryce, J. D., Royal Military Coll. of Science, UK; Reid, J. K., Rutherford Appleton Lab., UK; Sep. 11, 1998; ISSN 1358-6254; 1p; In English
Report No.(s): RAL-TR-1998-057; Copyright; Avail: Issuing ActivityChilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

We describe the design of a FORTRAN 90 code called AD01 for automatic differentiation. by changing the type of each independent variable and of each variable whose value depends on the independent variables and making a small number of other changes, the user can alter an existing code into one that calculates derivatives. Both the forward and backward methods are supported. With the forward method, any derivative may be found. With the backward method, first and second derivatives are available.
Author
Applications Programs (Computers); FORTRAN; Computer Programs

19990007860 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA
Layered Fault Tolerant Architecture to Support Context-Sensitive Reasoning for Lethal Unmanned Aerial Vehicle Application
Rau, Jennifer, Johns Hopkins Univ., USA; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper provides a description of communication utilities implemented to support fault tolerant features for a layered processor architecture. The defined software modules used existing message passing software based on TCP/IP, UDP protocols. The prototype software was tested to verify the routing, network diagnosis, and network recovery functions. Message traffic was monitored and after inducing a failure, the application was restarted without loss of state. The capability provided by these software modules can be readily applied with the definition of application specific messages and state variables. The layered processor architecture and associated communication utilities were developed to provide a basis for improved autonomous vehicle performance. It supports this goal by providing graceful degradation due to processor failures, optimization of onboard processing capability, subsystem communications, data collection and validation of subsystem data to support context-sensitive reasoning, elimination of single point failures in the processor and communications architecture, and isolation of high-level processing functions from payload integration specifics. A candidate software architecture for lethal UAV reasoning functions has been provided

to establish the benefits of an integrated design approach. This software architecture supports all key reasoning functions including; sensor management, weapon management, vehicle control, fault handling, target identification, target localization, maneuver control and mission replanning. The indicated data flows in the figures provided, identify interaction between these functions and subsystems. The defined software architecture for lethal UAV application builds on the layered processor architecture's key features to enhance the vehicle's mission effectiveness and survivability.
Author
Architecture (Computers); Onboard Data Processing; Fault Tolerance; Computer Programs; Message Processing; Software Engineering; Systems Integration; Protocol (Computers)

19990007951 George Mason Univ., Dept. of Operations Research and Statistics, Fairfax, VA USA
Nonlinear Rescaling and Proximal-Like Methods in Convex Optimization
Polyak, Roman, George Mason Univ., USA; Teboulle, Marc, Tel-Aviv Univ., Ramat-Aviv, Israel; Mathematical Programming; 1997; ISSN 0025-5610; Volume 76, pp. 265-284; In English
Contract(s)/Grant(s): NAGw-1397; NSF DMS-92-01297; NSF DMS-94-01871; NSF DMS-94-03218; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The nonlinear rescaling principle (NRP) consists of transforming the objective function and/or the constraints of a given constrained optimization problem into another problem which is equivalent to the original one in the sense that their optimal set of solutions coincides. A nonlinear transformation parameterized by a positive scalar parameter and based on a smooth scaling function is used to transform the constraints. The methods based on NRP consist of sequential unconstrained minimization of the classical Lagrangian for the equivalent problem, followed by an explicit formula updating the Lagrange multipliers. We first show that the NRP leads naturally to proximal methods with an entropy-like kernel, which is defined by the conjugate of the scaling function, and establish that the two methods are dually equivalent for convex constrained minimization problems. We then study the convergence properties of the nonlinear rescaling algorithm and the corresponding entropy-like proximal methods for convex constrained optimization problems. Special cases of the nonlinear resealing algorithm are presented. In particular a new class of exponential penalty-modified barrier functions methods is introduced.
Author
Nonlinearity; Procedures; Convexity; Optimization; Scalars; Algorithms

19990008370 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Software Requirements of the "CBERS" Orbit Maintenance Software
Prasad, Rajendra, Instituto Nacional de Pesquisas Espacias, Brazil; Kuga, Helio Koiti, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 30p; In English
Report No.(s): INPE-6739-NTC/243; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flight dynamics analysis is the process of generating information related to position and orientation of the spacecraft relative to the selected frame of reference, predicting mission critical events, and monitoring on-board subsystems. When the analysis is performed near real-time schedule it can be referred to as mission support. The Flight dynamics analysis process can be divided into several major categories viz. data acquisition and preprocessing, trajectory generation, navigation, attitude analysis, orbit acquisition, station keeping by executing orbit maneuvers, and results formatting and data delivery along with post flight analysis. This document describes exclusively software requirements for orbit maintenance. It is mandatory to adopt software-engineering standards for mission critical software elements. The software life cycle starts when a software product is conceived and ends when it is no longer available for use. Life cycle model structures project activities into "phases" and defines activities to occur. The starting phase is "UR" (user requirement) phase, followed by "SR" (software requirements) phase. "SR" is the analysis phase of the software project. A vital phase of the analysis phase is the construction of a "model" describing what the software has to do and not how to do it. It is necessary to build prototypes. The principal deliverable of this phase is the SRD (software requirements document). The subsequent phase is AD (architectural design), DD (detailed design) and operations and maintenance of software. The major activity in SR phase is to transform user requirements to software requirements and construction of prototypes. In this document all the necessary parameters for software requirements exclusively for orbit maintenance software for CBERS are described along with brief summary of the flight dynamics software system.
Author
Software Engineering; Computer Programs; User Requirements; Postflight Analysis; Data Acquisition; Computer Programming

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990004895 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Effects of Group Support Systems on USA Air Force Strategic Planning Efforts
Hasty, Bryan K.; Sep. 1998; 73p; In English
Report No.(s): AD-A354291; AFIT/GIS/LAS/98S-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Strategic planning at an Air Force wing is a team based activity that offers many advantages to the Air Force. But, it is clear there are still questions about how to properly conduct strategic planning to produce the highest quality plans in the most effective and efficient manner. to answer this question, the Air Force created a research project aimed at discovering new methods to improve strategic planning at Air Force wing levels using a computer-mediated communication system. The research project's goal is to apply collaborative processes and technologies, such as Group Support Systems (GSS), to improve the quality of the strategic planning process. This thesis validated the measurement instruments and analyzed the data from one of those studies. The thorough evaluation of the measurement instruments led to validated scales that could be valuable for future use. The analysis shows a significant increase in overall plan quality, and increased participant satisfaction with both the process employed and the product created when the groups used a GSS instead of traditional face-to-face methods. These results lend support to the continued fielding of such systems to support the decision making process for these types of problems.
DTIC
Support Systems; Management Planning

19990005092 National Defense Industrial Association, Arlington, VA USA
National Defense Industrial Association Database Standardization Committee *Final Report*
Jun. 08, 1998; 38p; In English
Report No.(s): AD-A353361; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The committee began their efforts by outlining the following objectives, which, when thoroughly investigated, would lead to a briefing to government and a final report which would be available to government and industry through NDIA. The objectives selected were to: (1) Identify data sources. (2) Recommend standards and processes. (3) Review data sharing methods. (4) Identify advantages and disadvantages (of sharing data). (5) Recommend ways to avoid misuse. (6) Prioritize models needing databases. (7) Propose an implementation plan. Through the exploration of the objectives, a major void in the database support to the study process was identified. Databases were not maintained and updated for reuse, as was true for many of the major models. It was found that the Air Force Pedigree process satisfied the requirement for coherent, consistent, documented data. The study concluded it would be cost effective for the Government to adopt a process to develop and maintain databases with known pedigree to support a preferred set of standardized models.
DTIC
Data Bases; Defense Program; Industries; Standardization; Data Management; Distributed Processing

19990005992 Central Lab. of the Research Councils, Daresbury Lab., Warrington, UK
An Evaluation of Cost Effective Parallel Computers for CFD 1998
Emerson, D. R., Central Lab. of the Research Councils, UK; Maguire, K., Central Lab. of the Research Councils, UK; Takeda, K., Southampton Univ., UK; Nicole, D., Southampton Univ., UK; Sep. 1998; ISSN 1362-0193; 10p; In English
Report No.(s): DL-P-98-002; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An evaluation of the current status of two novel clusters, running Linux and NT, has been made to assess their performance for parallel CFD calculations. The core algorithm of the code is the conjugate gradient method used to solve the pressure equation. For good performance, a low latency and high bandwidth is required and the results indicate that, without substantial investment in this area, neither system is competitive on parallel performance when compared to more traditional distributed memory machines. At present, they are very suitable for development platforms and, for particular applications that are not too sensitive to latency and bandwidth, they offer a very cost effective computing resource.
Author
Parallel Computers; Computational Fluid Dynamics; Computer Programs; Algorithms; Distributed Memory; Conjugate Gradient Method

19990006023 Syracuse Univ., Northeast Parallel Architectures Center (NPAC), NY USA
Video on Demand Technologies and Demonstrations ***Final Report, Sep. 1994 - Nov. 1996***
Podgorny, Marek; Fox, Geoffrey C.; Jun. 1998; 393p; In English
Contract(s)/Grant(s): F30602-94-C-0256; AF Proj. 4519
Report No.(s): AD-A353279; AFRL-IF-RS-TR-1998-101; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

This effort demonstrated a functional video on demand (VoD) service running over a wide area high speed Asynchronous Transfer Mode (ATM) network. This report presents an overview of the efforts key results and accomplishments. the overall architecture of the video delivery service is described, including the implementation of the video search and retrieval methodology. The video server and video client architectures are discussed in detail, describing the options and paths chosen. Also included in the report is an overview of the hardware and network infrastructure that was built to provide the project testbed along with the wide area network (WAN) demonstrations used during the effort. Separate areas of the report provide information on several fundamental research issues such as Variable Bit Rate vs. Constant Bit Rate transmission, wavelet compression technology for video, I/O support for scalable coders, and multimedia networking.
DTIC
Multimedia; Asynchronous Transfer Mode; Proving

19990007799 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
A Comparison of Interoperability Architectures Within Object Oriented Multi-User Domains
Prekop, Paul, Defence Science and Technology Organisation, Australia; May 1998; 28p; In English
Report No.(s): DSTO-TR-0669; DODA-AR-010-539; Copyright; Avail: Issuing Activity (DSTO, Electronics and Surveilance Research Lab., PO Box 1500, Salisbury, South Australia), Hardcopy, Microfiche

MUDS (Multi-User Domains/Dungeons) are multi-user, text-based, networked computer environments, in which users can interact with each other in a type of text based virtual reality. While traditionally used for text based adventure games, or social worlds, WDs are increasing being used as the backbone for Computer Supported Collaborative Work (CSCW) or Anchor Desk Systems. Within the military domain Anchor Desks provide a single contact point for specialist areas (for example, logistics or intelligence, etc.) within a military organization. This paper explores the issues of interoperability between MOOs (Object Oriented MUD), and describes three different prototyped techniques for MOO Interoperability.
Author
Object-Oriented Programming; Architecture (Computers); Logistics

19990008195 Helsinki Univ. of Technology, Lab. of Aerodynamics, Otaniemi, Finland
FINFLO: The Parallel Multi-Block Flow Solver
Kaurinkoski, Petri, Helsinki Univ. of Technology, Finland; Hellsten, Antti, Helsinki Univ. of Technology, Finland; Jan. 21, 1998; ISSN 0358-2620; 48p; In English
Report No.(s): Rept-A-17; ISBN 951-22-3940-X; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The parallelization of an existing multi-block flow solver is described. The Reynolds-averaged thin-layer Navier-Stokes equations are solved by an implicit time-integration method. Turbulence is modelled with either the kappa - epsilon model, the kappa - omega-SST model or algebraic models. Different parallelization strategies using compiler directives or message-passing libraries are presented, and comparisons with the required programming techniques are made. The main features of the code are described together with some benchmarking results.
Author
Parallel Flow; Turbulence; Navier-Stokes Equation; Algebra; Compilers; Reynolds Averaging

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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.

19990004066 Arizona State Univ., Tempe, AZ USA
Methods for Monitoring Fractionally Sampled Multiple Stream Processes
Lanning, Jeffrey W.; Oct. 02, 1998; 216p; In English
Report No.(s): AD-A354307; 98-031D; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This study considers multiple stream systems where it is possible to monitor only a fraction of the total streams at a given time. This situation is of interest in those processes where the speed of production is great and includes a large number of streams, but the ability to monitor the process is not fully automated and unable to keep up with the speed of production. A method for determining the probability of detecting a shift from target of any fraction of the streams (including none of the streams) is presented. In addition to the mathematics involved in computing this detection probability, a computer program is given which automates the process and quickly gives a result for any number of streams allowing an infinite number of combinations of stream shift scenarios to be examined. Results from several of these scenarios are tabulated and graphed. Adaptive approaches to system monitoring are applied to multiple stream processes in general and the fractional sampling problem specifically. This represents the first application of adaptive techniques to multiple stream processes. The average time to signal for an adaptively-monitored, fractionally-sampled multiple stream process is developed using a Markov chain procedure. The average time-to-signal results are used to identify promising adaptive sampling schemes for monitoring multiple stream processes using fractional samples. The adaptive fraction approach is shown to give superior results to the fixed fraction scheme and often yields satisfactory results compared with those obtained by sampling all the streams involved in a process.
DTIC
Quality Control; Time Series Analysis; Process Control (Industry); Adaptive Control; Probability Theory

19990004067 Amsterdam Univ., Netherlands
Conditional Estimation of Vector Patterns in Remote Sensing and GIS ***Interim Report***
Masuch, J. M. F., Amsterdam Univ., Netherlands; Jul. 01, 1998; 31p; In English
Contract(s)/Grant(s): N68171-97-C-9027
Report No.(s): AD-A354138; BA-III-98-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Oriented patterns, such as those produced by vector propagation, raster pattern accretion, or deformation of geometric features, are common in image processing and GIS. Our approach to classifying such patterns is to decompose them into two parts: (1) the flow field, describing the direction of anisotropy; and (2) the residual pattern obtained by describing the image in a coordinate system built from the flow field. We develop a method for the local estimation of anisotropy and a method for combining the estimates to construct a flow coordinate system.
DTIC
Image Processing; Artificial Intelligence; Information Systems; Flow Distribution

19990004079 Space and Naval Warfare Systems Command, San Diego, CA USA
Multiple Resource Host Architecture for the Mobile Detection Assessment and Response System ***Final Report***
Everett, H. R., Space and Naval Warfare Systems Command, USA; Laird, R. T., Space and Naval Warfare Systems Command, USA; Gilbreath, G., Space and Naval Warfare Systems Command, USA; Heath-Pastore, T. A., Space and Naval Warfare Systems Command, USA; Inderieden, R. S., Space and Naval Warfare Systems Command, USA; Aug. 1998; 115p; In English
Contract(s)/Grant(s): Proj-PE63228N
Report No.(s): AD-A354050; SPAWAR-TD-3026; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The initial effort during Phase 1 of the Mobile Detection Assessment and Response System (MDARS) Program was aimed at demonstrating the feasibility of a single robotic security platform operating under the high-level control of a remote host with the direct supervision of a human operator. This document describes the concept of a distributed host architecture geared towards a single guard controlling up to eight robots and explores some of the key issues that were considered in the actual development. The objective is to field a supervised robotic security system that basically runs itself until an exceptional condition is encountered that requires human intervention. A globally shared world model is maintained to provide a real-time collision avoidance capability complementing the Cybermotion virtual path navigation scheme employed on their K2A robotic platform. A centralized database of high-value inventory is routinely compared with observed inventory as monitored by interactive RF tag-reading systems onboard the patrolling robots. Each robot is equipped with microwave and passive infrared motion detection sensors providing full 360-degree coverage, and an intelligent security assessment algorithm is employed to maximize the probability of detection while simultaneously filtering out nuisance alarms.
DTIC
Robotics; Artificial Intelligence; Feasibility Analysis; Security; Warning Systems

19990004174 Maryland Univ., Center for Automation Research, College Park, MD USA
Discrete, Nonlinear Curvature-Dependent Contour Evolution
Thompson, Scott, Maryland Univ., USA; Rosenfeld, Azriel, Maryland Univ., USA; Aug. 1997; 19p; In English
Contract(s)/Grant(s): N00014-95-1-0521
Report No.(s): AD-A353760; CAR-TR-868; CS-TR-3825; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There has been much recent interest in curvature dependent contour evolution, particularly when the resultant family of contours satisfies the heat (diffusion) equation. Modeling the evolution of a shape's boundary as a real valued solution to the reaction diffusion equation has been shown to be useful for shape decomposition. This approach to contour evolution involves solving a partial differential equation (PDE), is computationally demanding, and must deal with the problem of singularities. In this paper, we describe a low precision discrete method of contour evolution, based on the 8 connected chain code of the contour, that performs analogously to PDE based methods and avoids the singularity problem. Our discrete method is not limited to linear functions of curvature; we give several examples of contour evolution processes that depend nonlinearly on curvature, and illustrate their possible uses.
DTIC
Curvature; Computer Graphics; Contours; Computer Vision; Image Processing

19990004891 Amsterdam Univ., Netherlands
Unsupervised Spatial Feature and Change Detection in RS Imaging ***Interim Report No. 1, Apr - Jun. 1998***
Mokken, R. J.; Jul. 01, 1998; 6p; In English
Contract(s)/Grant(s): N68171-98-C-9012
Report No.(s): AD-A354150; R/D-8444-EN-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We adapted and completed the spectral unsupervised clustering algorithm in terms of modern high-dimensional nonparametric density estimation methodology. This led to the completion of the unsupervised spectral classification part of our system. We then studied possibilities to improve our method of geo-spatially biased sampling of pixels. One of these techniques, based on a Bayesian geo-spatial local/global density quotient seems to be the most promising to provide efficient spectral samples for the ensuing, second, unsupervised spectral classification step. Finally, we completed the third step, the allocation of all pixels in the image to the system of classes in the second step in terms of two optional methods.
DTIC
Neural Nets; Image Processing; Cluster Analysis; Change Detection; Bayes Theorem; Geographic Information Systems

19990005962 Oregon State Univ., Dept. of Computer Science, Corvallis, OR USA
Hybrid Computational Models for Skill Acquisition ***Final Report, 1 Mar. 1995 - 28 Feb. 1998***
Dietterich, Thomas G., Oregon State Univ., USA; Tadepalli, Prasad, Oregon State Univ., USA; Aug. 27, 1998; 7p; In English
Contract(s)/Grant(s): N00014-95-1-0557
Report No.(s): AD-A353324; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this research was to develop a hybrid real time problem solving architecture that couples symbolic planning methods with connectionist reinforcement learning methods. The advantage of this hybrid architecture is that it can immediately achieve reasonable performance, because the symbolic planning system can quickly develop an acceptable control policy, but it can also gradually achieve optimal real time performance, because the reinforcement learning system will eventually converge on a near optimal policy. Many DoD problems would benefit from the ability to perform near optimal real time control of complex systems.
DTIC
Real Time Operation; Couples; Problem Solving; Artificial Intelligence; Hybrid Computers; Machine Learning

19990007796 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Neural Network Applied to Attitude Control for Artificial Satellite ***Controle de Atitude de Satelites Artificias Terrestres Utilizando Redes Neurais Artificiais***
Varotto, Sebastiao Eduardo Corsatto, Instituto Nacional de Pesquisas Espacias, Brazil; 1997; 199p; In Portuguese
Report No.(s): INPE-6745-TDI/635; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This work evaluates the use of artificial neural networks for satellite attitude dynamics identification and control. In order to exemplify this application, a satellite with a rigid main body, three reaction wheel and three flexible solar panels is chosen (layout similar to Brazilian Remote Sensing Satellite). The differential equations therefore show the nonlinear dynamic effects to be identified by neural nets. The equations of motion used to generate training and testing data are derived by the Lagrangian approach for quasi-coordinates (rotational motion) and for generalized coordinates (elastic motion). to validate the attitude control

the situation of fine pointing, with open solar panels is considered in the presence of perturbing torques and errors in the satellite moments of inertia. The identification of neural nets parameters is performed by a Kahnan filtering algorithm local parallel processing and control structure used is that of the Internal Model Control (IMC).
Author
Neural Nets; Attitude Control; Artificial Satellites; Evaluation; Control Systems Design; Dynamic Control

19990008174 Massachusetts Inst. of Tech., Dept. of Mechanical Engineering, Cambridge, MA USA
The Design, Planning and Control of Robotic Systems in Space ***Final Report, 22 Jul. 1994 - 30 Sep. 1996***
Dubowsky, Steven, Massachusetts Inst. of Tech., USA; 1996; 33p; In English
Contract(s)/Grant(s): NAG1-1637; NAG1-801; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the future, robotic systems will be expected to perform important tasks in space, in orbit and in planetary exploration. In orbit, current technology requires that tasks such as the repair, construction and maintenance of space stations and satellites be performed by astronaut Extra Vehicular Activity (EVA). Eliminating, the need for astronaut EVA through the use of space manipulators would greatly reduce both mission costs and hazards to astronauts. In planetary exploration, cost and logistical considerations clearly make the use of autonomous and telerobotic systems also very attractive, even in cases where an astronaut explorer might be in the area. However, such applications introduce a number of technical problems not found in conventional earth-bound industrial robots. to design useful and practical systems to meet the needs of future space missions, substantial technical development is required, including in the areas of the design, control and planning. The objectives of this research program were to develop such design paradigms and control and planning algorithms to enable future space robotic systems to meet their proposed mission objectives. The underlying intellectual focus of the program is to construct a set of integrated design, planning and control techniques based on an understanding of the fundamental mechanics of space robotic systems. This work was to build upon the results obtained in our previous research in this area supported by NASA Langley Research Center in which we have made important contributions to the area of space robotics. This program was proposed and accepted as a three year research program, a period of time necessary to make the type of fundamental developments to make a significant contributions to space robotics. Unfortunately, less than a year into the program it became clear that the NASA Langley Research Center would be forced by budgetary constraints to essentially leave this area of research. As a result, the total funding we received under this grant represented approximately one year of the original, proposed and approved, funding. For some time, there was substantial uncertainty that even this very reduced level of funding would be provided. The spending of the reduced available funds was spread just over two years to provide the support to permit the MS students who had joined the program to receive their master's degree and terminate their studies in this area.
Author
Aerospace Systems; Autonomy; Control Systems Design; Extravehicular Activity; Remote Control; Robotics; Space Exploration; Robots; Space Missions; Space Stations

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NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990007904 Hawaii Univ., Dept. of Electrical Engineering, Honolulu, HI USA
First-Order Approximation of the Ordered Binary-Symmetric Channel
Fossorier, Marc P. C., Hawaii Univ., USA; Lin, Shu, Hawaii Univ., USA; IEEE Transactions on Information Theory; Sep. 1996; ISSN 0018-9448; Volume 42, No. 5, pp. 1381-1387; In English
Contract(s)/Grant(s): NAG5-931; NAG5-2938; NSF NCR-91-15400; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents different results related to the ordering of a sequence of N received symbols with respect to their reliability measure, for BPSK transmission over the AWGN channel model. First, a tight approximation of Pe (i; N), the probability that the hard decision associated with the i-th symbol of the ordered sequence is in error, is derived. Then, it is shown that despite the fact that the random variables representing the noise at positions n 1(sub 1), n(sub 2), ..., n(sub j) of the ordering are no longer independent, the events of having a hard decision decoding error at these positions remain almost independent Pe (n(sub i), n2, ..., n(sub j); N), the probability that the hard decisions associated with the symbols at positions n(sub 1), n(sub 2), ..., n(sub j), in the ordered sequence are in error, is thus well approximated from each of the Pe (n(sub i): N), for i is a member of [1, j]. Finally, based on the independence of these events, the fully connected 2(sup N) -state BSC representing the channel after ordering is simplified

by N independent time-shared 2-state BSC's. This new model allows one to easily and tightly approximate the capacity of the channel after ordering.
Author
Random Variables; Binary Phase Shift Keying; Approximation

19990008127 Institute for Computer Applications in Science and Engineering, Hampton, VA USA
A New Time-Space Accurate Scheme for Hyperbolic Problems, 1, Quasi-Explicit Case ***Final Report***
Sidilkover, David, Institute for Computer Applications in Science and Engineering, USA; Oct. 1998; 24p; In English
Contract(s)/Grant(s): NAS1-97046; NAS1-19480; RTOP 505-90-52-01
Report No.(s): NASA/CR-1998-208436; NAS 1.26:208436; ICASE-98-25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a new discretization scheme for hyperbolic systems of conservations laws. It satisfies the TVD property and relies on the new high-resolution mechanism which is compatible with the genuinely multidimensional approach proposed recently. This work can be regarded as a first step towards extending the genuinely multidimensional approach to unsteady problems. Discontinuity capturing capabilities and accuracy of the scheme are verified by a set of numerical tests.
Author
High Resolution; TVD Schemes; Finite Volume Method; Essentially Non-Oscillatory Schemes

19990008206 Rutherford Appleton Lab., Chilton, UK
Preconditioning and Parallel Preconditioning
Duff, I. S., Rutherford Appleton Lab., UK; vanderVorst, H. A., Rutherford Appleton Lab., UK; Aug. 13, 1998; ISSN 1358-6254; 45p; In English
Report No.(s): RAL-TR-1998-052; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

We review current methods for preconditioning systems of equations for their solution using iterative methods. We consider the solution of unsymmetric as well as symmetric systems and discuss techniques and implementations that exploit parallelism. We particularly study preconditioning techniques based on incomplete LU factorization, sparse approximate inverses, polynomial preconditioning, and block and element by element preconditioning. In the parallel implementation, we consider the effect of reordering.
Author
Parallel Computers; Matrices (Mathematics); Factorization; Polynomials

19990008243 Kanazawa Univ., Faculty of Science, Japan
Gaussian Composition of Congruence Classes
Furuta, Yoshiomi, Kanazawa Univ., Japan; The Science Reports of Kanazawa University; Jul. 1992; ISSN 0022-8338; Volume 37, No. 1, pp. 1-22; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Gaussian composition of binary quadratic forms is recalled in some convenient forms and the composition of integral quadratic forms is generalized in the case of congruence classes.
Author
Congruences; Gauss Equation; Digital Systems

19990008244 Kanazawa Univ., Faculty of Science, Japan
On the Generalized Divisor Problem in Arithmetic Progressions
Nakaya, Hideki, Kanazawa Univ., Japan; The Science Reports of Kanazawa University; Jul. 1992; ISSN 0022-8338; Volume 37, No. 1, pp. 23-47; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper we investigate the asymptotic behavior of the summatory function D(sub z)(x,q,l) and pi(sub k)(x,q,l), its relation to the Riemann hypothesis for the Dirichlet L-function.
Author
Arithmetic; Dirichlet Problem; Asymptotic Methods

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SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990004403 Air War Coll., Maxwell AFB, AL USA
Airpower, Chaos, and Infrastructure: Lords of the Rings
Felker, Edward J., Air War Coll., USA; Aug. 1998; 45p; In English
Report No.(s): AD-A354043; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This interesting study by Lt Col Edward J. Felker, US Air Force, describes a methodology to exploit airpower's capacities at the operational and strategic levels of war. It focuses on the third ring (infrastructure) of John A. Warden III's theory of five strategic rings, which the author argues is often neglected in the debate over the importance of leadership (first ring) versus fielded forces (fifth ring). The author emphasizes that lines of communications transmit all of society's military, economic, and political goods, services, and information. infrastructure provides the framework that links the various elements of a nation's power. This infrastructure contains critical nodes that are vulnerable to airpower. by understanding this infrastructure, we better understand an adversary as a complex, adaptive, and open system. Colonel Felker's paper espouses a practical theory of airpower based on the synergistic relationship among societal structure and lines of communications that comprise infrastructure. Rather than isolating different elements of a society and their concomitant targets, the theory views targets in a more holistic way. of note, the theory articulates a culturally based paradigm with air-power applied against the linkages within a society's system processes, rather than a "one-size-fits-all" target list that attacks form. The theory describes a way to think about airpower, not a way to execute its missions.
DTIC
Procedures; Warfare; Leadership; Complex Systems; Military Operations; Air Defense

19990007786 Norwegian Defence Research Establishment, Kjeller, Norway
Three Games Designed for the Study of Human and Automated Decision Making: Definitions and Properties of the Games Campaign, Operation Lucid and Operation Opaque
Dahl, Fredrik A., Norwegian Defence Research Establishment, Norway; Halck, Ole Martin, Norwegian Defence Research Establishment, Norway; Jun. 03, 1998; 22p; In English; Original contains color illustrations
Contract(s)/Grant(s): FFISYS Proj. 722/161.3
Report No.(s): FFI/RAPPORT-98/02799; ISBN 82-464-0266-8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes three different two-player zero-sum games that have been defined in the FFI project "Synthetic Decision Making". Military interpretations are given, and the games are classified game-theoretically. For one of the games (Campaign) an algorithm for calculating a solution is presented. The games will serve as benchmark problems for testing different artificial intelligence techniques.
Author
Decision Making; Zero Sum Games; War Games

19990007831 NASA Langley Research Center, Hampton, VA USA
Architectural Optimization of Digital Libraries
Biser, Aileen O., NASA Langley Research Center, USA; Dec. 1998; 79p; In English
Report No.(s): NASA/TM-1998-208956; NAS 1.15:208956; L-17790; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This work investigates performance and scaling issues relevant to large scale distributed digital libraries. Presently, performance and scaling studies focus on specific implementations of production or prototype digital libraries. Although useful information is gained to aid these designers and other researchers with insights to performance and scaling issues, the broader issues relevant to very large scale distributed libraries are not addressed. Specifically, no current studies look at the extreme or worst case possibilities in digital library implementations. A survey of digital library research issues is presented. Scaling and performance issues are mentioned frequently in the digital library literature but are generally not the focus of much of the current research. In this thesis a model for a Generic Distributed Digital Library (GDDL) and nine cases of typical user activities are defined. This model is used to facilitate some basic analysis of scaling issues. Specifically, the calculation of Internet traffic generated for different configurations of the study parameters and an estimate of the future bandwidth needed for a large scale distributed digital library implementation. This analysis demonstrates the potential impact a future distributed digital library implementation would

have on the Internet traffic load and raises questions concerning the architecture decisions being made for future distributed digital library designs.
Author
Libraries; Digital Systems; Information Retrieval; Internets; Information Systems

19990007838 Alenia Spazio S.p.A., Product Development, Turin, Italy
From Manned to Unmanned: A Viable Alternative to the Scrapyard
Gatti, A., Alenia Spazio S.p.A., Italy; System Design Considerations for Unmanned Tactical Aircraft (UTA); Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Analyzing the different scenarios currently considered by NATO (Peace keeping, Out of Area, Counter Proliferation, Article 5) requirements of weapon systems at the same time precise, lethal, with a great stand-off range and endurance capability emerge. Budget, humanitarian and political needs together with improvements in technology suggest that un-habitated systems will become the best answer to those requirements. The Italian Air Force still operate a large number of F-104s that within a few years will be phased out. The conversion of F-104s into autonomous and recoverable unmanned vehicles able to perform ground attack or SEAD missions, or into a high-altitude reconaissance platform is feasible and seems an attractive and affordable way to develop an effective hardware able to safely operate in mixed air operations in which manned and unmanned planes share different roles.
Author
North Atlantic Treaty Organization (NATO); Pilotless Aircraft; F-104 Aircraft; Cost Effectiveness

19990007839 Aerospatiale, Defense Systems Preliminary Design Dept., Les Mureaux, France
The Role of Unmanned Tactical Aircraft in the Battlefield Surveillance
Thevenot, Regis, Aerospatiale, France; dAudiffret, Antoine, Aerospatiale, France; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper deals with the role of Unmanned Tactical Aircraft (UTA) in tactical surveillance and support missions on a battlefield. It addresses the main following points: (1) A definition of what are the ”UTA” addressed in this paper; (2) An overview of the new battlefields and their influence in the surveillance and reconnaissance missions and architectures; (3) A presentation of the environment where the UTA have to fly - atmospheric constraints, operational constraints, enemy constraints; (4) A description of the various missions which could be performed. In particular, for reconnaissance and surveillance missions, some examples extracted from STANAG 3769 will be given and will demonstrate the ability of some classes of UTAs and sensors to perform some specific missions; and (5) An overview of some UTA proposed by Aerospatiale and some other companies with their main characteristics. This part will be focused on existing systems such as CL 289 (deployed in Bosnia), Medium Altitude vehicles and High Altitude Long Endurance concepts. The paper will end with the description of some Concepts of Operations for UTA systems on a Battlefield.
Author
Pilotless Aircraft; Surveillance; Aerial Reconnaissance

19990007841 Defence Evaluation Research Agency, Centre for Defence Analysis, Farnborough, UK
The Operational Effectiveness of UCAVs in Mobile Target Attack
Stewart, B. D., Defence Evaluation Research Agency, UK; Jul. 1998; 6p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper addresses a high-level approach to the analysis of uninhabited combat air vehicle (UCAV) effectiveness. The need for effectiveness analysis to take place in a range of realistic operational contexts is established, and the utility of effectiveness analysis is addressed. It is argued that it is necessary to take a ’system of systems’ view in assessing UCAV effectiveness due to the diversity of impacts such systems will have on military operations. Relationships between some areas of UCAV performance, and their impacts on UCAV effectiveness, are presented as examples of the complexity of UCAV operations and to demonstrate the need for effectiveness analysis to assist in system definition.
Author
System Effectiveness; Systems Analysis; Pilotless Aircraft; Target Acquisition

19990007843 Aerospatiale, Defense Systems Preliminary Design Dept., Les Mureaux, France
CONOPS of HALE UTA in an Infrared Early Warning Mission for Theater Missiles Defense
Gilibert, Herve, Aerospatiale, France; Thevenot, Regis, Aerospatiale, France; Jul. 1998; 8p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents the concept of High Altitude Long Endurance UTA equipped with Infrared sensors for Tactical Ballistic Missiles (TBM) detection and tracking. After a short presentation of the general context of operations in an Anti Tactical Ballistic Missile (ATBM) defense system, the IR HALE concept is depicted in its technical aspects as well as in its operational aspects: (1) analysis of potential ”observable features” (signatures) of missiles, and crossing with general ATBM defense needs leading to introduce the IR HALE concept; (2) analysis of its potential performance levels in two major observation functions (missiles detection and tracking), derivation of a preliminary design; (3) exploration of major operational features (survivability,...); (4) synthesis of these elements: analysis of defense capabilities in typical TBM ”Out of Area” scenery, potential roles inside global ATBM defense Systems, for Early Warning, and Weapon Systems commitment; (5) description of the command and control segment of such a system and its integration into air operations; and (6) brief overview of the other missions that can be envisioned for such a UTA. Concluding remarks highlight the position of the IR HALE UTA concept among other Early Warning / Cueing systems, both in terms of technical performance and military concept of employment.
Author
Early Warning Systems; Missile Defense; Ballistic Missiles; Pilotless Aircraft; Missile Tracking; Infrared Tracking; Remotely Piloted Vehicles

19990007845 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Joint Semi-Autonomous Air Weapon System
Schwartz, R. W., Naval Air Warfare Center, USA; Millett, S. B., Naval Air Warfare Center, USA; Rogers, F. T., Naval Air Warfare Center, USA; Hedman, B., Naval Air Warfare Center, USA; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Naval Air Warfare Center has investigated the idea of a semi-autonomous air weapon system that could be used in a lethal role. While such a system appears to be a natural continuation of military aviation we are just now beginning to appreciate some of the nuances inherent in such a system. In our approach we will not just ”put weapons on UAV” or ”take the pilot out of cockpit” either physically or mentally, or produce ”more capable one-time use weapons”. Rather our proposal for Joint Semi-Autonomous Air Weapon System (JSAAWS) is for a total weapon system designed for the tasks at hand. There are two lessons to be learned from history. The first lesson is that a new weapon concept such as JSAAWS must be designed for its intended application and not be just a retrofit of an existing system. The second lesson is that we need to develop JSAAWS in an orderly fashion, we need to walk before we run. Potential advantages of a JSAAWS for a Naval Expeditionary Force include increased survivability, decreased cost, increased lethality, via increased OPTEMPO and the ability of a JSAAWS to act as a force multiplier, and the ability to show a more aggressive presence when first-on-the-scene. In whatever role it plays, JSAAWS must be cost effective when compared to manned aircraft and one time use ’smart’ weapons. One major contributor to cost savings would be greatly decreased operations and support costs due to vastly decreased flying hours. For example, life cycle cost could be reduced by 28% just from reduced flight hours. We have looked at several missions for a JSAAWS, some of which are more suitable for a JSAAWS then others.. These are: SEAD (the initial mission of choice for the operational community), Battlefield Support/Simplification, Armed Recce, ASuW in the Littoral, supporting Operational Maneuver ... from the Sea, Counter Cruise Missiles, Offensive Counter Air, and Defensive Counter Air. Three notional system design concepts have been defined that cover all of the missions for a Naval Expeditionary Force. The high-end concept is the Highly Maneuverable Lethal Vehicle, which will be described in detail in paper 4 of this Conference. This would be a multi-role system for both air-to-air and air-to-surface missions. The air arsenal ship is a concept that has been put forward by the US Air Force. It would have limited air-to-air and air-to-surface roles. The low-end concept would have capability in a limited, but operationally significant, set of air-to-surface missions, CAS, BAI, AI, SEAD, Indirect Fires. Included in this mission set is a significant percentage of the total targets for tactical combat aircraft.
Author
Weapon Systems; Systems Engineering; Weapons Development; Autonomous Navigation

19990007850 NASA Dryden Flight Research Center, Edwards, CA USA
Operational Concepts for Uninhabited Tactical Aircraft
Deets, Dwain A., NASA Dryden Flight Research Center, USA; Purifoy, Dana, NASA Dryden Flight Research Center, USA; Jul. 1998; 4p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes experiences with five remotely piloted flight research vehicle projects in the developmental flight test phase. These projects include the Pathfinder, Perseus B, Altus, and X-36 aircraft and the Highly Maneuverable Aircraft Technology (HiMAT). Each of these flight projects was flown at the NASA Dryden Flight Research Center. With the exception of the HIMAT, these projects are a part of the Flight Research Base Research and Technology (R&T) Program of the NASA Aeronautics and Space Transportation Technology Enterprise. Particularly with respect to operational interfaces between the ground-based pilot or operator, this paper draws from those experiences, then provides some rationale for extending the lessons learned during

developmental flight research to the possible situations involved in the developmental flights proceeding deployed uninhabited tactical aircraft (UTA) operations. Two types of UTA control approaches are considered: autonomous and remotely piloted. In each of these cases, some level of human operator or pilot control blending is recommended. Additionally, ”best practices” acquired over years of piloted aircraft experience are drawn from and presented as they apply to operational UTA.
Author
Remotely Piloted Vehicles; Pilotless Aircraft; Research Vehicles; Highly Maneuverable Aircraft; Autonomous Navigation; Remote Control; Flight Control

19990007851 Defence Evaluation Research Agency, Air Systems Sector, Farnborough, UK
The Challenge of UAV Supporting Offensive Air Operations
Frampton, R. A., Defence Evaluation Research Agency, UK; Jul. 1998; 6p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper provides an overview of some of the challenges facing the use of UAV in combat roles. Offensive roles are identified and the suitability of UAV for these discussed. The use of UAV for surveillance, target acquisition and reconnaissance is acknowledged as well established, the roles involving weapon delivery are less defined. The limitations on using UAV in combat roles are not seen dominantly as technical but more operational. The need to define the concept of operations for using UAV in combat is considered vital. Simulation is advocated to establish the viability of combat UAV concepts, conduct performance trade-off studies and to develop appropriate partitioning of control and decision making. Manned and un-manned platforms are seen as being complementary for the foreseeable future with UAV freeing up the manned platforms enabling them to undertake the roles needing flexibility. The major challenge is seen as establishing an environment in which both manned and un-manned platforms can work together effectively and safely.
Author
Pilotless Aircraft; Combat; Target Acquisition; Surveillance; Aerial Reconnaissance; Weapon Systems

19990007853 Sverdrup Technology, Inc., Eglin AFB, FL USA
Mission Re-Planning for Standoff Weapons
Henne, Marlow, Sverdrup Technology, Inc., USA; Baker, James H., Air Force Development Test Center, USA; Jul. 1998; 12p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper frames a general discussion of current air campaign planning methods at the campaign and mission command echelons, and discusses the operational and technical mission re-planning requirements required for standoff weapons to engage fleeting targets or targets discovered immediately before or during a weapons delivery mission. Some weapon systems already have the technology needed to engage this threat; doctrinal advances and allocation of scarce sensor and weapons resources are the driving factors preventing effective fleeting target engagement.
Author
Mission Planning; Weapon Systems; Weapons Delivery; Target Acquisition; Target Recognition; Combat

19990007862 Defence Evaluation Research Agency, Weapons Sector, Farnborough, UK
Unmanned Tactical Air Vehicles: An Electronic Combat Perspective
Langham, S. J., Defence Evaluation Research Agency, UK; Zanker, P. M., Defence Evaluation Research Agency, UK; Jul. 1998; 10p; In English; Also announced as 19990007836; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This discussion paper, arising from project work at UK DERA, considers UTAVs from an electronic combat perspective. The paper will focus firstly upon their application to Electronic Combat roles, and secondly upon the problems of UTAV self protection by means of Defensive Aids Subsystems (DASS). UTAVs will find a variety of roles in the military operations of the future, both in conflict, and in operations other than war, such as peace-keeping and humanitarian aid. This paper identifies in general the various roles and scenarios which may become applicable to UTAVs. Current UTAVs are predominantly used for reconnaissance, however their near-term role is expanding to encompass communications relay, electronic warfare, environmental monitoring, target designation and the suppression of enemy air defences (SEAD) applications. The paper addresses the SEAD scenario, sensor payloads, airframe performance requirements and levels of threat faced. The SEAD role presents a particularly high risk for airframe survivability, as the UTAV is challenging the very threats which may be used against it. Such UTAVs are likely to carry advanced payloads, making for a high-value vehicle, requiring some measure of self-protection. Defensive aids will therefore feature in UTAV system designs. It is important to match the style of defensive aids to the roles and concepts of operation of the various types of vehicle envisaged. The style of self protection may be biased towards threat avoidance, confusion of air defences, or towards the countering of immediate threats. The paper discusses these styles of defensive aids systems, their cost and system drivers, and the types of components needed to realize them. The defensive aids suites could in most cases have to operate without

manual intervention, and in this respect will be rather different to the traditional systems found in manned aircraft. The paper discusses these differences, and their implications in terms of system cost, complexity and effectiveness. The style of any countermeasure responses proposed for UTAVs may vary considerably according to the type of operation and the rules of engagement. Consideration must be given to the dangers of collateral damage, and even environmental damage, in certain circumstances. The paper discusses these considerations.
Author
Electronic Warfare; Air Defense; Pilotless Aircraft; Combat; Airframes

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THEORETICAL MATHEMATICS

Includes topology and number theory.

19990005991 Norwegian Defence Research Establishment, Kjeller, Norway
On the Absorbing Boundary Conditions for Diffusion Equations
Lie, Ivar, Norwegian Defence Research Establishment, Norway; Mar. 25, 1998; 17p; In English
Report No.(s): FFI/RAPPORT-98/01716; FFIVM/670/170; ISBN 82-464-0255-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a technique for constructing absorbing boundary conditions for diffusion equations from Neumann operators. The symbol of the Neumann operator is approximated by a rational interpolant with symmetric interpolation points. The absorbing boundary conditions thus obtained is used in the diffusion split step in the internal wave model.
Author
Partial Differential Equations; Boundary Conditions; Mathematical Models; Interpolation; Neumann Problem

19990006004 Maryland Univ., Computer Vision Lab., College Park, MD USA
Determining Simplicity and Computing Topological Change in Strongly Normal Partial Tilings of R2 or R3
Saha, Punam K.; Rosenfeld, Azriel; Feb. 1998; 24p; In English
Contract(s)/Grant(s): DAMD17-97-1-7271
Report No.(s): AD-A353990; CAR-TR-879; CS-TR-3877; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A convex polygon in R2, or a convex polyhedron in R3, will be called a tile. A connected set P of tiles is called a partial tiling if the intersection of any two of the tiles is either empty, or is a vertex or edge (in R3: or face) of both. P is called strongly normal (SN) if, for any partial tiling P' P and any tile P epsilon P', the neighborhood N(P,P) of P (the union of the tiles of P' that intersect P) is simply connected. Let P be SN, and let N*(P,P) be the excluded neighborhood of P in P (i.e., the union of the tiles of P, other than P itself, that intersect P). We call P simple in P if N(P,P) and N*(P,P) are topologically equivalent. This paper presents methods of determining, for an SN partial tiling P, whether a tile P epsilon P' is simple, and if not, of counting the numbers of components and holes (in R3: components, tunnels and cavities) in N*(P,P).
DTIC
Topology; Polygons; Computer Vision; Convexity

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PHYSICS (GENERAL)

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

19990006022 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
Application of a Nystrom Method to Solving 3-D Electromagnetic Interior Scattering Problems ***Interim Report, Aug. 1997 - Jan. 1998***
Samn, Sherwood, Air Force Research Lab., USA; Jul. 1998; 19p; In English
Contract(s)/Grant(s): AF Proj. 7757
Report No.(s): AD-A353267; AFRL-HE-BR-TR-1998-0048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In studying interior scattering problems of electromagnetic waves in biological systems, it is natural to consider finite inhomogeneous models in 3-space. With the advent of ever-increasing computing power and noval computer architecture for parallel processing, integral equation formulations of the problem have become viable alternatives to more traditional finite difference

or finite element approaches. This report describes a generalization of the classical Nystrom Method to solving 3-D electromagnetic interior scattering problems using an iterated integral method.
DTIC
Electromagnetic Scattering; Electromagnetic Fields

19990008068 NASA, Washington, DC USA
Concerning a Method for the Measurement of Very High Temperatures in Nearly Transparent Arc Columns ***Ueber ein Verfahren zur Messung sehr Hoher Temperaturen in Nahezu Durchlaessigen Bogensaeulen***
Larenz, Rudolf Wilhelm; Dec. 1960; 22p; Repr. from Zeitschrift fuer Physik, v. 129, 1951; In English, 15 Apr. 1950, Muenster, Germany; Sponsored by German Physical Society, Germany
Report No.(s): NASA-TT-F-54; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report presents a method of measuring the temperature distribution across an arc column by use of a spectrograph. An equation is developed for the determination of the electronic temperature that corresponds to the point of maximum spectral line intensity across an arc column. A graphical solution is given which relates the various parameters such as statistical weights, excitation potential, pressure, etc., to spectral line intensity and temperature.
Author (revised)
Temperature Measurement; High Temperature Environments; Spectrophotometry; Line Spectra

19990008241 Kyushu Univ., Inst. of Advanced Material Study, Kasuga, Japan
Problems on Pattern Image Velocimetry
Hayami, Hiroshi, Kyushu Univ., Japan; Aramaki, Shinichiro, Kyushu Univ., Japan; Tsutsui, Hitoshi, Kyushu Univ., Japan; Koso, Toru, Kyushu Univ., Japan; The Reports of Institute of Advanced Material Study, Kyushu University; 1994; ISSN 0914-3793; Volume 8, No. 2, pp. 245-251; In Japanese; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The particle image velocimetry based on the pattern correlation method has been successfully applied to the relative fluid flow in a small model of a Francis type pump turbine by processing the video images pictured using a video camera rotating with the runner. The pattern correlation method has an inherent problem of erroneous velocity vectors due to erroneous correlation. The images of absolutely static fluid removing a runner were taken by a rotating video camera and they were analyzed using the pattern correlation method, where the connect velocity vectors are easily specified. The problems including the cause of erroneous velocity vectors which occur in the pattern correlation method and the countermeasures are discussed.
Author
Velocity Measurement; Particle Image Velocimetry; Fluid Flow; Countermeasures

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ACOUSTICS

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

19990004178 Naval Research Lab., Washington, DC USA
Coherent Acoustic Communications During the Littoral Warfare Advanced Development 98-1 and SCV-97 Experiments
Al-Kurd, A., Naval Research Lab., USA; Schindall, J., Naval Research Lab., USA; Yang, T. C., Naval Research Lab., USA; Carey, E., Naval Research Lab., USA; Sep. 30, 1998; 27p; In English
Report No.(s): AD-A354046; NRL/MR/7123--98-8199; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Coherent acoustic communication experiments were performed during two Littoral Warfare Advanced Development (LWAD) exercises. The first exercise, the 1997 System Concept Validation (SCV-97), was conducted September 1997 off the South Carolina coast. The second exercise (LWAD 98-1) was conducted in the Gulf of Mexico, 30 nmi south of Key West Florida. The Acoustic Communication (ACOMM) experiment during the SCV-97 was allotted Event 5 which included two segments, one hour each. The ACOMM waveforms were projected using a mid-frequency acoustic source (BSDS) and received at multiple platforms using sonar system AN/SQS-53C, Vertical arrays (VLA), sonobuoys (SSQ-57A), and a submerged acoustic receiver. The received signals were stored on DAT and Exabyte tapes for post experiment processing. During LWAD 98-1 the ACOMM signals were projected using a mid-frequency acoustic source (F-56). The signals were received at multiple platforms using VLA's and sonobuoys. Two receiving platforms had ACOMM modems on board, one modem was a dedicated receiver and real-time signal processor, the other modem was an alternate receiver and transmitter. When the F-56 was idle, the second modem would transmit mid-frequency or high frequency ACOMM signals. The received signals were processed in situ and stored on DAT tapes for post

experiment analysis. The analysis of the SCV-97 and LWAD 98-1 experiments data show significant time-spread and a very strong multipath acoustic propagation environment.
DTIC
Acoustic Propagation; Communication; Experimentation; Underwater Communication; Elastic Scattering; Signal Analyzers

19990004347 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Application of the Spectral Element Method to Interior Noise Problems ***Final Report, 1 Aug. 1995 - 31 Jul. 1998***
Doyle, James F., Purdue Univ., USA; Oct. 26, 1998; 86p; In English
Contract(s)/Grant(s): NAG1-1749; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The primary effort of this research project was focused the development of analytical methods for the accurate prediction of structural acoustic noise and response. of particular interest was the development of curved frame and shell spectral elements for the efficient computational of structural response and of schemes to match this to the surrounding fluid.
Author
Noise (Sound); Spectra; Isoelectronic Sequence; Spectral Sensitivity; Spectroscopy

19990004402 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Multiple-Sprung Masses for Wideband Noise Control, ***1 Jan - 31 Aug. 1998***
Maidanik, G., Naval Surface Warfare Center, USA; Becker, K., Naval Surface Warfare Center, USA; Aug. 31, 1998; 66p; In English
Report No.(s): AD-A354042; NSWCCD-SIG-C98/149-7030; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The design of a wide frequency band neutralizer, vibration absorber and/or structural fuzzy, in the form of multiple sprung masses, is extensively reported in the open literature. The action of the device is reported in terms of the joint point impedance of the sprung masses. This joint impedance is merely the sum over the impedances of the individual sprung masses at the common point to which the device is to be attached to a master structure. The normalized frequency bandwidth of a device composed of a single sprung mass is proportional to the loss factor of that sprung mass. to increase this bandwidth, a device composed of more than one sprung mass is utilized. The multiplicity of sprung masses with distributed resonance frequencies is the scheme by which a wide frequency band is attained. to keep the undulations in the joint impedance of a set composed of a multiplicity of sprung masses suppressed, the loss factors are rendered larger than the normalized separations between adjacent anti-resonance frequencies. This modal overlap condition, together with the conservation of weight, are central to the design of the device.
DTIC
Bandwidth; Design Analysis; Vibration; Broadband; Noise Measurement; Frequencies; Noise (Sound)

19990005985 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Inst. of Applied Physics, Delft, Netherlands
Statistical Energy Analysis Applied to Ship-Like Structures, Part 1, Air-Borne Noise Radiation
Termeer, M. K., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; deJong, C. A. F., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Jul. 07, 1998; 62p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KM/132; TNO Proj. 827.215
Report No.(s): TD98-0116/PT1; TNO-HAG-RPT-980080/PT1; Copyright; Avail: Issuing Activity (TNO Inst. of Applied Physics, Stieltjesweg1, 2628 CK Delft, The Netherlands), Hardcopy, Microfiche
This report investigates the applicability of Statistical Energy Analysis (SEA) as a prediction tool for the underwater noise radiation of ships due to structure-borne sound from machinery. A brief introduction to the theory of SEA is given and the SEA-modelling approach is discussed. SEA-predictions are compared to measurements of a single and triple section ANTEASR model. Topics of investigation are input mobilities, energy distribution and the sound radiation to air. In future research sound radiation to water will be investigated.
Author
Sound Waves; Statistical Analysis; Ships

19990008134 Research Inst. of National Defence, Div. of Guidance and Control, Materials and Underwater Sensors, Stockholm, Sweden
Multiple Invariance Spatio-Temporal Spectral Estimation ***Topical Report Spatiotemporal Spektralestimering med Multipelinvarianser***
Robinson, John W. C., Research Inst. of National Defence, Sweden; Nov. 1997; ISSN 1104-9154; 44p; In English
Report No.(s): PB99-102345; FOA-R-SE-00617-409-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this work, the authors present an efficient high resolution signal subspace method for the simultaneous determination of center frequencies and directions-of-arrival (DOAs) of multiple narrow-band sources. The method is based on ESPRIT and an array with multiple spatio-temporal invariances. The authors show that by employing certain symmetries in the space-time sampling pattern the number of sensors can be kept very low relative to the number of signals, without relying on frequency separation via prefiltering. Moreover, these symmetries make it possible to solve the problem of pairing the frequencies and DOAs in a simple way. The 2-D parameter estimation problem is formulated in terms of three coupled 1-D problems that can be solved in parallel. Simulation results are provided to illustrate the application of the method.
NTIS
Invariance; Spectra; High Resolution; Spatial Resolution; Temporal Resolution; Sonar

19990008245 Defence Science and Technology Organisation, Maritime Operations Div., Melbourne, Australia
Underwater Acoustic Imaging: Rapid Signal Processing
Blair, David G., Defence Science and Technology Organisation, Australia; Jones, Ian S. F., Defence Science and Technology Organisation, Australia; Apr. 1998; 28p; In English
Report No.(s): DSTO-TN-0098; DODA-AR-010-280; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

An innovation program to develop an underwater acoustic imaging system able to resolve objects down to millimeter resolution in turbid waters is under way. The defence need is for the identification of minelike objects. This report reviews options for the signal processing or beamforming stage of the program. An image consisting of 3 x lO(exp 9) voxels (volume pixels) could be formed by a summation of the voltages from 4000 sensor elements, each taken from the element's voltage stream at the appropriate time. With a suitable allowance (factor of 9) for calculating the time delays, it appears at first sight that 9 x l.2 x 10(exp 13) operations would be required. The problem is to calculate a three-dimensional image of adequate quality in the shortest time at the least cost. A hierarchical structure of options is developed in an attempt to capture all possibilities. At the top level, three approaches are identified. First, the use of appropriate hardware, such as computers with parallelism. Second, a reduction in the number of operations (a 'software' solution). and third, the defining of a suitable reduced goal, which appears to come down to the imaging of a subvolume of the original volume that contains the object of interest. Each of these three approaches is divided into suboptions; these are discussed in detail to bring out difficulties and advantages.
Author
Pixels; Underwater Acoustics; Signal Processing; Imaging Techniques; Acoustic Imaging; Beamforming; Millimeter Waves

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ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990004211 Oulu Univ., Dept. of Theoretical Physics, Finland
Heavy Fermion Behaviour Explained by Bosons
Kallio, A., Oulu Univ., Finland; Poykko, S., Oulu Univ., Finland; Apaja, V., Oulu Univ., Finland; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 209-218; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Conventional heavy fermion theories require existence of massive fermions. We show that heavy fermion phenomena can also be simply explained by existence of bosons with moderate mass but temperature dependent concentration below the formation temperature T(sub B), which in turn is close to room temperature. The bosons B++ are proposed to be in chemical equilibrium with a system of holes h+: B++ in equilibrium with h+ + h+. This equilibrium is governed by a boson breaking function f(T), which determines the decreasing boson density and the increasing fermion density with increasing temperature. Since HF-compounds are hybridized from minimum two elements, we assume in addition existence of another fermion component h(sub s)+ with temperature independent density. This spectator component is thought to be the main agent in binding the bosons in analogy with electronic or muonic molecules. Using a linear boson breaking function we can explain temperature dependence of the giant linear specific heat coefficient gamma(T) coming essentially from bosons. The maxima in resistivity, Hall coefficient and susceptibility are explained by boson localization effects due to the Wigner crystallization. The antiferromagnetic transitions in turn are explained by similar localization of the pairing fermion system when their density n(sub h)(T(sub FL) becomes lower than n(sub wc), the critical density of Wigner crystallization. The model applies irrespective whether a compound is superconducting or not. The same model explains the occurrence of low temperature antiferromagnetism also in high-Tc superconductors. The double

transition in UPt(sub 3) is proposed to be due to the transition of the pairing fermion liquid from spin polarized to unpolarized state.
Author
Fermions; Bosons; Temperature Dependence; Heavy Ions; Chemical Equilibrium

19990004897 Mission Research Corp., Nashua, NH USA
ARCHON Technical Reference and User Manual ARCHON58, *1 Jun - 1 Dec. 1997*
Armstrong, Russell A.; Jul. 1998; 51p; In English
Contract(s)/Grant(s): DNA001-96-C-0041
Report No.(s): AD-A354412; MRC-NSH-R-97-005; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This combined report on ARCHON58 is an update to the earlier report on ARCHON22 (DNA-TR-89-65-Vl&2). The earlier report consisted of two volumes, volume 1 being a detailed description of ARCHON and the ARCHON reaction rate data set listing, and volume 2 being the user guide to ARCHON. There have been significant updates to both the ARCHON code and to the reaction rate data set. Updates to the ARCHON code itself has been primarily to address run time efficiencies and inadequacies in the former code - there is a speed-up factor of 20-50 with ARCHON58 over ARCHON22. This speed-up is primarily attributable to modifications to the integration technique and the addition of a user-specified option to substitute the GEAR integrator method. One of the more important changes is the addition of a variable time step routine which has been added so that when ARCHON senses a rapid change in a driver parameter (temperature, density, e.g. shock wave), the time step is reduced accordingly. The ”standard” ARCHON reaction rate data set is now called ARD
DTIC
User Manuals (Computer Programs); Reaction Kinetics

19990008065 Clark-Atlanta Univ., Dept. of Physics, GA USA
Energy Levels and Oscillator Strengths for Allowed Transitions in S III
Tayal, S. S., Clark-Atlanta Univ., USA; Journal of Physics B. Atomic, Molecular and Optical Physics; 1995; ISSN 0953-4075; Volume 28, pp. 5193-5200; In English
Contract(s)/Grant(s): NAGw-4447; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
We have calculated energy levels and oscillator strengths for dipole-allowed transitions between the terms belonging to the 3s(sup 2)3p(sup 2), 3s3p(sup 3), 3S(sup 2)3p3d, 3S(sup 2)3p4s, 3S(sup 2)3p4p and 3s(sup 2)3p4d configurations of S iii in the LS-coupling scheme. We used flexible radial functions and included a large number of configurations in the configuration-interaction expansions to ensure convergence. The calculated energy levels are in close agreement with the recent laboratory measurement. The present oscillator strengths are compared with other calculations and experiments and most of the existing discrepancies between the available calculations are resolved.
Author
Energy Levels; Oscillator Strengths; Computation

19990008382 Meiji Univ., School of Science and Technology, Kawasaki, Japan
Pressure-Induced Phase Transition in Stillinger-Weber System
Takasaki, Ichiro, Meiji Univ., Japan; Ishibashi, Kiyoshi, Meiji Univ., Japan; Eguchi, Haruki, Meiji Univ., Japan; Tsumuraya, Kazuo, Meiji Univ., Japan; Research Reports of the School of Science and Technology, Meiji University; 1996; ISSN 0916-4944, No. 14(70), pp. 1-10; In English
Report No.(s): I-156; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
We study the pressure-induced structural phase transition in Stillinger and Weber (SW) system using a variable size and shape form of molecular dynamics method. We use a revised method by Cleveland, which is originally developed by Parrinello and Rahman. The system consist of atoms interacting via a three-body SW potential. The application of both the [100] unaxial stress and the hydrostatic pressure simulates the transition to the distorted beta-tin phase which shuffles on every other (200) plane in [010] direction. Softening of the bond angle term in the SW potential simulates the transition to beta-phase under the application of the hydrostatic pressure alone. We discuss the present simulation based on the heterogeneous nucleation of the structural transition phase.
Author
Research; Phase Transformations; Simulation; Hydrostatic Pressure

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NUCLEAR AND HIGH-ENERGY PHYSICS

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

19990007756 Rutherford Appleton Lab., Chilton, UK
Six-Jet Production at Lepton Colliders
Moretti, S., Rutherford Appleton Lab., UK; Sep. 11, 1998; ISSN 1358-6254; 69p; In English
Report No.(s): RAL-TR-98-035; Copyright; Avail: Issuing ActivityChilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

We study electron-positron annihilation into six jets at the parton level in perturbative Quantum Chromo-Dynamics (QCD), via the elementary processes e(+)e(-) right arrow qq(bar)gggg, e(+)e(-) right arrow qq(bar)q'q'(bar)gg and e(+)e(-) right arrow qq(bar)q'q'(bar)q"q"(bar), for massive quarks q, q' and q" and massless gluons g. Several numerical results of phenomenological relevance are given, at three different collider energies and for a representative selection of jet clustering algorithms. We also present helicity amplitudes and colour factors needed for the tree-level calculation.
Author
Research; Annihilation Reactions; Electron Beams; Quantum Chromodynamics; Positron Annihilation

19990007917 National Inst. for Fusion Science, Nagoya, Japan
Studies on Advanced Superconductors for Fusion Device, Part 3, High-T(sub c) Oxide Superconductors
Tachikawa, K., Editor, National Inst. for Fusion Science, Japan; Mito, T., Editor, National Inst. for Fusion Science, Japan; Mar. 1998; ISSN 0915-6372; 209p; In Japanese
Report No.(s): NIFS-MEMO-27/PT3; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A series of reports on the present status of the development in Nb3Sn and other advanced metallic superconductors has been published as NIFS-MEMO-20(March, 1996) and NIFS-MEMO-22(March, 1997). The third report of this series covers the recent development of different high-Tc oxide superconductors(HTS). Bi-based HTS tapes have been fabricated by powder-in-tube and other processes for power transmission cables operating at 77 K, superconducting magnets operating at 20 K, and ultra high-field insert coils operating at 4.2 K. Coated conductors of Y- and Tl- based HTS with improved performance at higher temperatures and fields are being developed. The fabrication of Hg-based HTS with the highest Tc among HTS is also being studied. The ac performance and the mechanical tolerance of HTS, which are the key factors in the practical use, are described in this report. The international activities on the standardization of critical current measurement method in HTS tapes has been recently initiated. The irradiation effects on HTS has gained much interests for enhancing flux pinning in HTS. Meanwhile, the melt processed Y- and RE-based HTS bulk materials are being developed as strong permanent magnets. The development of HTS current leads has realized refrigerator-cooled superconducting magnets convenient for broad applications. High performance magnetic shielding facilities have been developed using HTS thick films coated on metal substrates. An appreciable progress in the performance of HTS may be expected through researches on the material science and processing technologies of HTS. The material aspects of HTS are described in detail in this report. Different HTS components, e.g. wires, current leads, magnetic shields, etc., may yield substantial contribution for the progress of fusion technologies in future. Keywords: high-Tc superconductors, material aspects, Bi-based oxide tape, application, Y-based oxide tape, Tl- and Hg-based oxide tapes, ac properties, mechanical tolerance, irradiation effect, current lead, melt processed bulk, magnetic shield
Author
Superconductors (Materials); Fusion Reactors; Product Development; Fabrication; High Temperature Superconductors; Research and Development; Technologies

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OPTICS

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

19990006018 Army Research Lab., Sensors Directorate, Adelphi, MD USA
CMOS Design for a Smart Focal Plane Array ***Final Report, Jan. - May 1996***
Bambha, Neal, Army Research Lab., USA; Jul. 1998; 16p; In English
Report No.(s): AD-A353192; ARL-TR-1501; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A smart focal plane array has been designed that incorporates the functions of edge extraction, brightness adaptation, and moving-object detection. The design is based on a concept first presented by Mead and Mahowald, who built a silicon retina that was modeled on the distal portion of the vertebrate retina. Their chip generated, in real time, outputs that correspond directly to signals observed in the corresponding levels of biological retinas; the design employed a resistive network to perform signal aggregation between cells. The design presented in this report is compatible with complementary metal oxide semiconductor (CMOS) technology and can be readily fabricated through MOSIS (MOS implementation system). The layout of a prototype array was created with the MOSIS scalable CMOS n-well analog 2.0 micron process. Although the array presented here uses Si phototransistors, the architecture is applicable to any semiconductor system in which pnp transistors and MOSFETs (MOS field-effect transistors) can be produced. Therefore it could be adapted for use with GaAs quantum-well infrared photodetectors (QWlPs) to produce smart focal plane arrays in the infrared. In addition, the design is appropriate for HgCdTe detectors if selected area growth on Si is possible. A preliminary design in which each pixel is connected to a light-emitting diode (LED) is also discussed.
DTIC
Focal Plane Devices; Arrays; CMOS; Image Processing

19990007745 Universitaet der Bundeswehr, Mess- und Informationstechnik, Hamburg, Germany
Practical Application of Pattern Recognition Techniques
Rothe, Hendrik, Universitaet der Bundeswehr, Germany; vonderFecht, Arno, Universitaet der Bundeswehr, Germany; Kasper, Andre, Universitaet der Bundeswehr, Germany; Rinder, Thomas, Universitaet der Bundeswehr, Germany; Advanced Pattern Recognition Techniques; Sep. 1998; 24p; In English; Also announced as 19990007733; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper deals with three examples for pattern recognition and an estimation of the computational effort needed for the real time parts (prediction) of the following approaches: (1) Discriminant Analysis; (2) Feedforward Neural Network; and (3) Sugeno Fuzzy Classificator. The first example is of the simple pattern matching type. A satellite photograph of our university from a freely distributed CD-ROM was used. We extracted the clock tower of the building where the chair for measurement and information technology is located and tried to find that place by correlation analysis. This pattern recognition works without features. We found the location of the clock tower with an accuracy of about +/- 1 pixel (+/- 1 meter) in a photograph which actually displays 2 x 2 kilometers. The interesting point is, however, that one can use data freely available and a simple PC-platform with common numerical software like MatLab(TM). In the second example we show our work in the field of in-situ inspection of high performance optics (e.g. degradation of airborne surveillance systems) and supersmooth surfaces, like wafers, hard discs and flat panel displays. In this case the extraction of the correct feature variables and the appropriate classificators is of great importance for the performance of the pattern recognition system. It is shown that empirical statistical moments and Discriminant Analysis perform best. The third example of the paper is based on a range gated 3D laser radar system without scanner developed in our group. The design of the system is explained and measurement results are presented. This part of the paper explains, why one can use very simple features and straightforward classifiers, if the hardware of the pattern recognition system is specially designed for classification purposes. to our knowledge it is the first time that such an approach is published unclassified.
Author
Pattern Recognition; Discriminant Analysis (Statistics); Feedforward Control; Neural Nets; Classifiers; Fuzzy Systems; Image Processing; Imaging Techniques; Image Classification

19990008057 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Airborne Infrared Spectroscopy of 1994 Western Wildfires
Worden, Helen, Jet Propulsion Lab., California Inst. of Tech., USA; Beer, Reinhard, Jet Propulsion Lab., California Inst. of Tech., USA; Rinsland, Curtis P., NASA Langley Research Center, USA; Journal of Geophysical Research; Jan. 20, 1997; ISSN 0148-0227; Volume 102, No. D1, pp. 1287-1299; In English
Report No.(s): Paper-96JD02982; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In the summer of 1994 the 0.07/ cm resolution infrared Airborne Emission Spectrometer (AES) acquired spectral data over two wildfires, one in central Oregon on August 3 and the other near San Luis Obispo, California, on August 15. The spectrometer was on board a NASA DC-8 research aircraft, flying at an altitude of 12 km. The spectra from both fires clearly show features due to water vapor, carbon dioxide, carbon monoxide, ammonia, methanol, formic acid, and ethylene at significantly higher abundance and temperature than observed in downlooking spectra of normal atmospheric and ground conditions. Column densities are derived for several species, and molar ratios are compared with previous biomass fire measurements. We believe that this is the first time such data have been acquired by airborne spectral remote sensing.
Author
Airborne Equipment; Infrared Spectrometers; Data Acquisition; Remote Sensing; Fires

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990004227 Alfred Univ., NY USA
High T(sub c) Superconductors Fabricated by Plasma Aerosol Mist Deposition Technique
Wang, X. W., Alfred Univ., USA; Vuong, K. D., Alfred Univ., USA; Leone, A., Alfred Univ., USA; Shen, C. Q., Alfred Univ., USA; Williams, J., Alfred Univ., USA; Coy, M., Alfred Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 372-381; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We report new results on high T(sub c) superconductors fabricated by a plasma aerosol mist deposition technique, in atmospheric environment. Materials fabricated are YBaCuO, BiPbSRCaCuO, BaCaCuO precursor films for TlBaCaCuO, and other buffers such as YSZ. Depending on processing conditions, sizes of crystallites and/or particles are between dozens of nano-meters and several micrometers. Superconductive properties and other material characteristics can also be tailored.
Author
High Temperature Superconductors; Fabrication; Plasmas (Physics); YBCO Superconductors; Thallium Compounds

19990005955 National Inst. for Fusion Science, Nagoya, Japan
Development of(bar)V(sub mu) Mu Beam Detector and Large Area (bar)V(sub mu) Beam Source by H2 Gas Discharge, 2
Uramoto, Joshin, National Inst. for Fusion Science, Japan; Mar. 1998; ISSN 0915-633X; 21p; In English
Report No.(s): NIFS-542; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

From outside of a H2 gas discharge in magnetic field, negative pionlike particles Pi(sup -) are extracted in a low voltage (800 V) with H(-) ions and are shot into a thick metal plate MP. When electrons (above a critical electron energy) are supplied in the opposite side of the metal plate MP, some positive muonlike particles mu(sup +) appear continuously while the energy of mu(sup +) is corresponding to the pi(sup -) extraction voltage. From the thickness of MP, some unknown particles penetrating MP are estimated to be anti-mu neutrinos (bar)V(sub mu). Thus, a new detector for (bar)V(sub mu) beam are found and a large area (bar)V(sub mu) beam source are produced by opening many apertures over large area extraction electrodes of p(sup -) under a sheet discharge of H2 gas. This large area (bar)V(sub mu) source is very important when the (bar)V(sub mu) beam must be detected after a long distance flight or in a very small current. The negative pionlike particles pi(sup -) from the H2 discharge can be concluded to be true negative pions as the characteristics of (bar)V(sub mu) beam are clarified in this experiment.
Author
Product Development; Beams (Radiation); Gas Discharges; Hydrogen; Neutrinos; Pions; Electron Energy; Measuring Instruments

19990005957 National Inst. for Fusion Science, Toki, Japan
The Quest for Fusion Energy
Johnson, John L., Princeton Univ., USA; Oct. 1997; ISSN 0915-633X; 20p; In English; Original contains color illustrations
Report No.(s): NIFS-517; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A brief history of the magnetic fusion program from the point of view of a stellarator enthusiast who worked at a major tokamak laboratory. The reason that success in the magnetic fusion energy program is essential is presented.
Author
Tokamak Devices; Nuclear Fusion; Stellarators

19990008042 NASA Marshall Space Flight Center, Huntsville, AL USA
A Model for Lower Hybrid Wave Excitation Compared with Observations by Viking
Khazanov, G. V., NASA Marshall Space Flight Center, USA; Liemohn, M. W., NASA Marshall Space Flight Center, USA; Krivorutsky, E. N., Alabama Univ., USA; Horwitz, J. L., Alabama Univ., USA; Geophysical Research Letters; Oct. 01, 1997; ISSN 0094-8534; Volume 24, No. 19, pp. 2399-2402; In English
Contract(s)/Grant(s): NSF ATM-94-02310; NSF ATM-95-23699
Report No.(s): Paper-97GL02389; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The mechanism of lower hybrid wave (LHW) excitation due to the O+ relative drift in a plasma subjected to low-frequency waves (LFWs) is used for analysis of Viking satellite data for events in the cusp/cleft region. In some cases, such a mechanism

leads to LHW energy densities and ion distribution functions close to those observed, suggesting the proposed mechanism is a plausible candidate to explain certain classes of LHW generation events in space plasmas.
Author
Wave Excitation; Space Plasmas; Flux Density; Distribution Functions; Plasma Waves

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SOLID-STATE PHYSICS

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

19990004070 Carnegie-Mellon Univ., Pittsburgh, PA USA
Growth of Lattice Matched Nitride Alloys and Structures ***Final Report, 15 Dec. 1994 - 15 Mar. 1998***
Skowronski, Marek, Carnegie-Mellon Univ., USA; Greve, D. W., Carnegie-Mellon Univ., USA; Sep. 22, 1998; 19p; In English
Contract(s)/Grant(s): F49629-95-1-0087
Report No.(s): AD-A354115; AFRL-SR-BL-TR-98-0661; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Boron-gallium nitride, boron-aluminum nitride and gallium-aluminum nitride films have been deposited on sapphire substrates by organometallic vapor phase epitaxy and their properties have been investigated by Transmission Electron Microscopy, high resolution x-ray diffraction, and Hall effect. Solid solubility limits of boron in AlN and GaN have been determined to be 1 and 7%, respectively. Growth of B(x)Ga(1-x)N shows severe poisoning effect with growth rates dropping rapidly whenever sp2-bonded BN phase is detected by x-ray diffraction. The quality of B(x)Ga(1-x)N and B(x)Al(1-x)N films degrades with increasing x both in terms of changes of lattice parameter indicating random strains/composition variation and misorientations between low angle grains in the film. The concentration of point defects also increases resulting in increase of electron concentration at low x and deep center concentration at x greater than 0.20. n-type doping of films with silicon allowed to achieve electron concentration in 10(exp 18)/cu cm range for x up to 0.55. For higher aluminum content silicon donors exhibit DX-like behavior.
DTIC
Lattice Parameters; Nitrides; Organometallic Compounds; Crystal Growth; Metal Films; Sapphire; Vapor Phase Epitaxy

19990004078 Space and Naval Warfare Systems Command, San Diego, CA USA
In-Situ Laser Doping of Silicon Carbide ***Final Report***
Russell, S. D., Space and Naval Warfare Systems Command, USA; Ramirez, A. D., Space and Naval Warfare Systems Command, USA; Aug. 1998; 26p; In English, Mar. 1998, USA; Sponsored by American Physical Society, USA
Report No.(s): AD-A354054; SPAWAR-TD-3036; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This Technical Document is a compilation of posters presented at the March 1998 meeting of the American Physical Society in Los Angeles, CA. It summarizes the inherent difficulties in fabricating silicon carbide microelectronic devices, the novel laser setup used to form electrical junctions in silicon carbide, detailed analyses of the laser-processed materials, and applications for this technique. This is the first reported demonstration of incorporation and activation of dopants into silicon carbide using excimer laser recrystalization in the presence of a doping ambient.
DTIC
Silicon Carbides; Fabrication; Microelectronics; Junction Transistors; Laser Materials

19990004137 California Univ., Dept. of Computer Engineering, Santa Barbara, CA USA
Lateral Epitaxial Overgrowth of GaN on Si(111) ***Progress Report***
Sep. 1998; 2p; In English
Report No.(s): AD-A353896; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
The lateral epitaxial overgrowth of GaN on Si(111) substrates was achieved using an extension of our standard LEO process on GaN/Al2O3 substrates, and the reduction of the dislocation density was demonstrated by transmission electron microscopy (TEM) and atomic force microscopy (AFM). The growth on the Si(111) substrate was initiated with the deposition of a thin AlN buffer layer to avoid the formation of potentially detrimental silicon nitride at the interface. The wafers were then patterned with a SiO2 layer in which 5 micron wide opening separated by 35 microns were etched using buffered HF. After reloading the samples in the MOCVD chamber, the LEO growth was performed using our standard parameters. There are a few unresolved issues concerning the effect of the AlN buffer thickness and its chemical compatibility with the SiO2 mask layer, but after a basic

optimization we were able to obtain 5 microns of lateral overgrowth with smooth sidewalls in a reproducible manner. We are currently investigating the use of mask materials other than SiO2 to achieve LEO on Si(111) over a wider range of process parameters. DTIC

Epitaxy; Metalorganic Chemical Vapor Deposition; Gallium Nitrides; Silicon; Microstructure; Substrates

19990004180 Minnesota Univ., School of Physics and Astronomy, Minneapolis, MN USA

High Temperature Superconducting Compounds ***Final Report, 1 Jun. 1995 - 31 May 1998***

Goldman, Allen M.; Sep. 01, 1998; 4p; In English

Contract(s)/Grant(s): F49620-95-1-0397

Report No.(s): AD-A353980; AFRL-SR-BL-TR-98-0650; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Selective epitaxial growth of DyBa2Cu3O7 using Dy(1-delta)Cu(delta)Ox templates has produced superconducting wires as small as 2 um in width. A systematic study of the effects of template composition on the superconducting wires was undertaken. The lateral diffusion of Dy and Cu from the template into the wires was measured with characteristic x-ray maps. Optimized templates were found to be useful in defining device size features without degradation of the superconducting properties of the films. DTIC

High Temperature Superconductors; Josephson Junctions; Epitaxy; Wire

19990004188 NASA Johnson Space Center, Houston, TX USA

Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity, Volume 1

Krishen, Kumar, Editor, NASA Johnson Space Center, USA; Burnham, Calvin, Editor, World Congress on Superconductivity, USA; Apr. 1995; 420p; In English; 4th; World Congress on Superconductivity, 27 Jun. - 1 Jul. 1994, Orlando, FL, USA; Sponsored by NASA Johnson Space Center, USA; Also announced as 19990004189 through 19990004229

Report No.(s): NASA-CP-3290-Vol-1; S-792-Vol-1; NAS 1.55:3290-Vol-1; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

This document contains papers presented at the 4th International Conference Exhibition: World Congress on Superconductivity held at the Marriott Orlando World Center, Orlando, Florida, June 27-July 1, 1994. This conference encompassed research, technology, applications, funding, political, and social aspects of superconductivity. Specifically, the areas of research, technology, and development covered during the conference included high-temperature materials, thin films, C-60 based superconductors, persistent magnetic fields and shielding, fabrication methodology, space applications, physical applications, performance characterization, device applications, weak link effects and flux motion, accelerator technology, superconductivity energy, storage, future research and development directions, medical applications, granular superconductors, wire fabrication technology, computer applications, technical and commercial challenges, and power and energy applications. The key objective of this conference was to provide a forum for the world community to share technological results of recent advances made in the field of superconductivity and to discuss translation of the research to technology which will benefit humanity. More than 150 presentations were made at this conference.

Author

Conferences; Superconductivity; Superconductors (Materials); Superconducting Devices; Technology Utilization; Technology Assessment; High Temperature Superconductors

19990004189 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Korea's Development Program for Superconductivity

Hong, Gye-Won, Korean Atomic Energy Research Inst., Korea, Republic of; Won, Dong-Yeon, Korean Atomic Energy Research Inst., Korea, Republic of; Kuk, Il-Hyun, Korean Atomic Energy Research Inst., Korea, Republic of; Park, Jong-Chul, Korean Standards Research Inst., Korea, Republic of; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 3-9; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Superconductivity research in Korea was first carried out in the late 70s by a research group in Seoul National University (SNU), who fabricated a small scale superconducting magnetic energy storage system under the financial support from Korea Electric Power Company (KEPCO). But only a few researchers were involved in superconductivity research until the oxide high Tc superconductor was discovered by Bednorz and Mueller. After the discovery of YBaCuO superconductor which operated above the boiling point of liquid nitrogen (77K), the Korean Ministry of Science and Technology(MOST) sponsored a special fund for the high Tc superconductivity research to universities and national research institutes by recognizing its importance. Scientists engaged in the "High Temperature Superconductivity Research Association (HITSRA)" project organized for effective conducting of research. Its major functions were to coordinate research activities on high Tc superconductivity and organize the

workshop for active exchange of information. During the last seven years the major of superconductivity research has been carried out through the coordination of HITSRA. The major parts of Korea's superconductivity research program were related to high temperature superconductors and only a few groups were carrying out research on conventional superconductor technology. Korea Atomic Energy Research Institute (KAERI) and Korea Electrotechnology Research Institute (KERI) have led this research. In this paper the current status and future plans of superconductivity research in Korea will be reviewed based on the results presented in an interim meeting of HITSRA, April 1-2, 1994, Taejeon, as well as the research activity of KAERI.
Author
Superconductors (Materials); Superconductivity; Energy Technology; Research and Development; Technology Assessment; Korea

19990004190 Industrial Technology Research Inst., Materials Research Labs., Hsinchu, Taiwan, Province of China
Progress of Applied Superconductivity Research at Materials Research Laboratories, ITRI (Taiwan)
Liu, R. S., Industrial Technology Research Inst., Taiwan, Province of China; Wang, C. M., Industrial Technology Research Inst., Taiwan, Province of China; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 10-23; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

A status report based on the applied high temperature superconductivity (HTS) research at Materials Research Laboratories (MRL), Industrial Technology Research Institute (ITRI) is given. The aim is to develop fabrication technologies for the high-Tc materials appropriate to the industrial application requirements. to date, the majority of work has been undertaken in the areas of new materials, wires/tapes with long length, prototypes of magnets, large-area thin films, SQUIDs and microwave applications.
Author
Research and Development; High Temperature Research; Superconductivity; Superconductors (Materials); Taiwan

19990004191 Tata Inst. of Fundamental Research, Bombay, India
Progress in Superconductivity: The Indian Scenario
Multani, Manu, Tata Inst. of Fundamental Research, India; Mishra, V. K., Government of India, India; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 24-36; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

India has made rapid progress in the field of high temperature superconductivity, beginning at the time of publication of the Zeitschrift fuer Physik paper by Bednorz and Mueller. Phase I of the program was conceived by the Department of Science and Technology of the Government of India. It consisted of 42 projects in the area of basic research, 23 projects in applications and 4 short-term demonstration studies. The second phase started in October 1991 and will run through March 1995. It consists of 50 basic research programs and 24 application programs. The total investment, mainly consisting of infrastructural development to supplement existing facilities and hiring younger people, has amounted to about Indian Rupees 40 crores, equivalent to about 13 million US dollars. The expenditure for the period 1992-1997 shall be up to about Rs. 27 crores, equivalent to about 9 million US dollars. The basic idea is to keep pace with developments around the world. One of the highlights of our achievements is the discovery of borocarbides as superconductors. We shall outline the main achievements of the past two to three years.
Derived from text
Research and Development; Superconductivity; Superconductors (Materials); Technology Assessment; Research Facilities; India

19990004192 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Superconductivity in Russia: Update and Prospects
Ozhogin, V., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 37-47; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The research in high temperature superconductivity in the former Soviet Union had been organized and financed since 1988 through a special State Program, the scheme being retained for Russia after the regretable decomposition of the Soviet Union. The scientific supervision is being carried out by the Scientific Council under the chairmanship of Academician Yu. Osipyan. The Council consists of four sections conditionally named "Physics", "Chemistry", "Weak Currents" and "High Currents" and headed by I. Shchegolev (Inst. of Solid State Phys., Chernogolovka), Yu. Tret'yakov (Moscow State Univ.), V. Lemanov (Phys.-Tech. Inst., St.-Petersburg), and N. Chernoplekov (RRC "Kurchatov Inst."), respectively. During the 2 years that passed between the 3rd and the 4th World Congresses on Superconductivity, the tendency has been toward curtailing the number of research groups working in the field of high temperature superconductivity and accordingly, toward cutting back the number of publications on

the subject. This process is due basically to the fact that this problem was given up by random people deprived of sufficient financial support and has been continued by high-grade professionals. Therefore the quality of publications rises and their subject matter becomes more and more purposeful. The situation in Russia is developing in the same direction, if only a little bit slower, partly because of less rigid approaches to the financing problem. Thus, in 1993 the HTSC State Program coordinated the activities within 275 projects, down from 340 in 1992 and 402 in 1991. The report is an overview of recent research and development.
Author
Superconductors (Materials); Research and Development; Technology Assessment; Russian Federation

19990004193 Eoetvoes LORANd Univ., Dept. for Low Temperature Physics, Budapest, Hungary
Preparation, Structure and Superconductivity of High-T(sub c) Compounds
Kirschner, I., Eoetvoes LORANd Univ., Hungary; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 48-55; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In this paper the main directions, methods and results of the investigation of high-Tc superconductors in Hungary are briefly summarized. The fundamental idea of this research is to study the effect of starting conditions on the microstructure of samples and the influence of the latter on their superconducting parameters. The investigation concerning technical development is also mentioned.
Author
High Temperature Superconductors; Superconductivity; Superconductors (Materials); Research and Development; Technology Assessment; Hungary

19990004194 Eoetvoes LORANd Univ., Dept. for Low Temperature Physics, Budapest, Hungary
High-T(sub c) Superconductors: Technical and Commercial Challenge
Kirschner, I., Eoetvoes LORANd Univ., Hungary; Horvath, E., EPOS-PVI, Inc., Hungary; Vajda, I., Technical Univ. of Budapest, Hungary; Bencze, L., Research Inst. of the Electrical Industry, Hungary; Goebl, N., Research Inst. of the Electrical Industry, Hungary; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 56-59; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Some basic questions which lead from the discovery of high-Tc superconductors and their applications are surveyed. The influence of high-Tc superconducting technology on industrial and social development is also briefly analyzed.
Author
High Temperature Superconductors; Superconductors (Materials); Research and Development; Technology Assessment; Hungary

19990004195 Midwest Superconductivity, Inc., Lawrence, KS USA
Technical and Commercial Challenges in High T(sub c) SQUIDs and Their Industrial Applications
Lu, D. F., Midwest Superconductivity, Inc., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 60-62; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

A SQUID is the most sensitive device for measuring changes in magnetic flux. Since its discovery in the sixties, scientists have made consistent efforts to apply SQUIDs to various applications. Instruments that are the most sensitive in their respective categories have been built, such as SQUID DC susceptometer that is now manufactured by Quantum Design, pico-voltmeter which could measure 10(exp -14) volts, and gravitational wave detectors. One of the most successful applications of SQUIDs is in magnetoencephalography, a non-invasive technique for investigating neuronal activity in the living human brain. This technique employs a multi-channel SQUID magnetometer that maps the weak magnetic field generated by small current when information is processed in brain, and its performance is marvelous. All the wonders of SQUIDs have been realized using low temperature superconducting (LTS) SQUIDs that must be cooled using liquid helium. Since the discovery of high temperature superconductors in 1986, people have long expected to replace LTS SQUIDs with their high Tc counterparts in some applications, or to find new applications for high temperature superconducting (HTS) SQUIDS. A HTS SQUID is capable of working at liquid nitrogen temperature, which is far more advantageous to liquid helium in terms of cost and in terms of possibility for field applications. Many efforts have been made to take advantage of HTS SQUIDS. Various types of HTS thin film or bulk SQUID magnetometers and gradiometers have been studied. The best HTS SQUID is very competitive with its LTS counterpart in properties and performance. However, there has not been any real commercial application of HTS SQUIDs yet. Despite the promising features of HTS SQUIDS, there are still many challenges ahead before HTS SQUIDs can be widely used in commercial products. In this

short paper, we will briefly discuss some of the issues that people need to be concerned with when trying to use a HTS SQUID in a particular application.
Derived from text
High Temperature Superconductors; Squid (Detectors); Superconductivity; Research and Development; Superconducting Devices

19990004196 European Organization for Nuclear Research, Geneva, Switzerland
The LHC Magnet System and its Status of Development
Bona, Maurizio, European Organization for Nuclear Research, Switzerland; Perin, Romeo, European Organization for Nuclear Research, Switzerland; Vlogaert, Jos, European Organization for Nuclear Research, Switzerland; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 65-74; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

CERN is preparing for the construction of a new high energy accelerator /collider, the Large Hadron Collider (LHC). This new facility will mainly consist of two superconducting magnetic beam channels, 27 km long, to be installed in the existing LEP tunnel. The magnetic system comprises about 1200 twin-aperture dipoles, 13.145 m long, with an operational field of 8.65 T, about 600 quadrupoles, 3 m long, and a very large number of other superconducting magnetic components. A general description of the system is given together with the main features of the design of the regular lattice magnets. The paper also describes the present state of the magnet Research and Development program. Results from short model work, as well as from full scale prototypes will be presented, including the recently tested 10 m long full-scale prototype dipole manufactured in industry.
Author
Superconductivity; Research and Development; Superconducting Devices; Superconducting Magnets; Particle Accelerators

19990004197 National Lab. for High Energy Physics, Tsukuba, Japan
Status of High Temperature Superconductor Development for Accelerator Magnets
Hirabayashi, H., National Lab. for High Energy Physics, Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 75-83; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

High temperature superconductors are still under development for various applications. As far as conductors for magnets are concerned, the development has just been started. Small coils wound by silver sheathed Bi-2212 and Bi-2223 oxide conductors have been reported by a few authors. Essential properties of high Tc superconductors like pinning force, coherent length, intergrain coupling, weak link, thermal property, AC loss and mechanical strength are still not sufficiently understood. In this paper, a review is given with comparison between the present achievement and the final requirement for high Tc superconductors, which could be particularly used in accelerator magnets. Discussions on how to develop high Tc superconductors for accelerator magnets are included with key parameters of essential properties. A proposal is also given on how to make a prototype accelerator magnet with high Tc superconductors with prospects for future development.
Author
High Temperature Superconductors; Superconducting Magnets; Particle Accelerators; Research and Development; Technology Assessment

19990004198 Deutsches Elektronen-Synchrotron, Hamburg, Germany
Development Work for a Superconducting Linear Collider
Matheisen, Axel, Deutsches Elektronen-Synchrotron, Germany; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 84-92; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

For future linear e+e- colliders in the TeV range several alternatives are under discussion. The TESLA approach is based on the advantages of superconductivity. High Q values of the accelerator structures give high efficiency for converting RF power into beam power. A low resonance frequency for the RF structures can be chosen to obtain a large number of electrons (positrons) per bunch. For a given luminosity the beam dimensions can be chosen conservatively which leads to relaxed beam emittance and tolerances at the final focus. Each individual superconducting accelerator component (resonator cavity) of this linear collider has to deliver an energy gain of 25 MeV/m to the beam. Today s.c. resonators are in use at CEBAF/USA, at DESY/Germany, Darmstadt/Germany; KEK/Japan and CERN/Geneva. They show acceleration gradients between 5 MV/m and 10 MV/m. Encouraging experiments at CEA Saclay and Cornell University showed acceleration gradients of 20 MV/m and 25 MV/m in single and multicell structures. In an activity centered at DESY in Hamburg/Germany the TESLA collaboration is constructing a 500 MeV superconducting accelerator test facility (TTF) to demonstrate that a linear collider based on this technique can be built in a cost effective

manner and that the necessary acceleration gradients of more than 15 MeV/m can be reached reproducibly. The test facility built at DESY covers an area of 3,000 sq m and is divided into 3 major activity areas: 1) The testlinac, where the performance of the modular components with an electron beam passing the 40 m long acceleration section can be demonstrated; 2) The test area, where all individual resonators are tested before installation into a module; and 3) The preparation and assembly area, where assembly of cavities and modules take place. We report here on the design work to reach a reduction of costs compared to actual existing superconducting accelerator structures and on the facility set up to reach high acceleration gradients in a reproducible way.
Author
Superconductivity; Test Facilities; Cost Effectiveness; Linear Accelerators; Superconducting Cavity Resonators; Technology Assessment; Research Facilities

19990004199 TECHNOVA, Inc., Tokyo, Japan
Today's Research Development on the Application of the Superconductivity Transport System in Japan
Kyotani, Yoshihiro, TECHNOVA, Inc., Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 96-105; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

At the Miyazaki test track today, the new test vehicle, MLU002N, is under test run to obtain necessary data for Yamanashi test track where the construction is underway. The test vehicle has been ordered and the first tunnel was completed in December 1993. Superconducting magnetohydrodynamic drive ship, MHDS, "Yamato 1" has completed its experiment in 1992 and it is now under preparation to exhibit to the public in 1994. Furthermore, to promote the research development of MHDS, the detailed discussion is underway on the magnetohydrodynamic drive equipment as well as the research on the future scheme. Neither an automobile nor railway but a new transport system called EQUOS LIM CAR(ELC) has been proposed. by using the rotating magnetic field, it will levitate on the aluminum like reaction plate. On the normal road, it will run by rolling the wheels like an electric car but on the highway, it will levitate on the guideway resulting in less noise, less vibration and pollution free drive. to understand the concept of the ELC, the model was built and experimented by using permanent magnet. The same model was donated to the Museum of Science and Industry in Chicago and was displayed to the public. Today, the trial superconducting magnet has been made and the research development of the subsystem is underway. Research and development of the superconducting elevator, equipment for the launching of spaceship, tube transportation system and others are in progress for the superconducting applied transportation system.
Author
Magnetic Levitation Vehicles; Superconductivity; Test Vehicles; Rapid Transit Systems; Technology Assessment

19990004200 Oslo Univ., Dept. of Physics, Norway
Measurement and Calculation of Levitation Forces Between Magnets and Granular Superconductors
Johansen, T. H., Oslo Univ., Norway; Bratsberg, H., Oslo Univ., Norway; Baziljevich, M., Oslo Univ., Norway; Hetland, P. O., Oslo Univ., Norway; Riise, A. B., Oslo Univ., Norway; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 106-115; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Recent developments indicate that exploitation of the phenomenon of magnetic levitation may become one of the most important near-term applications of High Tc superconductivity. Because of this, the interaction between a strong permanent magnet(PM) and bulk high-Tc superconductor (HTSC) is currently a subject of much interest. We have studied central features of the mechanics of PM-HTSC systems of simple geometries. Here we report experimental results for the components of the levitation force, their associated stiffness and mechanical ac-loss. to analyze the observed behavior, a theoretical framework based on critical-state considerations is developed. It will be shown that all the mechanical properties can be explained consistently at a quantitative level using a minimum of model parameters.
Author
Superconductivity; Permanent Magnets; High Temperature Superconductors; Interactions; Mechanical Properties

19990004201 Eoetvoes LORANd Univ., Dept. for Low Temperature Physics, Budapest, Hungary
ESR, SIMS and TEMF of an Y-Ba-Cu-O Superconductor
Kirschner, I., Eoetvoes LORANd Univ., Hungary; Giber, J., Technical Univ. of Budapest, Hungary; Halasz, I., Central Research Inst. for Chemistry, Hungary; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 116-125; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Superconducting transition comes into being between 92 K and 82 K in the samples having a Meissner's state value of 68 vol.%. The main material content has an orthorhombic unit cell of Y1Ba2Cu4O8 accompanied by low quantity CuO and a sporadic phase. A proof of anisotropic superconductivity, an unusually high Cu(-) ion concentration and a temperature dependent transition of charge carriers have been observed.
Author
Anisotropy; Charge Carriers; Superconductivity; YBCO Superconductors; Magnetic Fields; Temperature Dependence

19990004202 Technical Univ. of Budapest, Dept. of Electrical Machines, Hungary
Serial and Parallel Power Equipment with High-Temperature Superconducting Elements
Bencze, Laszlo, Research Inst. of the Electrical Industry, Hungary; Goebl, Nandor, Research Inst. of the Electrical Industry, Hungary; Palotas, Bela, Technical Univ. of Budapest, Hungary; Vajda, Istvan, Technical Univ. of Budapest, Hungary; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 126-134; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

One of the prospective, practical applications of high-temperature superconductors is the fault-current limitation in electrical energy networks. The development and testing of experimental HTSC serial current limiters have been reported in the literature. A Hungarian electric power company has proposed the development of parallel equipment for arc suppressing both in the industrial and customers' networks. On the basis of the company's proposal, the authors have outlined the scheme of a compound circuit that can be applied both for current limitation and arc suppressing. In this paper, the design principles and methods of the shunt equipment are presented. These principles involve the electrical, mechanical and cryogenic aspects with special emphasis on the electrical and mechanical connection between the HTSC material and the current lead. Preliminary experiments and tests have been carried out to demonstrate the validity of the design principles developed. The results of the experiments and of the technological investigations are presented.
Author
Limiter Circuits; Electric Generators; Design Analysis; Fabrication; YBCO Superconductors; Superconducting Power Transmission; Superconducting Devices

19990004203 Battelle Memorial Inst., Columbus, OH USA
Stability, Mechanical Considerations and AC Loss in HTSC Monoliths, Coils and Wires
Sumption, M. D., Battelle Memorial Inst., USA; Collings, E. W., Battelle Memorial Inst., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 138-147; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

For monolithic high-Tc superconductors (HTSCs) calculations are presented of: (1) the initial flux jump field, H(sub fj), in melt-processed YBCO based on a field- and temperature dependent J(sub c), and (2) the radial and circumferential stresses in solid and hollow cylinders containing trapped magnetic flux. For model multifilamentary (MF) HTSC/Ag strands, calculations are presented of: (1) the limiting filament diameters for adiabatic and dynamic stability; and (2) the hysteretic and eddy current components of AC loss. Again for MF HTSC/Ag composite strands the need for filamentary subdivision and twisting is discussed.
Author
High Temperature Superconductors; YBCO Superconductors; Magnetic Flux; Dynamic Stability; Hysteresis; Superconductors (Materials); Magnetic Fields; Magnetic Properties

19990004204 Cornell Univ., Dept. of Mechanical and Aerospace Engineering, Ithaca, NY USA
Aspects of Passive Magnetic Levitation Based on High-T(sub c) Superconducting YBCO Thin Films
Schoenhuber, P., Cornell Univ., USA; Moon, F. C., Cornell Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 148-156; In English; Also announced as 19990004188
Contract(s)/Grant(s): FFWF-J863-TEC; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Passive magnetic levitation systems reported in the past were mostly confined to bulk superconducting materials. Here we present fundamental studies on magnetic levitation employing cylindrical permanent magnets floating above high-Tc superconducting YBCO thin films (thickness about 0.3 microns). Experiments included free floating rotating magnets as well as well-established flexible beam methods. by means of the latter, we investigated levitation and drag force hysteresis as well as magnetic stiffness properties of the superconductor-magnet arrangement. In the case of vertical motion of the magnet, characteristic high symmetry of repulsive (approaching) and attractive (withdrawing) branches of the pronounced force-displacement hysteresis could be detected. Achievable force levels were low as expected but sufficient for levitation of permanent magnets. With regard to magnetic stiffness, thin films proved to show stiffness-force ratios about one order of magnitude higher than bulk materials.

Phenomenological models support the measurements. Regarding the magnetic hysteresis of the superconductor, the Irie-Yamafuji model was used for solving the equation of force balance in cylindrical coordinates allowing for a macroscopic description of the superconductor magnetization. This procedure provided good agreement with experimental levitation force and stiffness data during vertical motion. For the case of (lateral) drag force basic qualitative characteristics could be recovered, too. It is shown, that models based on simple asymmetric magnetization of the superconductor describe well asymptotic transition of drag forces after the change of the magnet motion direction. Virgin curves (starting from equilibrium, i.e. symmetric magnetization) are approximated by a linear approach already reported in literature, only. This paper shows that basic properties of superconducting thin films allow for their application to magnetic levitation or - without need of levitation forces, e.g. microgravity - magnetic damping devices.
Author
High Temperature Superconductors; Superconducting Films; Permanent Magnets; Magnetic Suspension; Levitation; YBCO Superconductors; Superconducting Devices

19990004205 Houston Univ., Texas Center for Superconductivity, TX USA
Hybrid Superconductor Magnet Bearings
Chu, Wei-Kan, Houston Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 157; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

Hybrid superconductor magnet bearings (HSMBs) utilize high temperature superconductors (HTSs) together with permanent magnets to form a frictionless interface between relatively rotating parts. They are low mass, stable, and do not incur expenditure of energy during normal operation. There is no direct physical contact between rotor and stator, and hence there is no wear and tear. However, just as any other applications of HTSs, it requires a very cold temperature to function. Whereas this might be perceived as a disadvantage on earth, it is of no great concern in space or on the moon. to astronomers, the moon is an excellent site for an observatory, but the cold and dusty vacuum environment on the moon precludes the use of mechanical bearings on the telescope mounts. Furthermore, drive mechanisms with very fine steps, and hence bearings with extremely low friction are needed to track stars from the moon, because the moon rotates very slowly. All aspects considered, the HSMB is about the only candidate that fits in naturally. Here, we present a design for one such bearing, capable of supporting a telescope that weighs about 3 lbs on earth.
Author
High Temperature Superconductors; Magnetic Bearings; Permanent Magnets; Spaceborne Telescopes; Supports

19990004206 NASA Johnson Space Center, Houston, TX USA
Progress in HTS Trapped Field Magnets: J(sub c), Area, and Applications
Weinstein, Roy, Houston Univ., USA; Ren, Yanru, Houston Univ., USA; Liu, Jian-Xiong, Houston Univ., USA; Sawh, Ravi, Houston Univ., USA; Parks, Drew, Houston Univ., USA; Foster, Charles, Indiana Univ., USA; Obot, Victor, Texas Southern Univ., USA; Arndt, G. Dickey, NASA Johnson Space Center, USA; Crapo, Alan, Emerson Electric Co., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 158-166; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Progress in trapped field magnets is reported. Single YBCO grains with diameters of 2 cm are made in production quantities, while 3 cm, 4 1/2 cm and 6 cm diameters are being explored. For single grain tiles: J(sub c) - 10,000 A/sq cm for melt textured grains; J(sub c) - 40,000 A/sq cm for light ion irradiation; and J(sub c) - 85,000 A/J(sub c) for heavy ion irradiation. Using 2 cm diameter tiles bombarded by light ions, we have fabricated a mini-magnet which trapped 2.25 Tesla at 77K, and 5.3 Tesla at 65K. A previous generation of tiles, 1 cm x 1 cm, was used to trap 7.0 Tesla at 55K. Unirradiated 2.0 cm tiles were used to provide 8 magnets for an axial gap generator, in a collaborative experiment with Emerson Electric Co. This generator delivered 100 Watts to a resistive load, at 2265 rpm. In this experiment, activation of the TFMs was accomplished by a current pulse of 15 ms duration. Tiles have also been studied for application as a bumper-tether system for the soft docking of spacecraft. A method for optimizing tether forces, and mechanisms of energy dissipation are discussed. A bus bar was constructed by welding three crystals while melt-texturing, such that their a,b planes were parallel and interleaved. The bus bar, of area approx. 2 sq cm, carried a transport current of 1000 amps, the limit of the testing equipment available.
Author
Superconducting Magnets; Trapped Magnetic Fields; Superconductivity; YBCO Superconductors; Superconducting Devices

19990004207 Ship and Ocean Foundation, Kobe, Japan

The Superconducting MHD-Propelled Ship Yamato-1

Sasakawa, Yohei, Ship and Ocean Foundation, Japan; Takezawa, Setsuo, Ship and Ocean Foundation, Japan; Sugawara, Yoshinori, Ship and Ocean Foundation, Japan; Kyotani, Yoshihiro, Ship and Ocean Foundation, Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 167-176; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

In 1985 the Ship and Ocean Foundation (SOF) created a committee under the chairmanship of Mr. Yohei SASakawa, Former President of the Ship & Ocean Foundation, and began research into superconducting magnetohydrodynamic (MHD) ship propulsion. In 1989 SOF set to construction of an experimental ship on the basis of theoretical and experimental research pursued until then. The experimental ship named YAMATO-1 became the world's first superconducting MHD-propelled ship on her trial runs in June 1992. This paper describes the outline of the YAMATO-1 and sea trial test results.

Author

Magnetohydrodynamics; Superconducting Power Transmission; Marine Propulsion; Structural Design

19990004208 Ioffe (A. F.) Physical-Technical Inst., Saint Petersburg, Russia

Electric Field Effect in Superconductor-Ferroelectric Structures

Lemanov, V. V., Ioffe (A. F.) Physical-Technical Inst., Russia; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 180-187; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Electric field effect (the E-effect) in superconductors has been studied since 1960 when Glover and Sherill published their results on a shift of the critical temperature Tc about O.l mK in Sn and In thin films under the action of the field E=300 kV/cm. Stadler was the first to study the effect of spontaneous polarization of ferroelectric substrate on the electric properties of superconductors. He observed that the reversal of polarization of TGS substrate under action of external electric field in SN-TGS structures induced the Tc shift in Sn about 1.3 mK. Since, in this case, the effect is determined not by the electric field but by the spontaneous polarization, we may call this effect the P-effect. High-Tc superconductors opened the new possibilities to study the E- and P-effects due to low charge carrier density, as compared to conventional superconductors, and to anomalously small coherence length. Experiments in this field began in many laboratories but a breakthrough was made where a shift in Tc by 50 mK was observed in YBCO thin films. Much higher effects were observed in subsequent studies. The first experiments on the P-effect in high-Tc superconductors were reported. In this report we shall give a short description of study on the P-effect in high-Tc superconductors.

Derived from text

High Temperature Superconductors; Superconducting Films; Electric Fields; Dielectric Polarization; Ferroelectric Materials

19990004209 Pennsylvania State Univ., Materials Research Lab., University Park, PA USA

Oxide Perovskite Crystals for HTSC Film Substrates Microwave Applications

Bhalla, A. S., Pennsylvania State Univ., USA; Guo, Ruyan, Pennsylvania State Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 188-197; In English; Also announced as 19990004188

Contract(s)/Grant(s): DNA00014-90-J-4140; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The research focused upon generating new substrate materials for the deposition of superconducting yttrium barium cuprate (YBCO) has yielded several new hosts in complex perovskites, modified perovskites, and other structure families. New substrate candidates such as SR(Al(sub 1/2)Ta(sub l/2))O3 and SR(Al(sub 1/2)Nb(sub 1/2))O3, Ba(Mg(sub 1/3)Ta(sub 2/3))O3 in complex oxide perovskite structure family and their solid solutions with ternary perovskite LaAlO3 and NdGaO3 are reported. Conventional ceramic processing techniques were used to fabricate dense ceramic samples. A laser heated molten zone growth system was utilized for the test-growth of these candidate materials in single crystal fiber form to determine crystallographic structure, melting point, thermal, and dielectric properties as well as to make positive identification of twin free systems. Some of those candidate materials present an excellent combination of properties suitable for microwave HTSC substrate applications.

Author

Perovskites; High Temperature Superconductors; Superconducting Films; Substrates; Barium Oxides; Strontium Oxides; Ternary Systems

19990004210 American Research Corp. of Virginia, Radford, VA USA

Texturing of High T(sub c) Superconducting Polycrystalline Fibers/Wires by Laser-Driven Directional Solidification in a Thermal Gradient

Varshney, Usha, American Research Corp. of Virginia, USA; Eichelberger, B. Davis, III, American Research Corp. of Virginia, USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 198-208; In English; Also announced as 19990004188

Contract(s)/Grant(s): NSF ISI-91-01565; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper summarizes the technique of laser-driven directional solidification in a controlled thermal gradient of yttria stabilized zirconia core coated Y-Ba-Cu-O materials to produce textured high T(sub c) superconducting polycrystalline fibers/wires with improved critical current densities in the extended range of magnetic fields at temperatures greater than 77K. The approach involves laser heating to minimize phase segregation by heating very rapidly through the two-phase incongruent melt region to the single phase melt region and directionally solidifying in a controlled thermal gradient to achieve highly textured grains in the fiber axis direction. The technique offers a higher grain growth rate and a lower thermal budget compared with a conventional thermal gradient and is amenable as a continuous process for improving the J(sub c) of high T(sub c) superconducting polycrystalline fibers/wires. The technique has the advantage of suppressing weak-link behavior by orientation of crystals, formation of dense structures with enhanced connectivity, formation of fewer and cleaner grain boundaries, and minimization of phase segregation in the incongruent melt region.

Author

YBCO Superconductors; Directional Solidification (Crystals); Superconductors (Materials); Polycrystals; Superconducting Devices; Crystal Growth

19990004212 Texas A&M Univ., Physics Dept., College Station, TX USA

An Electron Tunneling Study of Superconductivity in Amorphous Sn(1 - x)Cu(x) Thin Films

Naugle, D. G., Texas A&M Univ., USA; Watson, P. W., III, Texas A&M Univ., USA; Rathnayaka, K. D. D., Texas A&M Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 222-231; In English; Also announced as 19990004188

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The amorphous phase of Sn would have a superconducting transition temperature near 8 K, much higher than that of crystalline Sn with Tc = 3.5 K. To obtain the amorphous phase, however, it is necessary to use a Sn alloy, usually Cu, and quench condense the alloy films onto a liquid He temperature substrate. Alloying with Cu reduces the superconducting transition temperature almost linearly with Cu concentration with an extrapolation of Tc to zero for x = 0.85. Analysis of the tunneling characteristics between a normal metal electrode with an insulating barrier and superconducting amorphous Sn-Cu films provides detailed information on the changes in the electron-phonon coupling which determines Tc in these alloys. The change from very strong electron-phonon coupling to weak-coupling with the increase in Cu content of amorphous Sn-Cu alloys for the range 0.08 phonon coupling in disordered metals.

Author

Electron Tunneling; Superconductivity; Superconducting Films; Metal Films

19990004214 Hyderabad Univ., School of Physics, India

Effect of Nb2O5 and V2O5 Addition on the Superconducting Properties of YBa2Cu3O(sub y) Thin Films

Srinivas, S., Hyderabad Univ., India; Bhatnagar, A. K., Hyderabad Univ., India; Pinto, R., Tata Inst. of Fundamental Research, India; Pai, S. P., Tata Inst. of Fundamental Research, India; Apte, P. R., Tata Inst. of Fundamental Research, India; Purandare, S. C., Tata Inst. of Fundamental Research, India; Souza, C. P. D., Tata Inst. of Fundamental Research, India; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 241-249; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The effect of Nb2O5 and V2O5 addition on the superconducting properties and microstructure of YBa2Cu3O(y) has been studied in thin films. Polycrystalline targets for laser ablation were prepared by mixing high purity V2O5 or Nb2O5 powders with a well characterized YBa2Cu3O(y) powder in the range 0 to 4 wt% by solid state reaction method. Thin films (approx. = 1500 A thickness) of the above targets were grown on SRTiO3(STO) and LaAlO3 (LAO) substrates at 700 C temperature by Pulsed Laser Deposition (PLD) technique. In the case of Nb205 addition we have noticed an increase in J(sub c) up to 0.5 wt% and higher additive concentration (greater than 0.5 wt%) have degraded the superconducting properties. However, in the case of V2O5 addition, there is an improvement in current density and microstructural properties up to 1 wt% and the superconducting properties degrade for concentrations greater than 1 wt%. The best J(sub c) for 0.5 wt% of Nb2O5 added YBCO thin film is 1.6 x lO(exp 6) A/sq cm and for that of V2O5 added sample is 3.4 x lO(exp 6) A/sq cm at 77K as compared to the pure YBa2Cu3O(y) (YBCO)

film J(sub c) (1.2 x l0(exp 6) A/sq cm) observed on STO substrates. The reason for improvement in J(sub c) and microstructural properties in the case of V2O5 addition could be due to the low melting of V2O5(690 C) which can act as a very good surfactant during deposition. Overall, we have realized that Nb2O5 addition or V2O5 addition to YBCO have shown significant improvement over the undoped YBa2Cu3O(7-x) films grown under identical conditions.
Author
YBCO Superconductors; Superconducting Films; Microstructure; Superconductivity; Additives; Niobium Oxides; Vanadium Oxides

19990004215 Miami Univ., Physics Dept., Coral Gables, FL USA
Transparent Magnetic State in Single Crystal Nd(1.85)Ce(0.15)CuO(4-y)
Zuo, F., Miami Univ., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 250-259; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Several experimental studies have been reported as evidence of Josephson coupling between the superconducting layers in the highly anisotropic oxide such as the Bi2SR2CaCu2O8 and Tl2Ba2CuO6 systems. These include the large penetration depth of 100 micron measured, ac and dc Josephson effects. Recently two critical temperatures corresponding to Josephson coupling in between the layers and the Berezinskii-Kosterlitz-Thouless transition in the ab-plane have been directly observed in the transport measurements. If the field is applied parallel to the superconducting layers, the magnetic excitation is not the conventional Abrikosov vortices, but the Josephson vortices which extend lambda(sub a,b) in the c-axis direction and lambda(sub j) = gamma(sub s) in the plane (s is the interlayer distance, gamma is the anisotropy constant). Because of the weak screening effect associated with the Josephson vortices, there have been predictions of magnetic transparent states at magnetic field above a characteristic field H(sub J), a behavior distinctively different from that of the type-II superconductors. In this paper, we report an experimental result which illustrates a transition from the Meissner state to the magnetic transparent state in single crystal of Nd(1.85)Ce(0.15)CuO(4-y). Magnetization has been measured as a function of temperature and field in the magnetic field parallel or close to ab-plane geometry. For a fixed magnetic field, the magnetization shows a two-step transition in M(T); for a fixed temperature, the magnetization shows an abrupt change to almost zero value above a characteristic field H(sub J), an indication of magnetic transparent state. The data of magnetization as a function of field clearly deviates from the behavior predicted by the Abrikosov theory for type-II superconductors. Instead, the data fit well into the picture of Josephson decoupling between the CuO2 layers.
Author
Single Crystals; Superconductivity; Abrikosov Theory; Josephson Junctions; Neodymium Compounds; Transparence; Magnetic Properties

19990004217 Zurich Univ., Physik-Inst., Switzerland
Electronic Properties of Y-Ba-Cu-O Superconductors as Seen by Cu and O NMR/NQR
Brinkmann, D., Zurich Univ., Switzerland; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 273-282; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Nuclear Magnetic Resonance (NMR) and Nuclear Quadrupole Resonance (NQR) allow the investigation of electronic properties at the atomic level. We will report on such studies of typical members of the the Y-Ba-Cu-0 family such as YBa2Cu3O(6+x), (1-2-3-(6+x)), YBa2Cu4O8 (1-2-4) and Y2Ba4Cu7O15 (2-4-7) with many examples of recent work performed in our laboratory. In particular, we will deal with Knight shift and relaxation studies of copper and oxygen. We will discuss important issues of current studies such as: (1) Existence of a common electronic spin-susceptibility in the planes (and perhaps in the chains) of 1-2-4; (2) Strong evidence for the existence of a pseudo spin-gap of the antiferromagnetic fluctuations in 1-2-4 and 2-4-7; (3) Evidence for d-wave pairing in 1-2-4. (4) Strong coupling of inequivalent Cu-O planes in 2-4-7 and possible origin for the high T(sub c) value of this compound; and (5) The possibility to describe NMR data in the framework of a charge-excitation picture.
Author
YBCO Superconductors; Nuclear Magnetic Resonance; Nuclear Quadrupole Resonance; Electron Spin

19990004218 Tata Inst. of Fundamental Research, Bombay, India
Quaternary Borocarbides: New Class of Intermetallic Superconductors
Nagarajan, R., Tata Inst. of Fundamental Research, India; Gupta, L. C., Tata Inst. of Fundamental Research, India; Dhar, S. K., Tata Inst. of Fundamental Research, India; Mazumdar, Chandan, Indian Inst. of Tech., India; Hossain, Zakir, Tata Inst. of Fundamental Research, India; Godart, C., Centre National de la Recherche Scientifique, France; Levy-Clement, C., Centre National de

la Recherche Scientifique, France; Padalia, B. D., Indian Inst. of Tech., India; Vijayaraghavan, R., Tata Inst. of Fundamental Research, India; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 283-297; In English; Also announced as 19990004188
Contract(s)/Grant(s): Project 509-1; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Our recent discovery of superconductivity (SC) in the four-element multiphase Y-Ni-B-C system at an elevated temperature (T(sub c) approx. = 12K) has opened up great possibilities of identifying new superconducting materials and generating new physics. Superconductivity with T(sub c) (> 20 K) higher than that known so far in bulk intermetallics has been observed in multiphase Y-Pd-B-C and Th-Pd-B-C systems and a family of single phase materials RENi2B2C (RE= Y, rare earth) have been found. Our investigations show YNi2B2C to be a strong coupling hard type-II SC. H(sub c2)(T) exhibits an unconventional temperature dependence. Specific beat and magnetization studies reveal coexistence of SC and magnetism in RNi2B2C (R = Ho, Er, Tm) with magnetic ordering temperatures (T(sub c) approx. = 8 K, 10.5 K, 11 K and T(sub m) approx. = 5 K, 7 K, 4 K respectively) that are remarkably higher than those in known magnetic superconductors. micro-SR studies suggest the possibility of Ni atoms carrying a moment in TmNi2B2C. Resistivity results suggests a double re-entrant transition (SC-normal-SC) in HoNi2B2C. RENi2B2C (RE = Ce, Nd, Gd) do not show SC down to 4.2 K. The Nd- and Gd- compounds order magnetically at approx. 4.5 K and 19.5 K, respectively. Two SC transitions are observed in Y-Pd-B-C (T(sub c) approx. = 22 K, 10 K) and in Tb-Pd-B-C (T(sub c) approx. = 20 K, 14 K) systems, which indicate that there are at least two structures which support SC in these borocarbides. In our multipbase ThNi2B2C we observe SC at approx. 6 K. No SC was seen in multiphase UNi2B2C, UPd2B2C, UOs2Ge2C and UPd5B3C(0.35) down to 4.2 K. T(sub c) in YNi2B2C is depressed by substitutions (Gd, Th and U at Y- sites and Fe, Co at Ni-sites).
Author
Boron Carbides; Quaternary Alloys; Intermetallics; Superconductors (Materials); Superconductivity

19990004219 Allahabad Univ., Physics Dept., India
Electronic Structure and the van Hove Singularity Scenario in High T(sub c) HgBa2CuO(4+Delta) Superconductors
Agrawal, Bal K., Allahabad Univ., India; Agrawal, Savitri, Allahabad Univ., India; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 298-307; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The electronic structure and the hole concentrations in the high T(sub c) superconductor HgBa2CuO(4+delta) (delta = 0, 1) has been investigated by employing a first principles full potential self-consistent LMTO method with the local density functional theory. The scalar relativistic effects have been considered. The hole concentrations of the Cu-d and O-p(x,y) orbitals are seen to be larger for the HgBaCuO5 system than those of the HgBaCuO4 solid. However, the van Hove singularity (vHs) induced Cu-d and O-p peak which is seen to lie comparatively away and above the Fermi level in the delta=1 system shifts towards the Fermi level in the delta=0 system. Thus, the superconducting behavior appears to originate from the occurrence of the vHs peak at the Fermi level. The Fermi surface nesting area in the delta=0 compound is seen to be larger than in the delta=1 compound. The calculation reveals that the increase in pressure on the crystal enhances the hole concentrations but without showing any optimum value. On the other hand, the vHs peak approaches the Fermi level with pressure and crosses the Fermi surface near V/V(sub 0) approx. = 0.625 (V and V(sub 0) are the crystal volumes at high and normal pressures, respectively). Our calculated value of the bulk modulus equal to 0.626 Mbar predicts the occurrence of this crossover at about 24 GPa which is in complete agreement with the experimental value. At this pressure the compound has maximum nesting area and self-doped behavior.
Author
Atomic Structure; High Temperature Superconductors; Mercury Oxides; Fermi Surfaces; Superconductivity

19990004220 Oulu Univ., Dept. of Theoretical Physics, Finland
Boson Localization and Universality in YBa2Cu(3-x)M(x)O(7-Delta)
Kallio, A., Oulu Univ., Finland; Apaja, V., Oulu Univ., Finland; Poykko, S., Oulu Univ., Finland; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 308-317; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

We consider a two component mixture of charged fermions on neutralizing background with all sign combinations and arbitrary small mass ratios. In the two impurity limit for the heavier component we show that the pair forms a bound state for all charge combinations. In the lowest order approximation we derive a closed form expression V(sub eff)(r) for the binding potential which has short-range repulsion followed by attraction. In the classical limit, when the mass of embedded particles is large m(sub 2) >> m, we can calculate from V(sub eff)(r) also the cohesive energy E and the bond length R of a metallic crystal such as lithium. The lowest order result is R = 3.1 A, E = -.9 eV, not entirely different from the experimental result for lithium metal. The same interaction for two holes on a parabolic band with m(sub 2) > m gives the quantum mechanical bound state which one may interpret as

a boson or local pair in the case of high-T(sub c) and heavy fermion superconductors. We also show that for compounds of the type YBa2Cu(3-x)M(x)O(7-delta) one can understand most of the experimental results for the superconducting and normal states with a single temperature dependent boson breaking function f(T) for each impurity content x governing the decay of bosons into pairing fermions. In the normal state f(T) turns out to be a linear, universal function, independent of the impurity content x and the oxygen content delta. We predict with universality a depression in T(sub c)(x) with slight down bending in agreement with experiment. As a natural consequence of the model the bosons become localized slightly above T(sub c) due to the Wigner crystallization, enhanced with lattice local field minima. The holes remain delocalized with a linearly increasing concentration in the normal state, thus explaining the rising Hall density. The boson localization temperature T(sub BL) shows up as a minimum in the Hall density 1/R(sub ab). We also give explanation for very recently observed scaling of temperature dependent Hall effect in La(2-x)SR(x)CuO4.
Author
Bosons; Fermions; Superconductivity; YBCO Superconductors; Metal Crystals

19990004221 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Thermomagnetic Phenomena in the Mixed State of High Temperature Superconductors
Meilikhov, E. Z., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 318-327; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Galvano and thermomagnetic phenomena, Seebeck and Nernst effects as well as heat conductivity and the Peltier, Ettinghausen and Righi-Leduc effects in the mixed state of high temperature superconductors are presented.
CASI
High Temperature Superconductors; Thermal Conductivity; Thermomagnetic Effects

19990004222 Chalmers Univ. of Technology, Dept. of Physics, Goeteborg, Sweden
Spectroscopy of Infrared-Active Phonons in High Temperature Superconductors
Litvinchuk, A. P., Chalmers Univ. of Technology, Sweden; Thomsen, C., Technische Univ., Germany; Cardona, M., Max-Planck-Inst. fuer Festkoerperforschung, Germany; Boerjesson, L., Royal Inst. of Tech., Sweden; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 328-332; In English; Also announced as 19990004188; Sponsored in part by Swedish Superconductivity Consortium
Contract(s)/Grant(s): BMFT-13N5840; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

For a large variety of superconducting materials both experimental and theoretical lattice dynamical studies have been performed to date. The assignment of the observed infrared- and Raman-active phonon modes to the particular lattice eigenmodes is generally accepted. We will concentrate here upon the analysis of the changes of the infrared-phonon parameters (frequency and linewidth) upon entering the superconducting state which, as will be shown, may provide information on the magnitude of the superconductivity-related gap and its dependence on the superconducting transition temperature T(sub c).
Derived from text
High Temperature Superconductors; Transition Temperature; Superconductivity; Phonons; Energy Gaps (Solid State)

19990004223 Kyushu Inst. of Tech., Dept. of Computer Science and Electronics, Kawazu, Japan
Flux Pinning Characteristics and Irreversibility Line in High Temperature Superconductors
Matsushita, T., Kyushu Inst. of Tech., Japan; Ihara, N., Kyushu Inst. of Tech., Japan; Kiuchi, M., Kyushu Inst. of Tech., Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 337-346; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The flux pinning properties in high temperature superconductors are strongly influenced by thermally activated flux motion. The scaling relation of the pinning force density and the irreversibility line in various high temperature superconductors are numerically analyzed in terms of the flux creep model. The effect of two factors, i.e., the flux pinning strength and the dimensionality of the material, on these properties are investigated. It is speculated that the irreversibility line in Bi-2212 superconductors is one order of magnitude smaller than that in Y-123, even if the flux pinning strength in Bi-2212 is improved up to the level of Y-123. It is concluded that these two factors are equally important in determination of the flux pinning characteristics at high temperatures.
Author
High Temperature Superconductors; Flux Pinning; Melts (Crystal Growth); Current Density

19990004224 Talca Univ., Facultad de Recursos Naturales, Chile

Effects of Neutron Irradiation on the London Penetration Depth for Polycrystalline Bi(1.8)Pb(0.3)SR2Ca2Cu3O10 Superconductor

Ossandon, J. G., Talca Univ., Chile; Thompson, J. R., Tennessee Univ., USA; Sun, Yang Ren, Tennessee Univ., USA; Christen, D. K., Oak Ridge National Lab., USA; Chakoumakos, B. C., Oak Ridge National Lab., USA; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 347-353; In English; Also announced as 19990004188

Contract(s)/Grant(s): DE-AC05-84OR-21400; FONDECYT-1930210; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Magnetization studies of polycrystalline Bi(1.8)Pb(0.3)SR2Ca2Cu3O10 superconductor, prior to and after neutron irradiation, showed an increase in J(sub c) due to irradiation damage. Analysis of the equilibrium magnetization revealed significant increases in other more fundamental properties. In particular, the London penetration depth increased by approx. 15% following irradiation with 8 x 10(exp 16) neutrons/sq cm. Corresponding changes were observed in the upper critical magnetic field H(sub c2). However, the most fundamental thermodynamic property, the superconductive condensation energy F(sub c), was unaffected by the moderate level of neutron-induced damage.

Author

Polycrystals; Neutron Irradiation; Magnetization; Current Density; Thermodynamic Properties; BSCCO Superconductors

19990004225 Saint Petersburg Technical Univ., Russia

The Thermopower in the Temperature Range T(sub c)-1000 K and the Band Spectrum of Bi-Based Superconductors

Gasumyants, V. E., Saint Petersburg Technical Univ., Russia; Vladimirskaya, E. V., Saint Petersburg Technical Univ., Russia; Smirnov, V. I., Saint Petersburg Technical Univ., Russia; Kazanskiy, S. V., Saint Petersburg Technical Univ., Russia; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 354-358; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The temperature dependencies of thermopower, S, in the range T = T(sub c)-1000K as well as of resistivity and Hall coefficient in the range T = T(sub c)-300K for the single-phase ceramic samples Bi2SR2Ca(1-x)Nd(x)Cu2O(y), have been measured. It was found that the S(T) dependencies in normal phase have three characteristic regions. Despite the fact that the S(T) dependencies in Bi-based high-T(sub c) superconductors (HTSC) differ essentially from ones in Y-based HTSC at T = T(sub c)-300K, the main feature of theirs (S(T) = const at high temperatures) retains in samples investigated at T > 620K. The results obtained have been analyzed on the basis of the narrow-band model with the use of assumption of slight asymmetry of the conductive band. The band spectrum parameters of the samples studied have been calculated. An analysis of the tendencies in these parameters changes with varying samples composition enables to make the conclusion about the similarity of the main features of the conductive band structure in Y- and Bi-based HTSC.

Author

High Temperature Superconductors; Bismuth Oxides; Thermoelectricity; Temperature Dependence; Ceramics; Transition Temperature

19990004226 Moscow State Univ., Low Temperature Dept., Russia

Nonequilibrium Transport in Superconducting Filaments

Arutyunov, K. Y., Moscow State Univ., Russia; Danilova, N. P., Moscow State Univ., Russia; Nikolaeva, A. A., Academy of Sciences of the Moldavian SSR, Moldova; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 359-368; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

The step-like current-voltage characteristics of highly homogeneous single-crystalline tin and indium thin filaments has been measured. The length of the samples L approx. = 1 cm was much greater than the nonequilibrium quasiparticle relaxation length Lambda. It was found that the activation of successive i-th voltage steps occur at current significantly greater than the one derived with the assumption that the phase slip centers are weakly interacting on a scale L >> Lambda. The observation of ”subharmonic” fine structure on the voltage-current characteristics of tin filaments confirm the hypothesis of the long-range phase slip centers interaction.

Author

Superconductivity; Superconducting Devices; Filaments; Current Density; Electric Potential; Electrical Resistivity

19990004228 Eidgenoessische Technische Hochschule, Nichtmetallische Werkstoffe, Zurich, Switzerland

Partial Melting of Bulk Bi-2212

Heeb, B., Eidgenoessische Technische Hochschule, Switzerland; Gaukler, L. J., Eidgenoessische Technische Hochschule, Switzerland; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 382-390; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Dense and textured Bi-2212 bulk samples have been produced by the partial melting process. The appropriate amount of liquid phase necessary for complete densification has been adjusted by controlling the maximum processing temperature. The maximum temperature itself has to be adapted to several parameters as powder stoichiometry, silver addition and oxygen partial pressure. Prolonged annealing at 850 and 820 C and cooling in N2 atmosphere led to nearly single phase material with T(sub c) = 92 K. Critical current densities j(sub c) of 2200 A/sq cm at 77 K/0 T have been achieved in samples of more than 1 mm thickness. Reducing the thickness below 0.4 mm enhances j(sub c) considerably to values > 4000 A/sq cm. The addition of 2 wt% Ag decreases the solidus temperature of the Bi-2212 powder by 21 C. Therefore, the maximum heat treatment temperature of Ag containing samples can be markedly lowered leading to a reduction of the amount of secondary phases. In addition, Ag enhances slightly the texture over the entire cross-section and as a result j(sub c) at 77 K/0 T.

Author

Melts (Crystal Growth); Fabrication; Bismuth; Current Density; Transition Temperature; Heat Treatment; High Temperature Superconductors

19990004229 Hitachi Ltd., Hitachi Research Lab., Japan

Correlation Between Fabrication Factor and Superconducting Properties of the Tl- and Bi-Based High-T(sub c) Superconductor

Maki, Naoki, Hitachi Ltd., Japan; Okada, Michiya, Hitachi Ltd., Japan; Doi, Toshiya J., Hitachi Ltd., Japan; Kanai, Tsuneyuki, Hitachi Ltd., Japan; Sato, Junichi, Hitachi Cable Ltd., Japan; Higashiyama, Kazutoshi, Hitachi Ltd., Japan; Proceedings of the Fourth International Conference and Exhibition: World Congress On Superconductivity; Apr. 1995; Volume 1, pp. 391-396; In English; Also announced as 19990004188; No Copyright; Avail: CASI; A02, Hardcopy; A04, Microfiche

Large critical current densities (J(sub c)) were obtained in c-axis oriented Tl-1223/Ag composite tapes fabricated by spraying methods without a vacuum. Transport measurements at 77K under a zero field indicated a J(sub c) of 9 x lO(exp 4) A/sq cm and 7 x 10(exp 3) A/sq cm at 1 T for the tapes fabricated by spray pyrolysis. The novel Gas Pressurized Melt (GPM) method was also applied for Bi-2212/Ag PIT composite wire, and found to be very effective for improving the distribution of voids, which are caused from the melt-solidifying process. The GPM showed a marked effect for obtaining homogeneous long wire. A 1 T class coil was successfully fabricated with monocore wire.

Author

Fabrication; Superconductivity; High Temperature Superconductors; Melts (Crystal Growth); Superconducting Devices; Magnetic Coils

19990004395 State Univ. of New York, Research Foundation, Albany, NY USA

Metal-Organic Chemical Vapor Epitaxy of GaN on Si(111) for Optoelectronic Applications ***Final Report, May 1995 - May 1996***

Kaloyeros, A.; Endisch, S.; Topol, A.; Sep. 1998; 18p; In English

Contract(s)/Grant(s): F30602-95-C-0134; AF Proj. 4600

Report No.(s): AD-A353993; AFRL-SN-RS-TR-1998-180; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Low temperature growth of gallium nitride on silicon via vapor phase epitaxy was investigated. The use of different nitrogen and gallium sources was explored. The gallium nitride deposition process was optimized by varying surface preparation, seed and buffer layer growth, and annealing conditions. Films were extensively characterized via X-ray diffraction, Rutherford backscatter, atomic force microscopy, X-ray photoemission spectroscopy, and Auger electron spectroscopy. Optimized growth rates of 60-120 A/min were achieved at 0.8 torr pressure, with 1:1 gallium to nitride ratio to within 0.1%. Films were hexagonal and polycrystalline with 3 nitride bi-layer buffers, with annealing, allowed stoichiometric gallium nitride growth of up to 6000 A, but the temperatures used were not high enough to deposit epitaxial gallium nitride.

DTIC

Microstructure; Vapor Phase Epitaxy; Polycrystals; Gallium Nitrides; Silicon; Electro-Optics

19990004899 Eidgenoessische Technische Hochschule, Lausanne, Switzerland
ISCGT-1: First International School on Crystal Growth Technology, ***5 - 16 Sep. 1998***
Scheel, Hans J.; Sep. 1998; 808p; In English; 1st; Crystal Growth Technology, 5-16 Sep. 1998, Beatenberg, Switzerland
Contract(s)/Grant(s): N00014-98-1-1010
Report No.(s): AD-A354428; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

Compilation of abstracts from the ”ISCGT-l” First International School on Crystal Growth Technology Meeting held 5 - 16 September 1998 in Beatenberg, Switzerland. This first international workshop of leading scientists and experts of crystal growth technology (including epitaxy technology) serves to exchange experiences and knowhow on the highest-possible pre-competitive level. The goal is the reduction of development costs by increased scientific understanding of the complex processes where ten or more parameters have to be optimized and compromised. The multidisciplinary nature of crystal growth technology demands collaboration of chemical and process engineers, thermodynamicists, hydrodynamicists, electrical and mechanical/machine engineers, material scientists, numerical simulation specialists, physicists, and crystallographers. Thereby, a common language and terminology has to be established which permits multidisciplinary discussions and collaborations.
DTIC
Crystal Growth; Crystallography

19990004900 Cornell Univ., School of Electrical Engineering, Ithaca, NY USA
High Power, Broadband, Linear, Solid State Amplifier ***Annual Report No. 2, 1 Sep. 1997 - 31 Aug. 1998***
Eastman, Lester F.; Weimann, N.; Chu, K.; Fontz, B.; Green, B.; Sep. 1998; 57p; In English
Contract(s)/Grant(s): N00014-96-1-1223
Report No.(s): AD-A354429; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Undoped polarization induced-electron HEMT’s have been grown and processed on sapphire and SiC substrates. Devices with gate lengths between .15 and 75 pm have been fabricated. With .15 pm gates, fL = 75 GHz and drain-source breakdown voltage of 35 V have been achieved. These values were 20 GHz and 140 V for .75 pm gates. Electron mobility values of 1,505 sq cm/V-s on SiC (oMVPE) and 1,232 sq cm/V-s on sapphire (MBE) have been obtained with 2 DEG density ofl.3-l.5 x lO(exp 3)/sq cm. Optimum devices in 3 GHz operation yielded > 70% power-added efficiency. The SIT device etching problem is solved using a combination of dry (ECR) and wet (hot KOH) etching. A traveling wave monolithic circuit will be used for our non-uniformly distributed power amplifier with no backward wave. Large periphery (.5-1 mm) transistor
DTIC
Solid State Devices; Broadband Amplifiers; Distributed Amplifiers; Fabrication; Linear Amplifiers; Molecular Beam Epitaxy; Monte Carlo Method; Combinatorial Analysis

19990005093 North Carolina State Univ., Raleigh, NC USA
Interface Engineering and Defect Control in Heteroepitaxial Growth of GaN ***Annual Report, ending June 1998***
Nemanich, Robert J., North Carolina State Univ., USA; Ade, Harald W., North Carolina State Univ., USA; Davis, Robert F., North Carolina State Univ., USA; Sep. 1998; 53p; In English
Contract(s)/Grant(s): N00014-97-1-0859
Report No.(s): AD-A353355; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The technique of photo electron emission microscopy (PEEM) combined with UV free electron laser (UV-FEL) excitation has been employed for in situ studies of the dynamics of semiconductor interfaces. Wide bandgap semiconductors such as diamond, GaN and AlN exhibit a small or even negative electron affinity. The PEEM results show a shift of the photo threshold or in situ annealed diamond surfaces consistent with an increase in the electron affinity due to the desorption of hydrogen. The electron emission from an array of GaN emitters has been observed with PEEM and field emission electron microscopy (FEEM). Both measurements indicate nearly uniform emission from all of the elements of the array. The technique of PEEM with UV-FEL has been applied to explore a buried interface. The results display a buried Ti contact below an AlN layer. The dynamics of the formation of nanometer epitaxial islands on Si has been shown with PEEM. A unique aspect is that both ripening and coalescence processes are observed.
DTIC
Defects; Gallium Nitrides; Interfaces; Field Emission

19990005095 Arizona Univ., Tucson, AZ USA

Developing Rare-Earth-Doped Semiconductor Light Sources ***Final Report, 1 Jun. 1995 - 31 May 1998***

Gibbs, Hyatt M.; Jul. 15, 1998; 3p; In English

Contract(s)/Grant(s): F49620-95-1-0381; AF Proj. 3483

Report No.(s): AD-A353330; AFRL-SR-BL-TR-98-0600; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Studies were performed on the precession of spin polarized electrons in a magnetic field of up to 12T. Even at densities high enough to provide gain and to see lasing, sufficient spin polarization remains for the lasing emission to alternate back and forth between right and left circular polarization as the spins precess. Thus, the vertical-cavity surface-emitting laser emission is locked to the spin precession clock, one example of coherent control.

DTIC

Doped Crystals; Semiconductors (Materials); Light Sources; Electrons; Magnetic Fields; Precession; Rare Earth Compounds

19990005117 Longwood Coll., Farmville, VA USA

Testing and Further Development of Improved Etches and Etching Methods for the Analysis of Bridgman Grown Semiconductor Crystals with an Emphasis on Lead-Tin-Telluride ***Final Report***

Barber, Patrick G., Longwood Coll., USA; Mar. 31, 1998; 43p; In English

Contract(s)/Grant(s): NAG1-1836; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goals outlined for the research project for this year have been completed, and the following supporting documentation is attached: 1. A copy of the proposal outlining the principal goals: (a) Improve the characterization of semiconductor crystals through new etches and etching procedures. (b) Developed a novel voltammetric method to characterize semiconductor crystals as a result of searching for improved etches for lead-tin-telluride. (c) Presented paper at ACCG- 10. (d) Prepared manuscripts for publication. Completed additional testing suggested by reviewers and re-submitted manuscripts. (e) Worked with an undergraduate student on this project to provide her an opportunity to have a significant research experience prior to graduation. 2. In addition to the anticipated goals the following were also accomplished: (a) Submitted the newly developed procedures for consideration as a patent or a NASA Tech Brief. (b) Submitted a paper for presentation at the forthcoming ICCG- 12 conference. 3. A copy of the final draft of the publication as submitted to the editors of the Journal of Crystal Growth.

Author

Performance Tests; Development; Procedures; Etching; Semiconductors (Materials); Crystal Growth

19990008054 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Electronic Structure of Tl2Ba2CuO(6+Delta) Epitaxial Films Measured by X-Ray Photoemission

Vasquez, R. P., Jet Propulsion Lab., California Inst. of Tech., USA; Ren, Z. F., State Univ. of New York, USA; Wang, J. H., State Univ. of New York, USA; Physical Review B (Condensed Matter); Sep. 01, 1996; ISSN 0163-1829; Volume 54, No. 9, pp. 6115-6118; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The valence electronic structure and core levels of Tl2Ba2CuO(6 + delta) (Tl-2201) epitaxial films have been measured with X-ray photoelectron spectroscopy and are compared to those of Tl2Ba2CaCu2O(8 + delta) (Tl-2212). Changes in the Tl-2201 core-level binding energies with oxygen doping are consistent with a change in the chemical potential. Differences between the Tl-2201 and Tl-2212 measured densities of states are consistent with the calculated Cu 3d and Tl 6s partial densities of states.

Author

Epitaxy; Nuclear Binding Energy; Atomic Structure; Polymeric Films

19990008055 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Electronic Structure of TlBa2CaCu2O(7-Delta)

Vasquez, R. P., Jet Propulsion Lab., California Inst. of Tech., USA; Novikov, D. L., Northwestern Univ., USA; Freeman, A. J., Northwestern Univ., USA; Siegal, M. P., Sandia National Labs., USA; Physical Review B (Condensed Matter); Jun. 01, 1997; ISSN 0163-1829; Volume 55, No. 21, pp. 14,623-14,631; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000; NSF DMR-91-20000; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The core levels of TlBa2CaCu2O(7-delta) (Tl-1212) epitaxial films have been measured with X-ray photoelectron spectroscopy (XPS). The valence electronic structure has been determined using the full-potential linear muffin-tin-orbital band-structure method and measured with XPS. The calculations show that a van Hove singularity (VHS) lies above the Fermi level (E(sub F)) for the stoichiometric compound (delta = 0.5), while for 50% oxygen vacancies in the Tl-O layer (delta = 0.5) E(sub F) is in close proximity to the VHS. Samples annealed in nitrogen (to reduce the hole overdoping by the removal of oxygen) exhibit higher core-level binding energies and a higher T(sub c), consistent with a shift of E(sub F) closer to the VHS. Comparisons are made to the core levels and valence bands of Tl2Ba2CaCu2O(8 + delta)(Tl-2212) and HgBa2CaCu2O)6 + delta) (Hg- 1212). The

similarity of the Cu 2p(sub 3/2) spectra for Tl-1212 and Tl-2212 indicates that the number of Tl-O layers has little effect on the Cu-O bonding. However, the Tl-1212 and Hg-1212 Cu 2p(sub 3/2) signals exhibit differences which suggest that the replacement of T(sup 3+) with Hg(sup 2+) results in a decrease in the O 2p right arrow Cu 3d charge-transfer energy and differences in the probabilities of planar vs apical oxygen charge transfer and/or Zhang-Rice singlet-state formation. Differences between the Tl-1212 and the Tl-2212 and Hg-1212 measured valence bands are consistent with the calculated Cu 3d and (Tl,Hg) 6s/5d partial densities of states.
Author
Atomic Structure; Titanium; Metal-Gas Systems; Epitaxy; Oxygen; Nuclear Binding Energy

19990008056 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
X-Ray Photoemission Measurements of La(1-x)Ca(x)CoO3(x = 0, 0.5)
Vasquez, R. P., Jet Propulsion Lab., California Inst. of Tech., USA; Physical Review B (Condensed Matter); Dec. 01, 1996; ISSN 0163-1829; Volume 54, No. 21, pp. 14,938-14,941; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

X-ray photoemission measurements of the core levels and valence electronic structure of LaCoO3 and La(0.5)Ca(0.5)CoO3 high quality epitaxial films are presented. Shifts of the core levels and main valence band features are consistent with a doping-induced change in the chemical potential. Oxygen states are found to significantly contribute to a peak in the valence band at 1 eV binding energy, verifying earlier results of cluster calculations. A Fermi level crossing of this same band upon doping is observed, yielding a high Fermi level density of states.
Author
X Rays; Photoelectric Emission; Valence; Electron Emission

19990008070 NASA, Washington, DC USA
An Experimental Determination of the Absolute Oscillator Strengths of the Lines of Two N II Supermultiplets ***Eine Experimentelle Bestimmung der Absoluten Oszillatorenstaerken der Linien Zweier N II-Supermultipletts***
Mastrup, Frithjof, Kiel Univ., Germany; May 1960; 22p; In English
Report No.(s): NASA-TT-F-38; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The following work describes the experimental determination of the absolute oscillator strengths of several N II-lines. The light source was the plasma of a wall-stabilized enclosed [cylindrical] arc in pure nitrogen. The parameters of this plasma near the axis of the arc were calculated from the measured total intensity of the hydrogen-like triplet-multiplet of the series 2p3d-2p4f. It was here assumed that the oscillator strengths of this multiplet can be calculated by the Bates and Damgaard Coulomb field approximation. In addition, an attempt was made to check the measured oscillator strengths of the N II line in the nitrogen plasma by measurements in a helium-nitrogen mixture, using the known oscillator strengths of helium.
Author
Nitrogen Plasma; Oscillator Strengths; Absorption Spectra; Line Spectra; Molecular Oscillators; Light Sources

19990008217 Helsinki Univ. of Technology, Dept. of Engineering Physics and Mathematics, Espoo, Finland
Facet Growth and Step Structure of He-4 Crystals at mK-Temperatures
Saramaeki, J. P., Helsinki Univ. of Technology, Finland; Tsepelin, V., Helsinki Univ. of Technology, Finland; Babkin, A. V., Helsinki Univ. of Technology, Finland; Hakonen, P. J., Helsinki Univ. of Technology, Finland; Husmann, A., Helsinki Univ. of Technology, Finland; 1998; ISSN 1455-0806; 36p; In English
Report No.(s): PB99-108599; TKK-F-A783; ISBN 951-22-4144-7; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Growth of c-facets of He-4 crystals has been investigated at mK-temperatures, using accurate capacitive crystal level and liquid pressure gauges. In order to obtain information about the width of elementary steps, giving rise to the spiral growth mechanism, small amounts of He-3 atoms have added to the liquid phase, forming a 3D Fermi gas. Within the authors' concentration and temperature range, the growth rates are affected by scattering of He-3 atoms by the steps. At low temperatures, the observed step mobilities clearly decrease with increasing He-3 concentration. The results are compared with theory, where high-frequency zero-point oscillations of the steps are taken into account, yielding an estimate xi approximately 8 nm for the width of an elementary step. During these measurements, facet growth was sometimes characterized by large threshold pressures and a square-root type dependence of the velocity on the driving pressure. These results are interpreted in terms of a single Frank-Read source dominating the facet growth. In addition, the authors have utilized a novel interferometric technique for measurements on c-facet growth of crystals grown from ultra-pure He-4.
NTIS
Helium Isotopes; Crystals; Low Temperature; Crystal Growth

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THERMODYNAMICS AND STATISTICAL PHYSICS

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

19990008067 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Efficient High-Pressure State Equations
Harstad, Kenneth G., Jet Propulsion Lab., California Inst. of Tech., USA; Miller, Richard S., Jet Propulsion Lab., California Inst. of Tech., USA; Bellan, Josette, Jet Propulsion Lab., California Inst. of Tech., USA; AIChE Journal; Jun. 1997; Volume 43, No. 6, pp. 1605-1610; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A method is presented for a relatively accurate, noniterative, computationally efficient calculation of high-pressure fluid-mixture equations of state, especially targeted to gas turbines and rocket engines. Pressures above I bar and temperatures above 100 K are addressed The method is based on curve fitting an effective reference state relative to departure functions formed using the Peng-Robinson cubic state equation Fit parameters for H2, O2, N2, propane, methane, n-heptane, and methanol are given. Author
Procedures; Accuracy; Computation; Equations of State; Rocket Engines; Gas Turbines

19990008140 Helsinki Univ. of Technology, Dept. of Engineering Physics and Mathematics, Espoo, Finland
Advanced Energy Systems *Annual Report*
Alm, Kirsi, Editor, Helsinki Univ. of Technology, Finland; Kajatie, Auli, Editor, Helsinki Univ. of Technology, Finland; Feb. 1998; ISSN 1455-5816; 72p; In English
Report No.(s): PB99-107658; TKK-F-C181; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

Contents include the following: Introduction; Laboratory Staff; Research; Radiation Physics; New and Renewable Energy Systems; Fusion and Plasma Physics; Laser Physics and Applications; Teaching Activities; Academic degrees and theses; Course selection; Publications; Scientific Visits and Professional Activities; Visitors to the Laboratory; and Visits and activities of the staff.
NTIS
Plasma Physics; Laser Applications; Energy Technology

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990004381 General Accounting Office, Washington, DC USA
Federal Advisory Committee Act: Advisory Committee Process Appears to Be Working, but Some Concerns Exist. Statement by L. Nye Stevens, Director, Federal Management and Workforce Issues, General Government Division
Jul. 14, 1998; 18p; In English
Report No.(s): PB99-107088; GAO/T-GGD-98-163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report discusses GAO's work on federal advisory committees as the Subcommittee explores possible changes to the Federal Advosory Committee Act (FACA) and the advisory committee process.
NTIS
Reviewing; Management Planning

19990008074 Advisory Group for Aerospace Research and Development, Flight Vehicle Integration Panel, Neuilly-Sur-Seine, France
Strategic Management of the Cost Problem of Future Weapon Systems *Gestion Strategique des Couts des Futurs Systemes d'Armes*
Sep. 1998; 268p; In English; In French; Flight Vehicle Integration Panel Symposium, 22-25 Sep 1997, Drammen, Norway; Sponsored by Advisory Group for Aerospace Research and Development, France; Also announced as 19990008075 through 19990008097; Original contains color illustrations
Report No.(s): AGARD-CP-602; ISBN 92-836-0058-4; Copyright Waived; Avail: CASI; A12, Hardcopy; A03, Microfiche

The Symposium comprised five sessions, each devoted to a particular field: Lessons learned, Overview of current programs, Cost management tools, Low cost manufacturing, and Government perspectives. The Symposium was organized by the Flight Vehicle Integration Panel (FVP) of AGARD and held in Drammen, Norway 22-25 September 1997.
Author
Weapon Systems; Design to Cost; Cost Analysis; Cost Effectiveness; Cost Reduction; Weapons Development; Management Systems; Aircraft Production; Government/Industry Relations; Aircraft Production Costs; Project Management; Defense Industry

19990008075 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA
Skunk Works Lessons Learned
Nicolai, Leland M., Lockheed Martin Corp., USA; Strategic Management of the Cost Problem of Future Weapon Systems; Sep. 1998; 12p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In order to manage a weapon system's cost you must first establish cost as the #1 priority and then incite the program manager and give him the means necessary to hold to the cost. Establishing cost as #l is a company edict and may require a cultural change. The program manager must be a zealot about cost because he will be pressured daily to relax cost in favor of more traditional metrics (i.e., performance, cost effectiveness, signature, etc.). Kelly's 14 Rules gives the program manager the authority and environment necessary to control the cost.
Author
Weapon Systems; Production Costs; Cost Effectiveness; Project Management; Cost Reduction

19990008076 National Defence Headquarters, Project Management Office, Ottawa, Ontario Canada
'COTS': Customization, Opportunities and Trade-Offs
Delaney, R. Grant, National Defence Headquarters, Canada; Sep. 1998; 12p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The aim of this paper is to describe the methods by which the Canadian Armed Forces (CF) balanced a commercial off-the-shelf (COTS) process by customization, opportunities and trade-offs (also COTS) as an example towards meeting the cost challenges of the 21st century. This paper will present a description of the specific customization efforts and associated trade-offs as they apply to the CH146 acquisition and fielding. It will not focus on cost benefit opportunities per se as these issues have been discussed in a previous paper. Some repetition of information will be unavoidable in illustrating opportunities achieved in the CH146 helicopter acquisition and introduction into service. Nor is it intended to discuss the decision making process resulting in the opportunity to acquire a common fleet of helicopters to replace three to four types of aircraft. The comparative arguments should allow the reader to make his or her own conclusion in respect of the ability of this aircraft to meet challenges of the future in your own individual programs.
Derived from text
Helicopters; Cost Effectiveness; Commercialization; Helicopter Design; Systems Integration; Tradeoffs

19990008077 Societe d'Applications Generales d'Electricite et de Mecanique, Argenteuil, France
Lessons to be Drawn From the Civilian-Military Duality: Example of SAGEM Company ***Lecons a Tirer de la Dualite Civil/Militaire: Exemple de SAGEM SA***
Remilleux, G., Societe d'Applications Generales d'Electricite et de Mecanique, France; Dupoux, T., Societe d'Applications Generales d'Electricite et de Mecanique, France; Strategic Management of the Cost Problem of Future Weapon Systems; Sep. 1998; 6p; In French; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

SAGEM Company is a dual enterprise within which the manufacturing of military equipment benefits by having and industrial tool base and skills that are shared with civilian activities. An inquiry conducted in these sectors has, however, allowed us to elucidate certain factors which generate excessive cost for military equipment. Analysis of these factors demonstrates that the situation of needs and industrial organizations are greater generators of excessive cost than are the specific constraints of the military.
Transl. by Schreiber
Government/Industry Relations; Production Costs; Production Management; Cost Effectiveness; Cost Analysis

19990008078 Hughes Space and Communications Group, Los Angeles, CA USA
Cost Management Processes for Satellite Communications Systems: Lessons Learned
Brackey, Thomas A., Hughes Space and Communications Group, USA; Drennan, Richard M., Hughes Space and Communications Group, USA; Sep. 1998; 6p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A satellite is a spacecraft bus and an integrated payload designed to perform a mission in space. Satellite systems encompass assigned orbital slots, launch support services, a space control segment, and terrestrial communication links for an end-user. Value added data-to-information regimen to fulfill customer demands for specified services is the objective. Satellites are not considered separately from these other segments but complementary to the system. Hughes Space and Communications (HSC) cost-management experience focuses on the satellite because we develop and manufacture satellite systems for domestic and international customers. Currently, 64 Hughes-built commercial satellites are in service in the USA and around the world, with a spacecraft reliability record of better than 99%. We also purchase blocks of launch services from the international launch vehicle community and either own or lease tracking, telemetry, and commanding services and provide technical support for customer operations. These require long-lead procurement to manage cost effectively and to pass these savings on to our government and commercial customers. Cost, schedule, technical performance, and customer focus are the key factors that shape our integrated management strategy with respect to cost management. These are essential to secure and assure our continued success as a viable business. In the USA, government, aerospace, industry, and academia have teamed to sponsor a ”lean aerospace manufacturing initiative”. The strategy is lean because it does more with less--often much less. It cuts cost and reduces cycle time while improving productivity and quality. The lean aerospace manufacturing industry initiative, with emphasis on the end customer, value streams, customer-forward manufacturing and assembly, leading-edge technology insertion, and quality assurance is exceeding performance projections and reducing mission life cycle costs. Similarly, our cost and management process has significantly increased employee productivity by 47% and reduced costs and cycle times by 30% and is widely emulated within the satellite industry. Therefore, the emphasis of this paper is on the satellite manufacturing enterprise, reduced cycle times, and the changes in business practices and processes needed to satisfy the customers’ contractual demands.
Author
Satellite Communication; Communication Networks; Cost Effectiveness; Cost Reduction; Management Systems; Cost Analysis

19990008079 Boeing Commercial Airplane Co., Systems, Seattle, WA USA
The Boeing 777: A Look Back
Glende, Wolf L., Boeing Commercial Airplane Co., USA; Sep. 1998; 12p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Boeing 777 is the largest twin-engine commercial jet transport in service today. In 1990, approval to proceed with its development was contingent on defining an airplane the airlines would buy at a price Boeing could afford. Innovative processes were developed and implemented that focused on achieving customer preference and reduced program cost. These processes centered on Design Build Teams, Digital Product Definition, and Digital Preassembly. Two years after delivery of the first airplane, the data show that the processes made the 777 the preferred airplane, lowered program costs as predicted, and set new standards and expectations for the development of jet transport aircraft.
Author
Commercial Aircraft; Aircraft Production Costs; Computer Aided Design; Boeing 777 Aircraft; Cost Reduction; Project Management

19990008080 Boeing Co., Philadelphia, PA USA
The Design and Manufacture of an All-Digital V-22
Dougherty, J. J., III, Boeing Co., USA; Liiva, J., Boeing Co., USA; Sep. 1998; 8p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The production V-22 has incorporated the latest technologies and computer-aided techniques and manufacturing processes. These are: (1) CATIA(TM) (Computer-Aided Three-Dimensional Interactive Application) for design. A single authority digital data base that contains all the design information; (2) Digital electronic mockup (EMU) to determine part fit-up and resolve interface problems during the design phase through Digital Pre-Assembly (DPA), instead of creating panic on the assembly line; (3) Concurrent Product Development using over 80 Integrated Product Teams (IPTs) consisting of engineering, tooling, manufacturing, supportability and subcontractor disciplines, working simultaneously on each major part of the aircraft to ensure a ”balanced” design. The multiple customers for the V-22 aircraft, USMC, USN, and USAF/SOCOM, are an integral part of the IPTs. An Analysis and Integration (A&I) team ensures consistency across interfaces and an Integrated Test Team (ITT) of contractor and customer personnel perform flight testing; and (4) Manufacturing process improvements including the utilization of part features to locate and assemble components; fiber placement of large pieces of composite structure with simple and compound curvature; high speed machining of large monolithic pieces of metallic structure rather than assembling them from pieces; laser optical layout templates driven from the CATIA(TM) data base to locate composite plies during lay-up; robotic trim and drill cells; automated creation of wiring form boards and numerically controlled, CATIA(TM) data base to locate composite plies during lay-up; robotic

trim driven, automatic bending of hydraulic tubes. The results of using these new technologies and processes are compared with 1980's methods.
Author
Computer Aided Manufacturing; Computer Aided Design; V-22 Aircraft; Concurrent Engineering; Aircraft Production Costs; Cost Effectiveness

19990008081 Thomson-CSF, Radars et Contremesures, Elancourt, France
Thomson-CSF Experience in Airborne System Integration
Monclar, Patrick, Thomson-CSF, France; Sep. 1998; 18p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The strategic management of the cost issue is of major importance for any company; basically, the question is to combine the customers' satisfaction and the company's profitability. The customers' satisfaction is met with agreeable and affordable levels of price and performance of the products and systems they buy. The company's profitability is needed to meet the basic rules of capital and strategic investment. In our so called "high tech" companies we have also to take account of the huge level of R and D required to run our projects and programs. More and more, this R and D is partially, if not totally, self-funded by the company itself. Furthermore, cost management must enable us to get the resources which are needed to be in the position to study, then develop and produce the future systems which will be in the Forces, our customers. Many answers can be given to this difficult question of cost management. After having introduced my company, THOMSON-CSF/Radars et Contremesures (RCM), and our main airborne systems, I will address our global methodology dedicated to these systems' studies and developments. This methodology, without any doubt, is the fundamental core of our know-how, not only relying on more or less heavy and sophisticated tools, but also and above all fed by the unique skill of our staff, for decades. Charts outlining RCM and its products and systems overview are presented.
Author
Cost Effectiveness; Cost Reduction; Systems Integration; Research and Development; Systems Engineering; Aircraft Production Costs; Aircraft Design

19990008082 Aermacchi S.p.A., Engineering Dept., Venegono Superiore, Italy
The Aermacchi YAK/AEM-130 and AT-2000 Design Objectives: A Topic in the Subsonic Versus Supersonic Training Trade-Off
Lucchesini, Massimo, Aermacchi S.p.A., Italy; Iaia, Pierclaudio, Aermacchi S.p.A., Italy; Sep. 1998; 12p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A modern trainer should be designed in accordance with the needs imposed by the entry into service of new and more capable operational aircraft. The trainers currently in service were designed, at best, with late 60's generation fighters in mind. The introduction of a modern trainer into service will allow substantial savings, over their life-cycle, with respect to the existing advanced trainers, even if updated with state-of-the-art avionic systems. This paper deals with the cost-effectiveness of selecting a subsonic or a supersonic configuration as a baseline. The result of a quantitative evaluation, carried on a representative training scenario, shows that the higher costs of a supersonic configuration will not be paid by the reduction in training costs, and that the optimal baseline is still a subsonic trainer, designed to be representative as much as possible of the modern combat aircraft.
Author
Training Simulators; Cost Effectiveness; Cost Reduction; Pilot Training; Training Analysis

19990008083 Department of Defense, Advanced Cost Estimating Team, Arlington, VA USA
Joint Strike Fighter: Cost Modeling in the JSF
Younossi, Obaid, Department of Defense, USA; Sep. 1998; 10p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper is about the Joint Common Cost Model(JCCM), a cost model developed to meet the unique challenges of estimating the cost of the Joint Strike Fighter Program. The cost model was developed to estimate the cost of a family of aircraft with maximum design and manufacturing commonality which meets the requirements of the USA Navy, Air Force, Marine Corps as well as the UK's Royal Navy. The JCCM incorporates the effect of commonality among different Service variants, the cost of advanced material composition, the cost of low observability, the costs of a robust avionics suite, the costs of a propulsion system capable of conventional flight and short take off and landing, and the cost effects of affordability initiatives in the area of Producibilty and Manufacturing. to our knowledge a model that meets these difficult requirements had not previously been developed.
Author

Fighter Aircraft; Aircraft Production Costs; Systems Integration; Cost Analysis; Mathematical Models; Cost Estimates; Project Management

19990008084 Kongsberg Gruppen ASA, Kongsberg, Norway
SIMEN: An In-House Simulation Tool, Reducing Risk and Cost for the NSM Development Program
Drogset, Gunn Helene, Kongsberg Gruppen ASA, Norway; Sep. 1998; 4p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes the simulation tool (SIMEN) developed to support a cost-effective and low-risk development of the new anti-ship missile (NSM) for the Royal Norwegian Navy (RNoN). Missile test firings are very expensive, difficult to plan and predict, and they seldom cover all test scenarios. Therefore, computer simulations in our missile programs have become more and more important as powerful computers and SW tools are getting more cost-effective. Powerful visualizations of simulations make SIMEN a useful tool for everybody working with NSM. One of the main goals with the use of SIMEN is to help the project detect errors in the missile system as early as possible to minimize the costs and technical risks.
Author
Missile Systems; Computerized Simulation; Missile Design; Mathematical Models; Computer Programs; Computer Aided Design

19990008085 Daimler-Benz Aerospace A.G., Military Aircraft Div., Munich, Germany
Parametrics as an Adequate Cost Estimation Tool for Affordable High-Tech Products
Wenzel, Meinolf, Daimler-Benz Aerospace A.G., Germany; Strategic Management of the Cost Problem of Future Weapon Systems; Sep. 1998; 26p; In English; Also announced as 19990008074; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is my understanding that this panel of AGARD deals with highly sophisticated technical matters, extending the edge of technology into the unknown and satisfying the human mind in so far as it gives a better understanding of physics and nature and hopefully has very practical consequences for applications. My subject deals with the affordability of such applications. This means an understanding of nature as well but it is the human nature and human behavior in engineering groups and program teams consequences that matter if we want to understand the ultimate cost drivers that are the key elements of cost origination.
Derived from text
Cost Estimates; Computer Aided Design; Design Analysis; Computer Programs; Cost Analysis; Parameter Identification; Computerized Simulation

19990008086 Kongsberg Defence and Aerospace A/S, Kongsberg, Norway
The IPF Project: Concurrent Engineering Efforts at Kongsberg Defence and Aerospace
Andersen, P., Kongsberg Defence and Aerospace A/S, Norway; Sep. 1998; 12p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes Kongsberg Defence & Aerospace's (KDA) work in the implementation of Concurrent Engineering (CE) practices. The work has been done through an internal improvement project, IPF. The paper provides information about background, methods, tools, supporting techniques, verification examples and results. It documents results showing that adaptation of the CE practices can lead to a tremendous savings in project cost and time.
Author
Concurrent Engineering; Cost Effectiveness; Project Management

19990008087 Det Norske Veritas, Hovik, Norway
CMT: An Innovative System for Project Risk Management
Pedersen, F. B., Det Norske Veritas, Norway; Tomte, E., Norwegian Air Material Command, Norway; Sep. 1998; 10p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A risk management system called Criticality Management Tools (CMT) /1/ is introduced. This system (procedures and software tools) supports a preventive and proactive approach, which enables early identification of hazards and risk affecting the project objectives. The hazards may originate from a broad range of disciplines, such as economy, politics, technology, environment, etc. An information management module contains the resources needed to perform risk monitoring and controls experience data collected from surveys and pilot projects. These data will be continuously updated with experience gained through the use of CMT in ordinary projects.
Author
Project Management; Information Management; Management Systems; Risk

19990008088 Alenia Aeronautica, Turin, Italy

Past and Future Programmes: A View on Cost Management Evolution and Challenges

Lojacono, E., Alenia Aeronautica, Italy; Mazzetti, B., Alenia Aeronautica, Italy; Sep. 1998; 8p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The challenge of meeting the requirements for an effective air combat capability in the future, constrained by ever more demanding budgetary limitations, must be faced in the broadest possible terms to identify the affordable solutions. Cost analysis of a weapon system must consider the entire life cycle of the system, from initial concept and realization of the first series through the variants which scenario requirements and technological evolution impose on the system to maintain an operational capacity which meets the demands of intended use. The cost of a program in its entirety, i.e. the Life Cycle Cost (LCC), is essentially determined by the physical parameters of the system produced and the process by which it is realized and managed: it is of course true to say that developments both in the recent past and currently in evolution have led to techniques and procedures which aim to reduce such effects to a minimum. However, in general terms, the level of cost is determined by factors of a general nature which reflect the system requirements and the contractual framework within which it is developed, acquired and managed during its lifetime. Experience gained in various programs operative during these years in which cost management techniques have been identified and to a certain extent put into practice, suggests the need to cross-analyze such elements of cost control: in a similar way to the constraints of requirements and contractual typologies they can condition the effectiveness of the techniques and procedures of cost management.

Author

Financial Management; Management Methods; Cost Analysis; Project Management

19990008089 Ministry of Defence, Abbey Wood, UK

Cost Effectiveness in UK Defence Procurement: The COEIA

Lindop, A. J., Ministry of Defence, UK; Sep. 1998; 20p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The UK has recently adopted a process for obtaining the most cost effective equipment for its armed forces, known as the Combined Operational Effectiveness and Investment Appraisal (COEIA). The role that the COEIA fulfills in the current UK defense procurement practice is explained and compared with previous practices. An outline of the process of selecting a Class of Military equipment by means of a Balance of Investment study is followed by a description of how to select the most cost effective Type of Equipment within a class using a combination of investment appraisal and estimating the military effectiveness of the equipment. The investment appraisal process for an aircraft system is described in terms of selecting the alternative procurement options, defining the assumptions, examining the cost breakdown structure, discounting the expected cash flow and analyzing the risks and uncertainties. The different mechanisms for measuring operational effectiveness are examined in order to explore the military benefit which is expected from the alternative options. In conclusion, alternative ways of combining cost and effectiveness are illustrated graphically to show how the most cost effective option for the procurement could be derived.

Author

Cost Effectiveness; Cost Analysis; Government Procurement; Equipment Specifications; Financial Management

19990008090 British Aerospace Public Ltd. Co., Preston, UK

The Future for Combat Aircraft Design: An Industrial View

Skorczewski, L., British Aerospace Public Ltd. Co., UK; Sep. 1998; 4p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The paper addresses the design and technology drivers which are likely to have the most impact on the next generation of combat aircraft from an industrial perspective. The nature of future conflicts and the emerging threats are becoming increasingly difficult to predict, and operational needs stress the growing importance of flexibility and survivability to meet these indefinable future scenarios. The inescapable fact is that market forces are no longer able to support ”performance at any cost” because defense budgets worldwide are being reduced and there is increasing competition for fewer orders. The key attribute of any future combat aircraft is now AFFORDABILITY, and the technology and design drivers which find their way into new combat aircraft will be those which provide major life cycle cost savings, whilst meeting adequate performance margins. The processes and mechanisms associated with achievement of major cost savings are discussed as a means of industrial survival in an increasingly competitive and uncertain world.

Author

Aircraft Design; Aircraft Production Costs; Cost Reduction

19990008091 British Aerospace Public Ltd. Co., Blackburn, UK

Agile Manufacturing: Mythology or Methodology?

Eastham, J., British Aerospace Public Ltd. Co., UK; Sep. 1998; 10p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The 'lean manufacturing' concept is well known and its application through the use of principles such as Pareto analysis, Kanban, JIT and WIP (etc) has the potential to realize significant cost benefits. There is, however, a potential down side to the 'lean and mean' environment; a reduced ability to respond to change. The need for a level of flexibility in the overall manufacturing process has therefore been recognized. Flexibility can be planned into the process at an early stage, perhaps as an intrinsic part of a risk management exercise for example, but such processes tend to be flexible only within the pre-set boundaries. In practice, however, the operational environment may be subject to a wide range of intrinsic and extrinsic variability which cannot be accounted for during the planning stage. More recently a new concept has begun to emerge which seeks to address the above issue; Agile Manufacture. The concept remains somewhat vaguely specified at present and has been variously interpreted as synonymous with 'flexibility', 'responsiveness' and even 'lean'. Alternatively Agile Manufacture may be seen as a new approach to production which encompasses flexible engineering methods and operations management. This paper addresses the agile concept from a manufacturing viewpoint and seeks to understand if agility is in fact a 'paradigm' or merely new coinage for an old currency.

Author

Engineering Management; Manufacturing; Flexibility; Cost Effectiveness; Production Management

19990008092 Aerospatiale Missiles, Service Genie Systeme et Logiciel, Chatillon, France

Cost Control in the Development of Systems and Their Software ***La Maitrise des Couts dans le Developpement des Systemes et de Leurs Logiciels***

Padel, P., Aerospatiale Missiles, France; Sep. 1998; 8p; In French; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Being both a systems developer and missile builder, Aerospatiale Missiles deals with systems that include a high proportion of software. Depending upon the type of product (integrated systems for command, fire control units, missiles, associated equipment), the software portion is generally greater than that of the hardware. The definition of a system results from studies which allow one to identify and characterize the function and architecture (technical solutions). These technical solutions are the resul of technological choices that can result from arbitration among all of the software and all of the hardware, or of intermediate blended solution. The forecasted cost of software is highly dependent on the choices that are made and therefore cannot be independent from that of the the rest of the system.

Transl. by Schreiber

Financial Management; Cost Effectiveness; Computer Systems Design; Software Engineering; Computer Programs; Systems Integration

19990008093 Boeing Co., Saint Louis, MO USA

The Value of S and T in Affordability

Lang, J. D., Boeing Co., USA; Birchfield, B., Boeing Co., USA; Saff, C. R., Boeing Co., USA; Shumaker, G., Air Force Research Lab., USA; Sep. 1998; 18p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Science and Technology (S&T) programs can have critical impact on the cost of aeronautical systems. The problem is to teach S&T personnel how to deal with the impact that their technologies have on cost as well as they deal with the technical performance impacts. The U.S. government focus on affordability in defense system procurement has provided a timely opportunity for initiatives to be developed and put in place. This paper discusses some of those government initiatives and some of those found in industry. Results are presented. The benefit of addressing four areas concurrently will be discussed. They are: Culture change, including the use of Integrated Product and Process Development (IPPD) and Integrated Product Teams (IPT), use of appropriate metrics, emphasis on transition of technologies to acquisition programs, and timely education and training.

Author

Research and Development; Product Development; Procurement; Cost Effectiveness; Government/Industry Relations; Education

19990008094 Department of Defense, Joint Strike Fighter Program Office, Arlington, VA USA

Technology: Solution for the Next Generation of Affordable Strike Fighters

Schwartz, Frederic C., Department of Defense, USA; Sep. 1998; 8p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

An essential element of the Joint Strike Fighter Program is the specific application of technologies to significantly reduce the life cycle cost of the weapon system. The strategy is to aggressively attack those attributes and features, which are high cost drivers for a strike fighter weapon system through various innovative approaches. The Joint Strike Fighter Program has addressed this by: 1) Identifying those specific features and characteristics which are high cost drivers so that one can apply scarce resources to the most leveraging attributes; 2) applying the Strategy-to-Task-to-Technology methodology and Quality, Function and Deployment(QFD) analysis to logically prioritize investment strategies; 3) identifying and leveraging opportunities for common technology demonstrations which apply to multiple weapon system concepts; and 4) coordinating activities across the various Science and Technology(S&T) communities to target significant life cycle cost drivers for strike fighter platforms.

Author

Weapons Development; Research and Development; Life Cycle Costs; Aircraft Production Costs; Fighter Aircraft

19990008095 Delegation Generale de l'Armement, Paris, France

Reorganization of the General Weapons Directorate (DGS) in France ***La Reorganisation de la Delegation Generale pour l'Armement (DGA) en France***

Salomon, Arnaud, Delegation Generale de l'Armement, France; Sep. 1998; 12p; In French; Also announced as 19990008074; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

As was mentioned in the general presentation, one of the goals of our symposium is to examine government prospects with respect to management of programs in order to achieve realistic cost, or to allow common adoption of better practices in order to take up the challenge of costs. The text which follows is not a comprehensive or official presentation of the new General Directorate for Weapons (DGA) in France. On the contrary, it reflects, in the same spirit of our symposium, an analysis by one member of the FVP committee which works with DGA, regarding the advantages which the French department gains after or during its reorganization. Without attempting to be comprehensive here, we will only deal with advances which are directly related to the theme of the symposium.

Transl. by Schreiber

Government/Industry Relations; Financial Management; Cost Effectiveness; Engineering Management; Organizing; Weapons Development

19990008096 Defence Evaluation Research Agency, Rotary Wing Aircraft Dept., Boscombe Down, UK

Reorganisation of Evaluation and research to Support Future Defence Procurement

Cadwallader, R., Defence Evaluation Research Agency, UK; Sep. 1998; 8p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In response to the changing defense environment and political and economic pressures, UK non-nuclear defense science and technology capability has been drawn together as the Defense Evaluation and Research Agency (DERA). The agency remains a government organization but operates as a trading agency supplying its services to customers (principally in the UK MoD) on a full cost basis, and required to demonstrate best commercial practices and financial viability. This paper traces the early days as the Defence Research Agency (DRA) through to its current structure, highlighting some of the challenges along the way, and sets out some future initiatives to maintain its position.

Author

Organizations; Government/Industry Relations; Organizing; Defense Industry; Cost Effectiveness

19990008097 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Cost Reduction Strategies in Acquiring Aircraft Weapon Systems at "Pax River"

Zalesak, Philip F., Naval Air Warfare Center, USA; Sep. 1998; 10p; In English; Also announced as 19990008074; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The most significant consolidation in the U.S. Department of Defense (DoD) just occurred at the Naval Air Station in Patuxent River, Maryland. This air station is commonly referred to as "Pax River". The U.S. Navy collocated its aircraft program managers, developers, testers, procurement, and logistics personnel at Pax River to achieve greater efficiency and effectiveness in buying

aircraft weapon systems. The purpose of this paper is to discuss this consolidation and the tremendous research, development, test and evaluation (RDT&E) capability now resident at this site.
Author
Defense Program; Consolidation; Cost Reduction; Research and Development; Government Procurement; Navy; Weapons Development

19990008221 General Accounting Office, General Government Div., Washington, DC USA
Management Reform: Agencies' Initial Efforts to Restructure Personnel Operations
Jul. 1998; 70p; In English
Report No.(s): PB99-109167; GAO/GGD-98-93; B-277016; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Resource reductions and changing missions, coinciding with the replacement of aging human resources management information systems, and driving efforts in federal agencies to restructure their personnel offices. Congress has made it clear, through enactment of a statutory framework with the Government Performance and Results Act of 1993 as its centerpiece, that it expects agencies to improve their accountability for resources, including human resources, in accomplishing agency missions. In addition, the National Performance Review (NPR), now called the National Partnership for Reinventing Government, in 1993, recommended that agencies reduce by half the costs of administrative positions, including personnel positions, by 1999.
NTIS
Management Information Systems; Personnel Management; Resources Management; Personnel; Management Planning

19990008223 General Accounting Office, Office of Public Affairs, Washington, DC USA
Month in Review: August 1998. Reports, Testimony, Correspondence, and Other Publications
Aug. 1998; 36p; In English
Report No.(s): PB99-103178; GAO/OPA-98-11; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document contains a list of reports, testimony, correspondence, and other publications on Medicare, Aircraft carriers, and defense spending. It also includes agriculture and food, economic development, energy; financial institutions; financial management, government operations, health, income security, information management, justice and law enforcement, national defense, natural resources, social services, tax policy and administration, transportation, veterans affairs, and special publications.
NTIS
Aircraft Carriers; Defense Program; Agriculture; Economic Development; Financial Management; Health; Information Management; Law (Jurisprudence); Security; Economic Analysis

19990008227 General Accounting Office, Health, Education, and Human Services Div., Washington, DC USA
Federal Contractors: Historical Perspective on Noncompliance with Labor and Worker Safety Laws. Statement of Cornelia M. Blanchette, Associate Director, Education and Employment Issues, Health, Education, and Human Services Division
Jul. 14, 1998; 13p; In English
Report No.(s): PB99-103814; GAO/T-HEHS-98-212; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We are pleased to be here today to assist the Subcommittee in its examination of issues involving federal contractors' noncompliance with federal labor laws. The consideration of a contractor's compliance with federal laws during an agency's procurement procedure remains a controversial issue.
NTIS
Contractors; Histories; Safety; Labor; Education; Medical Services

19990008263 General Accounting Office, General Government Div., Washington, DC USA
Government Printing: GPO Faces Management Challenges. Statement for the Record of L. Nye Stevens Director, Federal Management and Workforce Issues, General Government Division
Jul. 29, 1998; 10p; In English
Report No.(s): PB99-102923; GAO/GGD-98-180; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The report reviewed the contractor's workplans, regularly discussed the progress of agreed-upon tasks and development of findings, reviewed evidentiary support, and participated with Booz-Allen in several briefings for GPO management and congressional sponsors of the work. The final report makes some 90 recommendations organized under the topics of marketing, sales and

distribution, procurement services, human resources, financial management, and information technology. The Public Printer's comments are included in the final report.
NTIS
Printing; Resources Management; Management Information Systems; Information Management; Information Dissemination

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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.

19990004064 Ceskoslovenska Akademie Ved, Inst. of Computer Science, Prague, Czechoslovakia
Logic Colloquium 1998: Book of Abstracts *Final Report*
Sep. 23, 1998; 193p; In English, 9-15 Aug. 1998, Prague, Czechoslovakia
Report No.(s): AD-A354440; EOARD-CSP-98-1021; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche; Abstracts Only; Abstracts Only

This is an interdisciplinary conference. Topics include model theory, recursion theory, logic in computer science, and fuzzy logic.
DTIC
Fuzzy Systems; Mathematical Logic

19990004065 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Department of State IRM Modernization Program at Risk Absent Full Implementation of Key Best Practices
Sep. 1998; 33p; In English
Report No.(s): AD-A354315; GAO/NSIAD-98-242; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of State is spending hundreds of millions of dollars to replace its antiquated information technology (IT) infrastructure with modem hardware and software systems. In January 1997, the Department of State issued its 5-year, $2.7-billion information resource management (IRM) strategic plan which is designed to achieve a number of key goals by the end of fiscal year 2001, including (1) installing Year 2000 compliant hardware and software systems throughout State, (2) upgrading State's IT infrastructure, and (3) instituting professional management principles in all facets of State's IT operations. State's strategic plan is accompanied by a tactical plan that describes the 65 modernization projects designed to achieve the Department's strategic plan objectives. In light of disappointing results from prior State modernization efforts and widely publicized accounts of failed and costly modernization programs at several other federal agencies, the Government Accounting Office (GAO) was asked to examine the soundness of State's approach to modernizing its IT infrastructure. This report provides information and analysis on the progress made by State in implementing key IT management oversight and investment planning requirements mandated in recent federal legislation and related Office of Management and Budget (0MB) guidance. GAO also examined the soundness of the 5-year cost estimate included in the Department's IRM strategic plan and whether this estimate incorporates potential cost savings and efficiencies from State's modernization efforts.
DTIC
Information Systems; Data Management; Resources Management

19990004145 ENSCO, Inc., Applied Meteorology Unit, Cocoa Beach, FL USA
Data Quality Assessment Methods for the Eastern Range 915 MHz Wind Profiler Network
Lambert, Winifred C., ENSCO, Inc., USA; Taylor, Gregory E., ENSCO, Inc., USA; Jun. 01, 1998; 50p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS10-96018
Report No.(s): NASA/CR-1998-207906; NAS 1.26:207906; Rept-98-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Eastern Range installed a network of five 915 MHz Doppler Radar Wind Profilers with Radio Acoustic Sounding Systems in the Cape Canaveral Air Station/Kennedy Space Center area to provide three-dimensional wind speed and direction and virtual temperature estimates in the boundary layer. The Applied Meteorology Unit, staffed by ENSCO, Inc., was tasked by the 45th Weather Squadron, the Spaceflight Meteorology Group, and the National Weather Service in Melbourne, Florida to investigate methods which will help forecasters assess profiler network data quality when developing forecasts and warnings for critical ground, launch and landing operations. Four routines were evaluated in this study: a consensus time period check a precipitation

contamination check, a median filter, and the Weber-Wuertz (WW) algorithm. No routine was able to effectively flag suspect data when used by itself. Therefore, the routines were used in different combinations. An evaluation of all possible combinations revealed two that provided the best results. The precipitation contamination and consensus time routines were used in both combinations. The median filter or WW was used as the final routine in the combinations to flag all other suspect data points.
Derived from text
Acoustic Sounding; Wind Velocity; Boundary Layers; Spacecraft Launching; Forecasting; Atmospheric Sounding; Meteorological Radar; Wind (Meteorology)

19990004397 Logistics Management Inst., McLean, VA USA
Administering the Navy Virtual Library, 1.0 ***Final Report***
Duncan, Denise R.; Aug. 1998; 34p; In English
Contract(s)/Grant(s): DASW01-95-C-0019
Report No.(s): AD-A354009; LMI-NA710C1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Navy Virtual Library (NVL) is an Internet-based system that provides customized library services to researchers through their desktop computers. Using a World Wide Web interface and secure safety layer (SSL) encryption, users may search licensed databases, buy documents, read journal articles, and observe from a remote location as a reference librarian searches on line resources for them. User profiles and organization profiles are maintained by librarians so that those resources acquired by an organization, and relevant to the user's interests, are presented on his/her dynamically generated NVL web pages. Librarians administer resources through HTML forms, which allow restriction by dollar amount, or by number of transactions, at the user level and the distribution of an organization's resources among that organization's users and suborganizations. The NVL gives a user access to professional library support from a remote site, a hotel room, or shipboard, as long as an Internet connection, a secure browser, and a supporting library exist.
DTIC
Libraries; Internets; Information Systems

19990004629 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Report to the Chairman, Subcommittee on Military Research and Development Committee on National Security, House of Representatives. Defense Information Superiority: Progress Made, but Significant Challenges Remain
Aug. 1998; 30p; In English
Report No.(s): GAO/NSIAD/AIMD-98-257; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Achieving information superiority will be expensive and complex. Based on its analysis of the fiscal year 1999 through 2003 Future Years Defense Plan, DOD estimates it will budget an average of $43 billion a year (nearly 17 percent of the $257 billion budget request for fiscal year 1999) for C4ISR systems and activities during the plan period. Achieving information superiority is complex because it involves thousands of decentralized C4ISR systems and information networks. Furthermore, the systems, networks, and information superiority activities are managed by many different offices of the Secretary of Defense, Joint Chiefs of Staff, services, unified commands, and defense agencies throughout DOD. One of DOD's key activities to achieve information superiority is the development of a Department-wide C41SIZ information systems architecture. An information systems architecture is a blueprint that guides and controls the development and maintenance of many related systems. Another key activity is the development and deployment of a Department-wide Defense Information Infrastructures that features GCCS as DOD's principal worldwide command and control system. GCCS has more capabilities and functions (such as almost real-time knowledge of battlefield conditions, or situational awareness) than the system it replaced. DOD is also trying to consolidate the services' programmable, modular tactical radio development and acquisition programs into a single JTRS program to reduce costs and increase the ability of the services to communicate with each other.
Author
Military Technology; Research and Development; Congressional Reports; Estimates

19990005097 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Transition Packages for Expediting Technology Adoption: The Prototype Requirements Management Transition Package ***Final Report***
Fowler, Priscilla; Patrick, Malcom; Sep. 1998; 65p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A353172; CMU/SEI-98-TR-004; ESC*-TR-98-004; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the experience of building and evaluating a prototype transition package for organizations implementing processes in support of the Requirements Management Key Process Area of the Software Engineering Institute's Software Capability Maturity Model(SM). This report also describes the theories that led to the project and states our conclusions based on evaluation and review of the prototype by users typical of the audience targeted for transition packages. Feedback from these users indicated that they were typical "early or late majority" adopters, and that they found the transition package helpful for orientation and education as pan of implementing requirements management practices in their organizations. We argue in this report that transition packages. as part of a complete "whole product" that includes training and consulting, can be an effective mechanism for expediting the diffusion, adoption, and implementation of important technologies. Finally, we describe what we now know about creating transition packages and how they might be used.
DTIC
Prototypes; Software Engineering; Computer Programming; Data Management

19990005546 NASA Langley Research Center, Hampton, VA USA
Creating a Canonical Scientific and Technical Information Classification System for NCSTRL+
Tiffany, Melissa E., Computer Sciences Corp., USA; Nelson, Michael L., NASA Langley Research Center, USA; Dec. 1998; 28p; In English
Report No.(s): NASA/TM-1998-208955; NAS 1.15:208955; L-17797; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this paper is to describe the new subject classification system for the NCSTRL+ project. NCSTRL+ is a canonical digital library (DL) based on the Networked Computer Science Technical Report Library (NCSTRL). The current NCSTRL+ classification system uses the NASA Scientific and Technical (STI) subject classifications, which has a bias towards the aerospace, aeronautics, and engineering disciplines. Examination of other scientific and technical information classification systems showed similar discipline-centric weaknesses. Traditional, library-oriented classification systems represented all disciplines, but were too generalized to serve the needs of a scientific and technically oriented digital library. Lack of a suitable existing classification system led to the creation of a lightweight, balanced, general classification system that allows the mapping of more specialized classification schemes into the new framework. We have developed the following classification system to give equal weight to all STI disciplines, while being compact and lightweight.
Author
Integrated Library Systems; Information Management; Libraries; Digital Data; Classifications

19990006000 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA
Federal Implementation Guideline for Electronic Data Interchange. ASC X12 003060 Transaction Set 527D Material Due-In and Receipt (Due-In/Advance Receipt/Due Verification): Implementation Convention
Favreau, J. P., National Inst. of Standards and Technology, USA; Aug. 1998; 66p; In English
Report No.(s): PB99-107252; NIST/SP-881-74; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the Material Due-In and Receipt Transaction Set (527) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used to provide advanced notification of scheduled material receipts, to report receipts, and to inquire about the status of receipt reporting. This transaction set may be used to convey a description of the material, receiving conditions and quantities, necessary contract information, and other logistics information. This transaction set is bi-directional between trading partners.
NTIS
Data Processing; Computer Networks; Standards

19990006017 Naval Health Research Center, San Diego, CA USA
A Catalog of Department of Defense Medical Models and Simulations. Version 2
Gauker, Eleanor D., Naval Health Research Center, USA; Jan. 1998; 107p; In English
Report No.(s): AD-A353185; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Information about Department of Defense medical models and simulations is available from many different sources. The Internet, in particular, is a rich source of data, but searching the Web can be time-consuming. Although information is available, it is often difficult to locate, and, once found, is often outdated. The Joint Services Medical Readiness Modeling & Simulation Advisory Group (JSMRSAG) recognized this problem early in 1997, and in conjunction with the Naval Health Research Center (NHRC), compiled the Catalog of Department of Defense Medical Models and Simulations. That document was distributed on both the JSMRSAG and NHRC Web pages, as well as in hard copy and on disk. The initial effort alleviated the problem of finding

the information; now, a year later, that information must be updated. Objective The goal of the present effort is to update the Catalog of Department of Defense Medical Models and Simulations that was compiled in 1997.
DTIC
Catalogs (Publications); Defense Program; Computerized Simulation; Medical Services

19990007792 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Development, Implementation and Test of the Geostatistics Procedures (Kriging) for the Spring (Georeferenced Information Processing System) ***Desenvolvimento, Implementacao e Teste de Procedimentos Geoestatisticos (Krigeagem) no Sistema de Processamento de Informacoes Georreferenciadas (Spring)***
Camargo, Eduardo Celso Gerbi, Instituto Nacional de Pesquisas Espacias, Brazil; Jun. 1997; 146p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6410-TDI/620; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The aim of the present work is to develop, to implement and to test a geostatistics package for SPRING (Georeferenced Information Processing System). Kriging techniques, which are derived from Matheron's theory on regionalized variables (Matheron, 1971), are the conceptual basis for the geostatistics package. It comprises a set of integrated tools that can potentially enhance interpolation procedures due to its estimation character and the accuracy information provided by its inference model. GSLIB (Deutsh and Journel, 1992), a geostatistics library, was used to develop the necessary algorithms. A case study was performed with soil samples collected in the Canchim farm, in Sao Carlos, SP. Kriging interpolation was applied over the samples to generate continuous images of clay content in the soil. Results indicated a reasonable fit of the kriging techniques to the case study. A comparative analysis of kriging and other interpolation methods available in SPRING is also presented.
Author
Algorithms; Data Processing; Kriging; Interpolation

19990007861 MacDonald, Dettwiler and Associates Ltd., Richmond, British Columbia Canada
Image Data Management for Tactical Unmanned Airborne Surveillance
Davenport, Michael R., MacDonald, Dettwiler and Associates Ltd., Canada; Wehn, Hans, MacDonald, Dettwiler and Associates Ltd., Canada; Burke, Ian, MacDonald, Dettwiler and Associates Ltd., Canada; Jul. 1998; 12p; In English; Also announced as 19990007836; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper examines how more information and better information can be extracted from UAV data streams, and how that information can be presented to operators in the most effective manner possible. It examines the role of data management in all three phases of tactical reconnaissance: mission planning, mission execution, and post-mission analysis. It then describes some newly-developed tools for precisely positioning each pixel, fusing multiple images, extracting new information, and providing an accessible archive of that information. When implemented successfully, such a data management system can substantially increase the operational value of existing UAVs.
Author
Data Flow Analysis; Data Management; Management Systems; Image Processing; Data Simulation; Data Integration; Display Devices; Optical Data Processing

19990008173 Helsinki Univ. of Technology, Lab. of Information Processing Scinece, Espoo, Finland
Adapting CORBA-Like Environments to a Microkernel
Malinen, Jari, Helsinki Univ. of Technology, Finland; 1998; 62p; In English
Report No.(s): PB99-108276; TKK-TKO-B146; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche

A common object distribution architecture has been a longstanding goal for the software engineering industry. One of the most extensive standardization efforts in this field has been the Common Object Request Broker Architecture (CORBA). The communication mechanism at the core of this standard provides a common object request passing facility. This facility, the Object Request Broker (ORB), implements software interfaces for passing remote method calls between objects and their users. The most common platform on which to construct the ORB is the operating system TCP/IP protocol stack. The standard also allows for adapting the ORB to other types of platforms, such as a microkernel. This is a special kind of operating system implementing a small set of system primitives with emphasis on Inter-Process Communication (IPC). On a microkernel, the kernel-supported IPC message passing facility forms the basis for the ORB communication. This work examines three different approaches on how to adapt the ORB to the unmodified OSF Mach microkernel, and how each adaptation affect efficiency, conformance, and the flexibility for change.
NTIS
Computer Programming; Management Information Systems; Data Management; Data Bases

19990008222 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA

Federal Implementation Guideline for Electronic Data Interchange. ASC X12 003050 Transaction Set 846R Inventory Inquiry/Advice (Location Reconciliation). Implementation Convention

Favreau, Jean-Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 30p; In English

Report No.(s): PB99-109464; NIST/SP-881-79; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the inventory Inquiry/Advice Transaction Set (846) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used in the following ways: (1) for a seller of goods and services to provide inventory information to a prospective purchaser, with no obligation to the purchaser to acquire these goods or services; (2) for a representative of a seller of goods and services to supply inventory information to that seller; (3) for one location to supply another location with inventory information; and (4) for an inquiry as to the availability of inventory with no obligation on the seller of goods and services to reserve that inventory.

NTIS

Information Systems; Computer Networks; Procurement; Inventory Controls

19990008230 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA

Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 830W Planning Schedule with Release Capability (War Material Requirement). Implementation Convention

Favreau, Jean Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 28p; In English

Report No.(s): PB99-109472; NIST/SP-881-81; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the Planning Schedule with Release Capability Transaction Set (830) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used to provide for customary and established business practice relative to the transfer of forecasting/material release information between organizations. The planning schedule transaction may be used in various ways or in a combination of ways, such as: (1) a simple forecast; (2) a forecast with the buyer's authorization for the seller to commit to resources, such as labor or material; (3) a forecast that is also used as an order release mechanism, containing such elements as resource authorizations, period-to-date cumulative quantities, and specific ship/delivery patterns for requirements that have been representated in 'buckets,' such as weekly, monthly, or quarterly. The order release forecast may also contain all data related to purchase orders, as required, because the order release capability eliminates the need for discrete generation of purchase orders.

NTIS

Schedules; Warfare; Conventions; Information Systems; Computer Networks; Procurement; Management Planning; Data Processing; Draft

19990008231 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA

Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 846A Inventory Inquiry/Advice (Asset Reclassification). Implementation Convention

Favreau, Jean Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 36p; In English

Report No.(s): PB99-109498; NIST/SP-881-76; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the Inventory Inquiry/Advice Transaction Set (846) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used in the following ways: (1) for a seller of goods and services to provide inventory information to a prospective purchaser, with no obligation to the purchaser to acquire these goods or services; (2) for a representative of a seller of goods and services to supply inventory to that seller; (3) for one location to supply another location with inventory information; and (4) for an inquiry as to the availability of inventory with no obligation on the seller of goods and services to reserve that inventory.

NTIS

Conventions; Information Systems; Computer Networks; Standards; Procurement; Data Processing; Inventories; Draft

19990008232 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA

Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 511R Requisition. Implementation Convention

Favreau, Jean Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 56p; In English

Report No.(s): PB99-109506; NIST/SP-881-70; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the Requisition Transaction Set (511) for use within the context of an Electronic Data Interchange (EDI) environment. This transaction set can be used to requisition needed material and equipment from a supply distribution system for immediate consumption or stockage against projected requirements. The originator can also use this transaction set to inquire about the status of, amend, or terminate the original requisition. This transaction set may be used to convey a description and quantity of the required material, delivery and billing information, and other logistics information necessary to evaluate and meet the material needs of the originator. This transaction set is not used to establish a contractual relationship between trading partners, and may precede the use of a purchase order.

NTIS

Conventions; Information Systems; Standards; Computer Networks; Procurement; Data Processing; Draft

19990008233 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA

Federal Implementation Guideline for Electronic Data Interchange. ASC X12 003060 Transaction Set 846S Inventory Inquiry/Advice (LR Storage Transfer/Order/Reply) Implementation Convention

Favreau, Jean Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 28p; In English

Report No.(s): PB99-109514; NIST/SP-881-80; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the Inventory Inquiry/Advice Transaction Set (846) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used in the following ways: (1) for a seller of goods and services to provide inventory information to a prospective purchaser, with no obligation to the purchaser to acquire these goods or services; (2) for a representative of a seller of goods and services to supply inventory information to that seller; (3) for one location to supply another location with inventory information; and (4) for an inquiry as to the availability of inventory with no obligation on the seller of goods and services to reserve that inventory.

NTIS

Conventions; Inventories; Information Systems; Standards; Computer Networks; Procurement; Data Processing; Draft

19990008234 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA

Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 846D Inventory Inquiry/Advice (LR Storage/Transfer/ Decapitalization). Implementation Convention

Favreau, Jean Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 32p; In English

Report No.(s): PB99-109522; NIST/SP-881-77; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format the establishes the data contents of the Inventory Inquiry/Advice Transaction Set (846) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used in the following ways: (1) for a seller of goods and services to provide inventory information to a prospective purchaser, with no obligation to the purchaser to acquire these goods or services; (2) for a representative of a seller of goods and services to supply inventory information to that seller; (3) for one location to supply another location with inventory information; and (4) for an inquiry as to the availability of inventory with no obligation on the seller of goods and services to reserve that inventory.

NTIS

Conventions; Inventories; Information Systems; Standards; Computer Networks; Procurement; Data Processing; Draft

19990008236 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA

Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 180M Return Merchandise Authorization and Notification (Material Returns Reporting). Implementation Convention

Favreau, Jean Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 36p; In English

Report No.(s): PB99-110355; NIST/SP-881-72; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This Draft Standard for Trial Use contains the format and establishes the data contents of the Return Merchandise Authorization and Notification Transaction Set (180) for use within the context of an Electronic Data Interchange (EDI) environment. This

transaction set can provide for customary and established business and industry practice relative to the returning of merchandise to the vendor. This transaction set may satisfy request for returns, authorization or disposition of the return, notification of return, or notification of return, or notification of consumer return.
NTIS
Conventions; Consumers; Information Systems; Standards; Computer Networks; Procurement; Data Processing; Draft

19990008237 National Inst. of Standards and Technology, Electronic Commerce Acquisition Program Management Office, Gaithersburg, MD USA
Federal Implementation Guideline for Electronic Data Interchange: ASC X12 003060 Transaction Set 867D Product Transfer and Resale Report (Demand). Implementation Convention
Favreau, Jean Philippe, Editor, National Inst. of Standards and Technology, USA; Aug. 1998; 48p; In English
Report No.(s): PB99-110330; NIST/SP-881-75; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This Draft Standard for Trial Use contains the format and establishes the data contents of the Product Transfer and Resale Report Transaction Set (867) for use within the context of an Electronic Data Interchange (EDI) environment. The transaction set can be used to: (1) report information about product that has been transferred from one location to another; (2) report sales of product from one or more locations to an end customer; or (3) report sales of a product from one or more locations to an end customer, and demand beyond actual sales (lost orders). Report may be issued by either buyer or seller.
NTIS
Conventions; Information Systems; Standards; Computer Networks; Procurement; Data Processing; Inventory Controls; Draft

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ASTRONOMY

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

19990004107 NASA Marshall Space Flight Center, Huntsville, AL USA
Instrumentation for X-Ray Astronomy from High-Altitude Balloons: Recent Developments and Future Plans
Ramsey, B. D., NASA Marshall Space Flight Center, USA; Peskov, V., NASA Marshall Space Flight Center, USA; Fonte, P., Coimbra Univ., Portugal; Podoliak, E., Academy of Sciences (USSR), USSR; 1997; 11p; In English
Report No.(s): NASA/TM-1998-207905; NAS 1.15:207905; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We describe our current effort and future plans to develop new detectors and methods for studying hard x-ray emission from the Universe during balloon flights.
Author
X Ray Astronomy; Balloon Flight; Universe; X Ray Astrophysics Facility; Gamma Ray Astronomy; Spaceborne Astronomy; Astronomical Interferometry; Gamma Ray Observatory

19990004111 NASA Goddard Space Flight Center, Greenbelt, MD USA
ROSAT and ASCA Observations of the Seyfert Galaxy 1H0419-577, Identified with LB 1727
Turner, T. J., NASA Goddard Space Flight Center, USA; George, I. M., NASA Goddard Space Flight Center, USA; Nandra, K., NASA Goddard Space Flight Center, USA; Grupe, D., Eureka Scientific, Inc., USA; Remillard, R., Eureka Scientific, Inc., USA; Leighly, K., Eureka Scientific, Inc., USA; Marshall, H. L., Eureka Scientific, Inc., USA; May 1998; 23p; In English
Contract(s)/Grant(s): NASA Order S-57786-Z
Report No.(s): NASA/CR-1998-208595; NAS 1.26:208595; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
We discuss the properties of the Seyfert 1.5 galaxy LB 1727 based upon the analysis of two ASCA observations, a two-month ROSAT monitoring campaign, and optical data. The target is identified with the HEAO-A1 source 1H0419-577, so it has been observed by ASCA and ROSAT in order to obtain better X-ray variability and spectra data. Only modest (20%) variability is observed within or between ASCA and BeppoSAX observations in the approximately 2 - 10 keV band. However, the soft X-ray flux increased by a factor of 3 over a period of 2 months, while it was monitored daily by the ROSAT HRI instrument. The hard X-ray continuum can be parameterized as a power-law of slope Gamma approximately 1.5 - 1.6 across 9.7 - 11 keV in the rest-frame. We also report the first detection of an iron K(alpha) line in this source, consistent with emission from neutral material. The X-ray spectrum steepens sharply below 0.7 keV yielding a power-law of slope Gamma approximately 3.2. There is no evidence for absorption by neutral material, instrinsic to the nucleus. If the nucleus is unattenuated, then the break energy between the soft-excess and hard component is 0.7+/-0.08 keV. An ionized absorber may produce some tum-up in the spectrum at low energies, but a steepening of the underlying continuum is also required to explain the simultaneous ASCA and HRI data. We cannot rule out the

possibility that a significant column of ionized material exists in the line-of-sight, if that is true, then the continuum break-energy can only be constrained to lie within the approximately 0.1 - -0.7 keV band.
Author
Seyfert Galaxies; ROSAT Mission; X Rays; Active Galaxies; Galactic Nuclei

19990004146 NASA Goddard Space Flight Center, Greenbelt, MD USA
Developmental Cryogenic Active Telescope Testbed, a Wavefront Sensing and Control Testbed for the Next Generation Space Telescope
Leboeuf, Claudia M., NASA Goddard Space Flight Center, USA; Davila, Pamela S., NASA Goddard Space Flight Center, USA; Redding, David C., Jet Propulsion Lab., California Inst. of Tech., USA; Morell, Armando, NASA Goddard Space Flight Center, USA; Lowman, Andrew E., Jet Propulsion Lab., California Inst. of Tech., USA; Wilson, Mark E., NASA Goddard Space Flight Center, USA; Young, Eric W., NASA Goddard Space Flight Center, USA; Pacini, Linda K., NASA Goddard Space Flight Center, USA; Coulter, Dan R., Jet Propulsion Lab., California Inst. of Tech., USA; 1998; 11p; In English; Astronomical Telescopes and Instrumentation Symposium, 20-28 Mar. 1998, Kona, HI, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As part of the technology validation strategy of the next generation space telescope (NGST), a system testbed is being developed at GSFC, in partnership with JPL and Marshall Space Flight Center (MSFC), which will include all of the component functions envisioned in an NGST active optical system. The system will include an actively controlled, segmented primary mirror, actively controlled secondary, deformable, and fast steering mirrors, wavefront sensing optics, wavefront control algorithms, a telescope simulator module, and an interferometric wavefront sensor for use in comparing final obtained wavefronts from different tests. The developmental. cryogenic active telescope testbed (DCATT) will be implemented in three phases. Phase 1 will focus on operating the testbed at ambient temperature. During Phase 2, a cryocapable segmented telescope will be developed and cooled to cryogenic temperature to investigate the impact on the ability to correct the wavefront and stabilize the image. In Phase 3, it is planned to incorporate industry developed flight-like components, such as figure controlled mirror segments, cryogenic, low hold power actuators, or different wavefront sensing and control hardware or software. A very important element of the program is the development and subsequent validation of the integrated multidisciplinary models. The Phase 1 testbed objectives, plans, configuration, and design will be discussed.
Author
Cryogenic Temperature; Active Control; Hubble Space Telescope; Telescopes; Actuators; Control Simulation; Ambient Temperature

19990005952 Oxford Univ., Dept. of Physics, Oxford, UK
Further observations of IRAS 04302+2247
Lucas, P. W., Oxford Univ., UK; Roche, P. F., Oxford Univ., UK; 1998; 6p; In English
Report No.(s): OUAST/98/8; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present near infrared broad band and H2 images of the quadrupolar source IRAS 04302+2247. High resolution data at 3.8 microns show that the circumstellar envelope has a high degree of axisymmetry: the asymmetry at shorter wavelengths is almost certainly due to extinction by dust in the cavity. Photometry of the flux peaks confirms that the source is variable but little change in appearance is observed between Nov 1995 and Sep 1997. We report the first clear detection of the molecular outflow in H2 at 2.1 microns, revealing discrete streams which are inclined to the axis of cavity. The motion of knots in the outflow remains the most likely cause of the variability.
Author
Stellar Envelopes; Near Infrared Radiation; Pre-Main Sequence Stars; Hydrogen; Photometry

19990007915 Oxford Univ., Dept. of Physics, Oxford, UK
Imaging Polarimetry of Class I Young Stellar Objects
Lucas, P. W., Oxford Univ., UK; Roche, P. F., Oxford Univ., UK; 1998; 62p; In English
Report No.(s): OUAST/98/7; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We present near infrared imaging polarimetry of three Class I Young Stellar Objects in the Taurus-Auriga dark cloud. We use Monte Carlo simulations to analyse the flux distributions and polarization patterns of these three sources and five others from an earlier paper. In addition, we present high resolution polarimetry of HL Tau using the Shift and Add technique. Most YSOs in the sample display sharp, unresolved, peaks in the scattered light distribution. This is most simply explained by a strong concentration of matter in the centre, which we model by applying the rho proportional to r(exp -1.5) power law throughout the envelope. In terms of the Ulrich/Terebey, Shu and Cassen solution for the late stages of contraction of an initially spherical

non-magnetic cloud, this corresponds to rho(sup c) less than 10 au. However, this almost spherically symmetric density distribution is inconsistent with observations of flattened, disk-like structures so we conclude that this solution is not appropriate and different initial conditions apply. The multiple scattering models with spherical grains do not reproduce some features of the observed polarization patterns, in particular the broad regions of aligned vectors seen in some sources. We interpret this as evidence for elongated aligned grains. The weak wavelength dependence of nebular morphology shows that the dust grains in circumstellar envelopes obey a much shallower extinction law than interstellar grains in the near infrared, which we describe by the opacity ratio k(J/K) = 1.8 +/ 0.3, compared to the interstellar value of 3.25. We place an upper limit on albedo of omega less than 0.6 from 1.25 - 2.2 micro m and we find 0.1 less than omega less than 0.6 at 2.2 micro m. Analysis of the quadrupolar source IRAS 04302+2247 indicates that the scattering function is not highly forward throwing, which we express by the constraint g = (cos(theta)) less than 0.4. With the addition of 2 more observables derived from the observed degrees of linear and circular polarization we identify 5 empirical constraints on the properties of circumstellar dust. After calculating these observables for grain mixtures with a wide range of refractive indices and a variety of size distributions we find that highly metallic spherical grains.
Author
Circular Polarization; Imaging Techniques; Infrared Imagery; Stellar Envelopes; Polarized Electromagnetic Radiation; Linear Polarization; Magnetic Clouds; Flux (Rate)

19990007924 Colorado Univ., Center for Astrophysics and Space Astronomy, Boulder, CO USA
Airborne Astronomy with a 150 micron - 400 micron Heterodyne Spectrometer ***Final Report, 1 Oct. 1991 - 30 Sep. 1995***
Betz, A. L., Colorado Univ., USA; 1995; 14p; In English
Contract(s)/Grant(s): NAG2-753; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes work done under NASA Grant NAG2-753 awarded to the University of Colorado. The project goal was to build a far-infrared heterodyne spectrometer for NASA's Kuiper Airborne Observatory, and to use this instrument to observe atomic and molecular spectral lines from the interstellar medium. This goal was successfully achieved. Detections of particular note have been the 370 micron line of neutral atomic carbon, the 158 micron transition of ionized carbon, many of the high-J rotational lines of CO-12 and CO-13 between J=9-8 and J=22-21, the 119 micron and 163 micron rotational lines of OH, the 219 micron ground-state rotational line of H2D(+), and the 63 microns fine structure line of neutral atomic oxygen. All of these lines were observed at spectral resolutions exceeding 1 part in 10(exp 6), thereby allowing accurate line shapes and Doppler velocities to be measured.
Author
Heterodyning; Line Spectra; Atomic Spectra; Fine Structure; Oxygen Atoms; Neutral Atoms; Interstellar Matter

19990008009 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Search for Star Formation in the Translucent Cloud MBM 40
Magnani, Loris, Georgia Univ., USA; Caillault, Jean-Pierre, Georgia Univ., USA; Hearty, Thomas, Georgia Univ., USA; Stauffer, John, Harvard-Smithsonian Center for Astrophysics, USA; Schmitt, J. H. M. M., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Neuhaeuser, Ralph, Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Verter, Frances, NASA Goddard Space Flight Center, USA; Dwek, Eli, NASA Goddard Space Flight Center, USA; Astrophysical Journal; Jul. 10, 1996; ISSN 0004-637X; Volume 465, pp. 825-839; In English
Contract(s)/Grant(s): NAG5-1610; NAG5-2665; NAGw-2698; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The star formation status of the translucent high-latitude molecular cloud, MBM 40, is explored through analysis of radio, infrared, optical, and X-ray data. With a peak visual extinction of 1 to 2 mag, MBM 40 is an example of a high-latitude cloud near the diffuse/translucent demarcation. However, unlike most translucent clouds, MBM 40 exhibits a compact morphology and a kinetic energy-to gravitational potential energy ratio near unity. Our radio data, encompassing the CO (J = 1-0), CS (J = 2-1), and H2CO 1(sub 11-1(sub 10), spectral line transitions, reveal that the cloud contains a ridge of molecular gas with n greater than or equal to 10(exp 3)/ cc. In addition, the molecular data, together with IRAS data, indicate that the mass of MBM 40 is approx. 40 solar mass. In light of the ever-increasing number of recently formed stars far from any dense molecular clouds or cores, we searched the environs of MBM 40 for any trace of recent star formation. We used the ROSAT All-Sky Survey X-ray data and a ROSAT PSPC pointed observation toward MBM 40 to identify 33 stellar candidates with properties consistent with pre-main-sequence (PMS) stars. Follow-up optical spectroscopy of the candidates with V less than 15.5 was conducted with the 1.5 m Fred Lawrence Whipple Observatory telescope in order to identify signatures of T Tauri or pre-main- sequence stars (such as the Li 6708 A resonance line). Since none of our optically observed candidates display standard PMS signatures, we conclude that MBM 40 displays no evidence of recent or ongoing star formation. The absence of high-density molecular cores in the cloud and the relatively low column density compared to star-forming interstellar clouds may be the principal reasons that MBM 40 is devoid

of star formation. More detailed comparison between this cloud and other, higher extinction translucent and dark clouds may elucidate the necessary initial conditions for the onset of low-mass star formation.
Author
Star Formation; Molecular Clouds; X Ray Imagery; Data Acquisition; Infrared Radiation; Display Devices; Observatories; Stellar Mass

19990008071 California Inst. of Tech., Pasadena, CA USA
The ROSAT Deep Survey, 2, Optical Identification, Photometry and Spectra of X-Ray Sources in the Lockman Field
Schmidt, M., California Inst. of Tech., USA; Hasinger, G., Astrophysikalisches Inst., Germany; Gunn, J., Princeton Univ. Observatory, USA; Schneider, D., Pennsylvania State Univ., USA; Burg, R., Johns Hopkins Univ., USA; Giacconi, R., European Southern Observatory, Germany; Lehmann, I., Astrophysikalisches Inst., Germany; MacKenty, J., Space Telescope Science Inst., USA; Truemper, J., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Zamorani, G., Osservatorio Astronomico, Italy; Astronomy and Astrophysics; May 14, 1998; ISSN 0004-6361; 10p; In English; Sponsored in part by W. M. Keck Foundation
Contract(s)/Grant(s): DARA-FKZ-50-OR-9403-5; ASI-95-RS-152; NAG5-1531; NAG8-794; NAG5-1649; NAGw-2508; NAG5-1538; NAG8-1133; NSF AST-86-18257
Report No.(s): ASTRO-PH/9709144; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The ROSAT Deep Survey includes a complete sample of 50 X-ray sources with fluxes in the 0.5 - 2 keV band larger than 5.5 x 10(exp -15)erg/sq cm/s in the Lockman field (Hasinger et al., Paper 1). We have obtained deep broad-band CCD images of the field and spectra of many optical objects near the positions of the X-ray sources. We define systematically the process leading to the optical identifications of the X-ray sources. For this purpose, we introduce five identification (ID) classes that characterize the process in each case. Among the 50 X-ray sources, we identify 39 AGNs, 3 groups of galaxies, 1 galaxy and 3 galactic stars. Four X-ray sources remain unidentified so far; two of these objects may have an unusually large ratio of X-ray to optical flux.
Author
X Ray Sources; Charge Coupled Devices; Active Galactic Nuclei; X Ray Optics; Quasars

19990008183 Chicago Univ., Chicago, IL USA
Real Time Data/Video/Voice Uplink and Downlink for Kuiper Airborne Observatory ***Final Report, 1 Jul. 1995 - 30 Jun. 1997***
Harper, Doyal A., Chicago Univ., USA; 1997; 18p; In English
Contract(s)/Grant(s): NAG2-6001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

LFS was an educational outreach adventure which brought the excitement of astronomical exploration on NASA's Kuiper Airborne Observatory (KAO) to a nationwide audience of children, parents and children through live, interactive television, broadcast from the KAO at an altitude of 41,000 feet during an actual scientific observing mission. The project encompassed three KAO flights during the fall of 1995, including a short practice mission, a daytime observing flight between Moffett Field, California to Houston, Texas, and a nighttime mission from Houston back to Moffett Field. The University of Chicago infrared research team participated in planning the program, developing auxiliary materials including background information and lesson plans, developing software which allowed students on the ground to control the telescope and on-board cameras via the Internet from the Adler Planetarium in Chicago, and acting as on-camera correspondents to explain and answer questions about the scientific research conducted during the flights.
Author
Astronomy; Education; Ground Based Control; Infrared Radiation; Internets; Kuiper Airborne Observatory; Planetariums; Real Time Operation; Telescopes; Uplinking

19990008207 Columbia Univ., Columbia Astrophysics Lab., New York, NY USA
Surfing the High Density Universe ***Progress Report, 1 Oct. 1997 - 30 Sep. 1998***
Helfand, David J., Columbia Univ., USA; 1998; 7p; In English
Contract(s)/Grant(s): NAG5-6035
Report No.(s): CAL-3038; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The central theme of the proposed research is to link what we know about galaxy clusters and large-scale structure in the local Universe at z less than 0.1 to what we know about the original fluctuations that led to this structure as observed in the cosmic microwave background. The simple-minded approach to this question (the kind I always take) is to took at structure in the regime 0.1 less than z less than 1000. We have a unique resource to help us in this task in the form of the VLA FIRST radio survey in which, to date, we have completed mapping nearly 5000 deg2 of the northern sky to a 20 cm flux density limit of 1.0 mJy. The

435,000 radio sources detected all have positions accurate to better than 1. As this report is written, we are obtaining the next - 1000 deg 2 of data; the goal of the survey is to complete the full 10,000 deg 2 to be covered in the Sloan Digital Sky Survey.
Author
Astrophysics; Background Radiation; Flux Density; Galactic Clusters; Microwaves; Northern Sky; Radiant Flux Density

19990008347 NASA Ames Research Center, Moffett Field, CA USA
High Frequency Measurements of the Spectrum of Sgr A(sup *)
Serabyn, E., California Inst. of Tech., USA; Carlstrom, J. E., Chicago Univ., USA; Lay, O., NASA Ames Research Center, USA; Lis, D. C., California Inst. of Tech., USA; Hunter, T. R., Smithsonian Astrophysical Observatory, USA; Lacy, J. H., Hawaii Univ., USA; Hills, R. E., Mullard Radio Astronomy Observatory, UK; Astrophysical Journal Letters; Oct. 1997; 9p; In English
Contract(s)/Grant(s): NSF AST-96-15025; NSF AST 96-13717; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We report near-simultaneous interferometric measurements of the spectrum of Sgr A(sup *) over the 5 to 354 GHz range, and single-dish observations which have yielded the first detection of Sgr A(sup *) at 850 GHz. We confirm that Sgr A(sup *)'s spectrum rises more steeply at short mm wavelengths than at cm wavelengths, leading to a near-millimeter/submillimeter excess which dominates its luminosity. Below 900 GHz, Sgr A(sup *)'s observed luminosity is 70 +/- 30 solar luminosity). A new upper limit to Sgr A(sup *)'s 24.3 microns flux, together with a compilation of other extant IR data, imply a FIR spectral turnover, which can result either from an intrinsic synchrotron cutoff, or excess extinction near Sgr A(sup *). If the former applies, Sgr A(sup *)'s total synchrotron luminosity is less than 10(exp 3) solar luminosity, while in the latter case it is less than 3 x 10(exp 4) solar luminosity if spherical symmetry also applies.
Author
High Frequencies; Frequency Measurement; Spectra; Observation; Submillimeter Waves; Interferometry; Luminosity

19990008391 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
The Development of the Detector and Imaging Systems of the Masco Telescope *Desenvolvimento dos Sistemas Detector e de Imageamento do Telescopio Masco*
DAmico, Flavio, Instituto Nacional de Pesquisas Espacias, Brazil; Aug. 1997; 120p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6409/TDI-619; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In this thesis the detector and imaging systems of the MASCO telescope are described. MASCO is a gamma-ray imaging telescope with both high angular resolution and sensitivity. Conceived to be able to individually study sources in crowded fields, MASCO is an ideal mission to map sky regions like the Galactic Center. A revision of recent observational results obtained with imaging telescopes of this particular region is presented. Also presented is the sensitivity of the telescope for pulsed gamma-ray sources, taking GX 1+4 as an example. MASCO employs the coded-aperture imaging technique, and will be the first telescope to use a new type of mask patterns, the modified uniformly redundant arrays (MURAs). The coded-aperture imaging technique is reviewed and interesting properties of the MURAs discussed. This work gives two original contributions for MURA based coded mask telescopes: an empirical rule that says which MURA pattern is convenient to build a mask when we want to make observations with the mask-antimask method and the definition of the rotation center of a MURA pattern. MASCO uses a large number of scintillation detectors. The main detector of the experiment is a 41 cm diameter and 5 cm thick inorganic NaI(Tl) scintillation detector in an Anger Camera configuration, with approximately 10% energy resolution in 662 keV. Organic scintillation detectors are used to minimize the telescope background. and large volume scintillation detectors were built for the first time in Brazil. MASCO uses 12 of these scintillation detectors and the fabrication process are discussed together with tests for 2 different types of these detectors. MASCO shall have an angular resolution of 14 min in a 14 deg field-of-view and 20 micro-s of temporal resolution. A simulated image of the Galactic Center region in the 50-150 keV energy band is presented in order to show the imaging capabilities of the telescope. Preliminary tests results obtained with the detector and imaging systems are also presented together with the first laboratory images of the instrument, another original contribution of this work. These images are, to date, the only images obtained with a mask based in a MURA pattern.
Author
Imaging Techniques; Detectors; Gamma Ray Telescopes; Angular Resolution; Temporal Resolution; Gamma Rays; Field of View

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ASTROPHYSICS

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

19990004108 Massachusetts Inst. of Tech., Dept. of Physics, Cambridge, MA USA
The Nature and Evolutionary History of GRO J1744-28
Rappaport, S., Massachusetts Inst. of Tech., USA; Astrophysical Journal; Sep. 01, 1997; Volume 486, pp. 435-444; In English
Contract(s)/Grant(s): NAG5-2632; NAG5-3011; NAG5-4057
Report No.(s): NASA/CR-1997-207715; NAS 1.26:207715; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, Microfiche

GRO J1744-28 is the first known X-ray source to display bursts, periodic pulsations, and quasi-periodic oscillations. This source may thus provide crucial clues that will lead to an understanding of the differences in the nature of the X-ray variability from various accreting neutron stars. The orbital period is 11.8 days, and the measured mass function of 1.31 x 10(exp -4) solar mass is one of the smallest among all known binaries. If we assume that the donor star is a low-mass giant transferring matter through the inner Lagrange point, then we can show that its mass is lower than approximately 0.7 solar mass and probably closer to 0.25 solar mass. Higher mass, but unevolved, donor stars are shown to be implausible. We also demonstrate that the current He core mass of the donor star lies in the range of 0.20-0.25 solar mass. Thus, this system is most likely in the final stages of losing its hydrogen-rich envelope, with only a small amount of mass remaining in the envelope. If this picture is correct, then GRO J1744-28 may well represent the closest observational link that we have between the low-mass X-ray binaries and recycled binary pulsars in wide orbits. We have carried out a series of binary evolution calculations and explored, both systematically and via a novel Monte Carlo approach, the range of initial system parameters and input physics that can lead to the binary parameters of the present-day GRO J1744-28 system. The input parameters include both the initial total mass and the core mass of the donor star, the neutron-star mass, the strength of the magnetic braking, the mass-capture fraction, and the specifics of the core mass/radius relation for giants. Through these evolution calculations, we compute probability distributions for the current binary system parameters (i.e., the total mass, core mass, radius, luminosity, and K-band magnitude of the donor star, the neutron star mass, the orbital inclination angle, and the semimajor axis of the binary). Our calculations yield the following values for the GRO J1744-28 system parameters (with 95% confidence limits in parentheses): donor star mass: 0.24 solar mass (0.2-0.7 solar mass); He core mass of the donor star: 0.22 solar mass (0.20-0.25 solar mass); neutron-star mass: 1.7 solar mass (1.39-1.96 solar mass); orbital inclination angle: 18deg (7deg-22deg); semi- major axis: 64 lt-s (60-67 lt-s); radius of the donor star: 6.2 solar radius(6-9 solar radius); luminosity of donor star: 23 solar luminosity (15-49 solar luminosity), and long-term mass transfer rate at the current epoch: 5 x 10(exp -10)solar mass/yr (2 x 10(exp -10) to 5 x 10(exp -9)solar mass/yr). We deduce that the magnetic field of the underlying neutron star lies in the range of approximately 1.8 x 10(exp 11)G to approximately 7 x 10(exp 11)G, with a most probable value of 2.7 x 10(exp 11)G. This is evidently sufficiently strong to funnel the accretion flow onto the magnetic polar caps and suppress the thermonuclear flashes that would otherwise give rise to the type 1 X-ray bursts observed in most X-ray bursters. We present a simple paradigm for magnetic accreting neutron stars where X-ray pulsars, GRO J1744-28, the Rapid Burster, and the type 1 X-ray bursters may form a continuum of possible behaviors among accreting neutron stars, with the strength of the neutron-star magnetic field serving as a crucial parameter that determines the mode of X-ray variability from a given object. Author

X Ray Binaries; Neutron Stars; Stellar Evolution; Solar Radiation; Stellar Mass; Luminosity; Magnetic Stars; X Ray Sources

19990004138 Universities Space Research Association, High Energy Astrophysics Program, Columbia, MD USA
High Energy Astrophysics Program (HEAP), *1 Oct. 1997 - 31 Mar. 1998*
Angelini, Lorella, Universities Space Research Association, USA; Corcoran, Michael, Universities Space Research Association, USA; Drake, Stephen, Universities Space Research Association, USA; McGlynn, Thomas A., Universities Space Research Association, USA; Snowden, Stephen, Universities Space Research Association, USA; Mukai, Koji, Universities Space Research Association, USA; Cannizzo, John, Universities Space Research Association, USA; Lochner, James, Universities Space Research Association, USA; Rots, Arnold, Universities Space Research Association, USA; Christian, Eric, Universities Space Research Association, USA; Barthelmy, Scott, Universities Space Research Association, USA; Palmer, David, Universities Space Research Association, USA; Mitchell, John, Universities Space Research Association, USA; Esposito, Joseph, Universities Space Research Association, USA; Sreekumar, P., Universities Space Research Association, USA; Hua, Xin-Min, Universities Space Research Association, USA; Mandzhavidze, Natalie, Universities Space Research Association, USA; Chan, Kai-Wing, Universities Space Research Association, USA; Soong, Yang, Universities Space Research Association, USA; Barrett, Paul, Universities Space Research Association, USA; May 31, 1998; 72p; In English

Contract(s)/Grant(s): NAS5-32490
Report No.(s): NASA/CR-1998-206885; NAS 1.26:206885; Rept-11; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report reviews activities performed by the members of the USRA contract team during the 6 months of the reporting period and projected activities during the coming 6 months. Activities take place at the Goddard Space Flight Center, within the Laboratory for High Energy Astrophysics. Developments concern instrumentation, observation, data analysis, and theoretical work in astrophysics. Supported missions include advanced Satellite for Cosmology and Astrophysics (ASCA), X-Ray Timing Experiment (XTE), X-Ray Spectrometer (XRS), Astro-E, High Energy Astrophysics Science Archive Research Center (HEASARC) and others.
Author
Astrophysics; Cosmology; X Ray Spectrometers

19990004153 Dearborn Observatory, Evanston, IL USA
A2111: A z= 0.23 Butcher-Oemler Cluster with a Non-Isothermal Atmosphere and Normal Metallicity
Wang, Q. Daniel, Dearborn Observatory, USA; Henriksen, Mark, North Dakota Univ., USA; Sep. 1998; 18p; In English
Contract(s)/Grant(s): NASA Order S-92508-F; NAG5-6413; NSF AST-96-24716
Report No.(s): NASA/CR-1998-208604; NAS 1.26:208604; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report results from an x-ray spectral study of the z=0.23 Abell 2111 galaxy cluster using the Advanced Satellite for Astrophysics and Cosmology and the ROSAT Position Sensitive Proportional Counter. by correcting for the energy-dependent point-spread function of the instruments, we have examined the temperature structure of the cluster. The cluster's core within 3 is found to have a temperature of 5.4 +/- 0.5 keV, significantly higher than 2.8 +/-0.7 keV in the surrounding region of r = 3-6. This radially decreasing temperature structure can be parameterized by a polytropic index of gamma less than 1.4. Furthermore, the intracluster medium appears clumpy on scales less than 1. Early studies have revealed that the x-ray centroid of the cluster shifts with spatial scale and the overall optical and x-ray morphology is strongly elongated. These results together suggest that A2111 in undergoing a merger, which is likely responsible for the high fraction of blue galaxies observed in the cluster. We have further measured the abundance of the medium as 0.25 +/- 0.14 solar. This value is similar to those of nearby clusters which do not show a large blue galaxy function, suggesting that star formation in disk galaxies and subsequent loss to the intracluster medium do not drastically alter the average abundance of a cluster since z=0.23.
Author
X Rays; ROSAT Mission; Proportional Counters; Metallicity; Intergalactic Media; Galactic Clusters; Disk Galaxies; Astrophysics

19990004642 Wyoming Univ., Dept. of Physics and Astronomy, Laramie, WY USA
On the Existence of Low-Luminosity Cataclysmic Variables Beyond the Orbital Period Minimum
Howell, Steve B., Wyoming Univ., USA; Rappaport, Saul, Massachusetts Inst. of Tech., USA; Politano, Michael, Arizona State Univ., USA; Mon. Not. R. Atron. Soc.; 1997; Volume 287, pp. 929-936; In English
Contract(s)/Grant(s): NAG5-4057; NSF AST-92-01971; NAG5-2890; NAG5-3011
Report No.(s): NASA/CR-1997-207714; NAS 1.26:207714; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Models of the present-day intrinsic population of cataclysmic variables predict that 99 per cent of these systems should be of short orbital period. The Galaxy is old enough that approx. 70 per cent of these stars will have already reached their orbital period minimum (approx. 80 min), and should be evolving back toward longer periods. Mass-transfer rates in these highly evolved binaries are predicted to be less or equal to 10(exp -11), leading to M(sub V) of approx. 10 or fainter, and the secondaries would be degenerate, brown dwarf-like stars. Recent observations of a group of low-luminosity dwarf novae (TOADS) provide observational evidence for systems with very low intrinsic M,. and possibly low-mass secondaries. We carry out population synthesis and evolution calculations for a range of assumed ages of the Galaxy in order to study P(sub orb) and M distributions for comparison with the TOAD observations. We speculate that at least some of the TOADs are the predicted very low- luminosity, post-period-minimum cataclysmic variables containing degenerate (brown dwarf-like) secondaries having masses between 0.02 and 0.06 M, and radii near 0.1 R., We show that these low-luminosity systems are additionally interesting in that they can be used to set a lower limit on the age of the Galaxy. The TOAD with the longest orbital period currently known (123 min), corresponds to a Galaxy age of at least 8.6 x 10(exp 9) yr.
Author
Brown Dwarf Stars; Cataclysmic Variables; Galaxies; Luminosity; Mass Transfer; Faint Objects; Star Clusters; Stars; Radiant Flux Density; Incandescence

19990005053 California Univ., San Diego, Dept. of Chemistry and Biochemistry, La Jolla, CA USA
Meteoritic Sulfur Isotopic Analysis ***Final Report, 1 Mar. 1995 - 28 Feb. 1996***
Thiemens, Mark H., California Univ., San Diego, USA; 1996; 11p; In English
Contract(s)/Grant(s): NAGw-3551; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Funds were requested to continue our program in meteoritic sulfur isotopic analysis. We have recently detected a potential nucleosynthetic sulfur isotopic anomaly. We will search for potential carriers. The documentation of bulk systematics and the possible relation to nebular chemistry and oxygen isotopes will be explored. Analytical techniques for delta(sup 33), delta(sup 34)S, delta(sup 36)S isotopic analysis were improved. Analysis of sub milligram samples is now possible. A possible relation between sulfur isotopes and oxygen was detected, with similar group systematics noted, particularly in the case of aubrites, ureilites and entstatite chondrites. A possible nucleosynthetic excess S-33 has been noted in bulk ureilites and an oldhamite separate from Norton County. High energy proton (approximately 1 GeV) bombardments of iron foils were done to experimentally determine S-33, S-36 spallogenic yields for quantitation of isotopic measurements in iron meteorites. Techniques for measurement of mineral separates were perfected and an analysis program initiated. The systematic behavior of bulk sulfur isotopes will continue to be explored.
Author
Meteoritic Composition; Sulfur Isotopes; Achondrites; Chondrites; Iron Meteorites; Ureilites; Oxygen Isotopes

19990005959 Columbia Univ., Columbia Astrophysics Lab., New York, NY USA
Monitoring MRK 509: The Origin of the Reprocessor and Broad Band X-ray Spectrum of Narrow Line Seyfert 1 AKN 564 ***Final Report, 1 Aug. 1996 - 31 Jan. 1998***
Halpern, Jules P., Columbia Univ., USA; Leighly, Karen M., Columbia Univ., USA; Mar. 1998; 21p; In English
Contract(s)/Grant(s): NAG5-3307
Report No.(s): NASA/CR-1998-207611; NAS 1.26:207611; CAL-2798; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The ten monitoring observations of Mrk 509 were made successfully between October 20 and November 26 last year. These observations were simultaneously with RXTE observations. A preliminary analysis of the RXTE observations has been done, and the light curve is shown in figure 1. Our aim in this experiment is to determine the location of the emission region of the reflection component by reverberation mapping. This component could be emitted from the accretion disk, within 100 Scwartzschild radii (R(sub s)) from the source. Note that the monitoring interval of 2.5 days corresponds to 100 R(sub s) for a 2 x 10(exp 8) solar mass black hole, which may be appropriate for this luminous object. In that case, we would expect the reflected component to vary along the direct flux, and there should be no spectral variability between observations. Alternatively, the reflected emission could come from the molecular torus, several parsecs from the nucleus. In that case, the reflection component flux should not vary. The light curve in figure 1 shows that during the monitoring period, the target varied in an ideal way, since significant variability was observed between observations and yet the most rapid variability is apparently sampled. The analysis of this data is not yet completed. The measurement of the reflection component in the combined ASCa and RXTE spectra depends critically on the RXTE background subtraction and calibration, but these have not yet progressed to the point where the analysis can be done.
Derived from text
Seyfert Galaxies; Light Curve; Stellar Mass; Calibrating; Black Holes (Astronomy); Accretion Disks

19990007784 NASA Marshall Space Flight Center, Huntsville, AL USA
An X-ray Pulsar with a Superstrong Magnetic Field in the Soft Gamma-Ray Repeater SGR1806-20
Kouveliotou, C., NASA Marshall Space Flight Center, USA; Dieters, S., NASA Marshall Space Flight Center, USA; Strohmayer, T., Universities Space Research Association, USA; vanParadijs, J., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; Meegan, C. A., NASA Marshall Space Flight Center, USA; Hurley, K., California Univ., USA; Kommers, J., Massachusetts Inst. of Tech., USA; Smith, I., Rice Univ., USA; Frail, D., National Radio Astronomy Observatory, USA; Murakami, T., Tokyo Univ., Japan; Nature; May 21, 1998; Volume 393, pp. 235-237; In English
Report No.(s): NASA/TM-1998-208282; NAS 1.15:208282; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Soft gamma-ray repeaters (SGRs) emit multiple, brief (approximately O.1 s) intense outbursts of low-energy gamma-rays. They are extremely rare; three are known in our galaxy and one in the Large Magellanic Cloud. Two SGRs are associated with young supernova remnants (SNRs), and therefore most probably with neutron stars, but it remains a puzzle why SGRs are so different from 'normal' radio pulsars. Here we report the discovery of pulsations in the persistent X-ray flux of SGR1806-20, with a period of 7.47 s and a spindown rate of 2.6 x 10(exp -3) s/yr. We argue that the spindown is due to magnetic dipole emission and find that the pulsar age and (dipolar) magnetic field strength are approximately 1500 years and 8 x 10(exp 14) gauss, respectively. Our observations demonstrate the existence of 'magnetars', neutron stars with magnetic fields about 100 times stronger

than those of radio pulsars, and support earlier suggestions that SGR bursts are caused by neutron-star 'crust-quakes' produced by magnetic stresses. The 'magnetar' birth rate is about one per millenium, a substantial fraction of that of radio pulsars. Thus our results may explain why some SNRs have no radio pulsars.
Derived from text
Gamma Rays; Pulsars; X Rays; Magnetic Fields; Supernova Remnants; Magnetic Dipoles; Repeaters

19990007923 Oxford Univ., Dept. of Physics, Astrophysics, Oxford, UK
Evolution of the Angular Momentum of Protogalaxies from Tidal Torques: Zel'Dovich Approximation
Catelan, Paolo, Oxford Univ., UK; Theuns, Tom, Oxford Univ., UK; Apr. 03, 1996; 25p; In English
Report No.(s): OUAST/96/11; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Physics, Astrophysics, Keble Rd., Oxford, OX1 3RH, England), Hardcopy, Microfiche

The growth of the angular momentum L of protogalaxies induced by tidal torques is reconsidered. We adopt White's formalism and study the evolution of L in Lagrangian coordinates; the motion of the fluid elements is described by the Zel'dovich approximation. We obtain a general expression for the ensemble expectation value of the square of L in terms of the first and second invariant of the inertia tensor of the Lagrangian volume Gamma enclosing the protoobject's collapsing mass. We then specialize the formalism to the particular case in which Gamma is centered on a peak of the smoothed Gaussian density field and approximated by an isodensity ellipsoid. The result is the appropriate analytical estimate for the rms angular momentum of peaks to be compared against simulations that make use of the Hoffman-Ribak algorithm to set up a constrained density field that contains a peak with given shape. Extending the work of Heavens and Peacock, we calculate the joint probability distribution function for several spin parameters and peak mass M using the distribution of peak shapes, for different initial power spectra. The probability distribution for the rms final angular momentum (L(sub f, sup 2))(sub 1/2) on the scales corresponding to common bright galaxies, M approx. + 10(exp 11)solar mass, is centered on a value of approx = 10(sup 67) kg sq m/s, for any cosmologically relevant power spectrum, in line with previous theoretical and observational estimates for L(sub f). Other astrophysical consequences are discussed. In particular, we find that typical values (lambda(sup 2))(sup 1/2) approx. = 0.1 of the dimensionless spin parameter for peaks smoothed on galactic scales and of height upsilon approx. 1, usually associated with late type galaxies, may be recovered in the framework of the Gaussian peak formalism. This partially relaxes the importance attributed to dissipative processes in generating such high values of centrifugal support for spiral galaxies. In addition, the values of the specific angular momentum versus mass - as deduced from observations of rotational velocities and photometric radii of spiral galaxies - are well fitted by our theoretical isoprobability contours. In contrast, the observed lower values for the specific angular momentum for ellipticals of the same mass cannot be accounted for within our linear regime investigation, highlighting the importance of strongly non-linear phenomena to explain the spin of such objects.
Author
Angular Momentum; Tides; Torque; Galaxies; Algorithms; Centrifugal Force; Formalism

19990008066 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
No Large Brightness Variations on Nereid
Buratti, Bonnie J., Jet Propulsion Lab., California Inst. of Tech., USA; Goguen, Jay D., Jet Propulsion Lab., California Inst. of Tech., USA; Mosher, Joel A., Jet Propulsion Lab., California Inst. of Tech., USA; ICARUS; 1997; ISSN 0019-1035; Volume 126, pp. 225-228; In English
Report No.(s): Rept-IS965644; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Observations of Nereid with the 200-in. telescope on Palomar Mountain over three contiguous nights in July 1995 show no evidence for the large photometric variations seen by earlier observers. Total brightness variations within a single night are less than 10%. Our results suggest that Nereid may have a long rotational period, perhaps on the order of weeks. Our observations were not obtained close enough to Nereid's apoapsis to determine whether its rotation state is chaotic, as suggested by Dobrovoiskis.
Author
Nereid; Brightness; Observation

19990008126 Smithsonian Astrophysical Observatory, Cambridge, MA USA
An X-Ray and Infrared Study of Grains in the Puppis a Supernova Remnant ***Final Report, 15 Dec. 1994 - 14 Dec. 1997***
Vancura, O., Smithsonian Astrophysical Observatory, USA; Nov. 1998; 13p; In English
Contract(s)/Grant(s): NAG5-2453; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The second achievement meets the second objective for the second year. We choose adjustable prism couplers for connecting the sensor to optical fiber lines in our design of a breadboard prototype of the sensor. These couplers have good coupling efficiency at relatively low cost comparing to any other alternatives such as grating couplers. The third accomplishment meets the third

objective for the second year. We performed testing the breadboard prototype of the sensor using heating as a technique of changing its refractive index. The only difference is that we ruled out the channel waveguides as irrelevant to the final goals of the project. The feasibility of the sensor can be shown for the slab waveguide configuration without usage of relatively expensive technologies of channel waveguide delineation.
Author
X Rays; Waveguides; Supernova Remnants; Optical Fibers; Infrared Radiation; Breadboard Models

19990008175 Lockheed Martin Missiles and Space, Advanced Technology Center, Palo Alto, CA USA
An Investigation of the Largest Flares in Active Cool Star Binaries with ALEXIS ***Final Report, Mar. 1996 - Sep. 1997***
Stern, Robert A., Lockheed Martin Missiles and Space, USA; Jun. 03, 1998; 40p; In English
Contract(s)/Grant(s): NASA Order S-68399-F
Report No.(s): NASA/CR-1998-206897; NAS 1.26:206897; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
After a long delay due to the initial problems with the ALEXIS attitude control, the heroic efforts on the part of the ALEXIS satellite team enabled us to carry out this survey. However, the combination of the higher than expected and variable background in the ALEXIS detectors, and the lower throughput of the ALEXIS telescopes resulted in no convincing detections of large flares from the active binary systems. In addition, vignetting-corrected effective exposure times from the ALEXIS aspect solution were not available prior to the end of this contract; therefore, we were unable to convert upper limits measured in ALEXIS counts to the equivalent.
Author
Attitude (Inclination); Cool Stars; Surveys; Stellar Atmospheres; Stellar Temperature

19990008187 Johns Hopkins Univ., Baltimore, MD USA
The Study of Clusters of Galaxies and Large Scale Structures ***Final Report***
1998; 40p; In English
Contract(s)/Grant(s): NAGw-2508
Report No.(s): NASA/CR-1998-208292; NAS 1.26:208292; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Many research projects have been initiated and completed under support of this program. The results are summarized below. The work on the ROSAT Deep Survey has been successfully completed. A number of interesting results have been established within this joint MPE, Cal Tech, JHU, ST ScI, ESO collaboration. First, a very large fraction, 70-80 percent, of the X-ray background has been directly resolved into point sources. We have derived a new log N-log S for X-ray sources and have measured a source density of 970 sources per square degree at a limiting flux level. Care was taken in these studies to accurately model and measure the effects of sources confusion. This was possible because of our observing strategy which included both deep PSPC and HRI observations. No evidence of a population of narrow emission line galaxies has been established but some evidence for the evolution of low luminosity AGN (Seyfert galaxies) has been reported. The work on the ROSAT All Sky Survey Northern Cluster Survey has been substantially concluded but the publication of the list has been held up by the need to analyze newly re-calibrated data. This should result in publication over the next year. During the past year we have submitted a paper to the Astrophysical Journal which utilized a sample of clusters originally selected from the ROSAT All-sky survey at redshifts greater than 0.3. This sample was studied with ASCA to determine temperature and luminosity.
Author
Sky Surveys (Astronomy); Surveys; Seyfert Galaxies; ROSAT Mission; Red Shift; Luminosity; Galactic Clusters; Astrophysics

19990008339 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Numerical Modeling of Tidal Effects in Polytropic Accretion Disks
Godon, Patrick, Jet Propulsion Lab., California Inst. of Tech., USA; Astrophysical Journal; May 01, 1997; ISSN 0004-6256; Volume 480, pp. 329-343; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
A two-dimensional time-dependent hybrid Fourier-Chebyshev method of collocation is developed and used for the study of tidal effects in accretion disks, under the assumptions of a polytropic equation of state and a standard alpha viscosity prescription. Under the influence of the m = 1 azimuthal component of the tidal potential, viscous oscillations in the outer disk excite an m = 1 eccentric instability in the disk. While the m = 2 azimuthal component of the tidal potential excites a Papaloizou-Pringle instability in the inner disk (a saturated m = 2 azimuthal mode), with an elliptic pattern rotating at about a fraction (approx. = 1/3) of the local Keplerian velocity in the inner disk. The period of the elliptic mode corresponds well to the periods of the short-period oscillations observed in cataclysmic variables. In cold disks (r(Omega)/c(sub s) = M approx. = 40) we also find a critical value of the viscosity parameter (alpha approx. = 0.01), below which shock dissipation dominates and is balanced by the wave

amplification due to the wave action conservation. In this case the double spiral shock propagates all the way to the inner boundary with a Mach number M(sub s) approx. = 1.3.
Author
Mathematical Models; Numerical Analysis; Tides; Accretion Disks; Two Dimensional Models; Time Dependence; Collocation; Chebyshev Approximation

19990008340 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Advection in Accretion Disk Boundary Layers
Godon, Patrick, Jet Propulsion Lab., California Inst. of Tech., USA; Astrophysical Journal; Jul. 10, 1997; ISSN 0004-6256; Volume 483, pp. 882-886; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Recent numerical simulations of accretion disk boundary layers have shown qualitatively the importance tance of advected energy in the inner region of the disk. In this short paper we present quantitative results of advective boundary layers in the optically thick regime. Numerical results are obtained for various systems, by means of a one-dimensional time-dependent numerical code. At high accretion mass rates, dot-M approx. = 10(exp -4) solar mass/yr, or low values of the viscosity parameter, alpha approx. = 0.001-0.01 (characteristic of FU Orionis systems and some symbiotic stars), the optical thickness in the inner part of the disk becomes very large (tau much greater than 1). The disk, unable to cool efficiently, becomes geometrically thick (H/r approx. = 0.5). The energy dissipated in the dynamical boundary layer is radiated outward to larger radii and advected into the star. The boundary-layer luminosity is only a fraction of its expected value; the rest of the energy is advected into the star. The fraction of the advected energy is zeta = L(sub adv)/L(sub acc) approx. = 0.1 in symbiotic stars (accretion onto a low-mass main-sequence star) and zeta approx. = 0.2 in FU Ori systems (accretion onto a pre-main sequence star).
Author
Advection; Accretion Disks; Boundary Layers; Numerical Analysis; Optical Thickness

19990008390 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Radar Observations of Asteroids 7 Iris, 9 Metis, 12 Victoria, 216 Kleopatra, and 654 Zelinda
Mitchell, David L., Jet Propulsion Lab., California Inst. of Tech., USA; Ostro, Steven J., Jet Propulsion Lab., California Inst. of Tech., USA; Rosema, Keith D., Jet Propulsion Lab., California Inst. of Tech., USA; Hudson, R. Scott, Washington State Univ., USA; Campbell, Donald B., Cornell Univ., USA; Chandler, John F., Harvard-Smithsonian Center for Astrophysics, USA; Shapiro, Irwin I., Harvard-Smithsonian Center for Astrophysics, USA; ICARUS; 1995; ISSN 0019-1035; Volume 118, pp. 105-131; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We report 13-cm wavelength radar observations of the main-belt asteroids 7 Iris, 9 Metis, 12 Victoria, 216 Kleopatra, and 654 Zelinda obtained at Arecibo between 1980 and 1989. The echoes are highly polarized yet broadly distributed in Doppler frequency, indicating that our targets are smooth on decimeter scales but very rough on some scale(s) larger than about I m. The echo spectra are generally consistent with existing size, shape, and spin information based on radiometric, lightcurve, and occultation data. All of our targets possess distinctive radar signatures that reveal large- scale topography. Reflectivity spikes within narrow ranges of rotation phase suggest large flat regions on Iris, Metis, and Zelinda, while bimodal spectra imply nonconvex, possibly bifurcated shapes for Kleopatra and Victoria. Kleopatra has the highest radar albedo yet measured for a main-belt asteroid, indicating a high metal concentration and making Kleopatra the best main-belt candidate for a core remnant of a differentiated and subsequently disrupted parent body. Upon completion of the Arecibo telescope upgrade, there will be several opportunities per year to resolve main-belt asteroids with hundreds of delay-Doppler cells, which can be inverted to provide estimates of both three-dimensional shape and radar scattering properties.
Author
Radar Scattering; Observation; Asteroids; Wavelengths; Radar Tracking; Estimates

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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.

19990004121 Extrasolar Research Corp., Pasadena, CA USA
The Contribution of Ionizing Stars to the Far-Infrared and Radio Emission in the Galaxy ***Quarterly Report No. 4, Nov. 1997 - Jan. 1998***
Terebey, S., Extrasolar Research Corp., USA; Fich, M., Waterloo Univ., Canada; Taylor, R., Calgary Univ., Canada; Jan. 28, 1998; 3p; In English
Contract(s)/Grant(s): NAS5-97066
Report No.(s): NASA/CR-1998-206870; NAS 1.26:206870; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This quarterly report describes the fourth-quarter progess of the above proposal, with two research papers nearing completion and analysis continuing for the next stage of planned research, a quantitative study of the W4 HH region.
Author
Radio Emission; Ion Exchanging; Star Distribution; Astronomical Catalogs

19990004122 NASA Ames Research Center, Moffett Field, CA USA
An Intercomparison of the Dynamical Cores of Global Atmospheric Circulation Models for Mars ***Final Report, 26 Feb. 1996 - 25 Feb. 1998***
Hollingsworth, Jeffery L., San Jose State Univ., USA; Bridger, Alison F. C., San Jose State Univ., USA; Haberle, Robert M., NASA Ames Research Center, USA; 1998; 15p; In English
Contract(s)/Grant(s): NCC2-5171; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This is a Final Report for a Joint Research Interchange (JRI) between NASA Ames Research Cen- ter and San Jose State University, Department of Meteorology. The focus of this JRI has been to evaluate the dynamical ”cores” of two global atmospheric circulation models for Mars that are in operation at the NASA Ames Research Center. ne two global circulation models in use are fundamentally different: one uses spherical harmonics in its horizontal representation of field variables; the other uses finite differences on a uniform longitude-latitude grid. Several simulations have been conducted to assess how the dynamical processors of each of these circulation models perform using identical ”simple physics” parameterizations. A variety of climate statistics (e.g., time-mean flows and eddy fields) have been compared for realistic solstitial mean basic states. Results of this research have demonstrated that the two Mars circulation models with completely different spatial representations and discretizations produce rather similar circulation statistics for first-order meteorological fields, suggestive of a tendency for convergence of numerical solutions. Second and higher-order fields can, however, vary significantly between the two models.
Author
Atmospheric Circulation; Computational Grids; Meteorological Parameters; Meteorology; Spherical Harmonics; Convergence; Climate

19990004128 NASA Ames Research Center, Moffett Field, CA USA
Martian Meteorology: Determination of Large Scale Weather Patterns from Surface Measurements ***Final Report, 22 Jul. 1996 - 21 Jul. 1998***
Murphy, James R., San Jose State Univ., USA; Bridger, Alison F. C., San Jose State Univ., USA; Haberle, Robert M., NASA Ames Research Center, USA; 1998; 5p; In English
Contract(s)/Grant(s): NCC2-5181; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
We employed numerical modelling of the martian atmosphere, and our expertise in understanding martian atmospheric processes, to better understand the coupling between lower and upper atmosphere processes. One practical application of this work has been our involvement with the ongoing atmospheric aerobraking which the Mars Global Surveyor (MGS) spacecraft is currently undergoing at Mars. Dr. Murphy is currently a member of the Mars Global Surveyor (MGS) Aerobraking Atmospheric Advisory Group (AAG). He was asked to participate in this activity based upon his knowledge of martian atmospheric dynamical processes. Aerobraking is a process whereby a spacecraft, in an elliptical orbit, passes through the upper layers of the atmosphere (in this instance Mars). This passage through the atmosphere ’drags’ upon the spacecraft, gradually reducing its orbital velocity. This has the effect, over time, of converting the elliptical orbit to a circular orbit, which is the desired mapping orbit for MGS. Carrying out aerobraking eliminates the need for carrying large amounts of fuel on the spacecraft to execute an engine burn to achieve the desired orbit. Eliminating the mass of the fuel reduces the cost of launch. Damage to one of MGS’s solar panels shortly after launch has resulted in a less aggressive extended in time aerobraking phase which will not end until March, 1999. Phase 1

extended from Sept. 1997 through March 1998. During this time period, Dr. Murphy participated almost daily in the AAG meetings, and beginning in December 1997 lead the meeting several times per week. The leader of each of the daily AAG meetings took the results of that meeting current state of the atmosphere, identification of any time trends or spatial patterns in upper atmosphere densities, etc.) forward to the Aerobraking Planning Group (APG) meeting, at which time the decision was made to not chance MGS orbit, to lower the orbit to reach higher densities (greater 'drag'), or raise the orbit to avoid experiencing excessive, possibly damaging densities.
Author
Mars (Planet); Mars Atmosphere; Weather; Atmospheric Density; Orbital Velocity; Elliptical Orbits; Drag

19990004639 Brown Univ., Providence, RI USA
Planetary Geophysics and Tectonics ***Final Report, 1 Nov. 1989 - 31 Oct. 1997***
Parmentier, E. M., Brown Univ., USA; 1997; 2p; In English
Contract(s)/Grant(s): NAGw-1928
Report No.(s): NASA/CR-1996-208230; NAS 1.26:208230; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
Research supported by grant NAGW-1928 has addressed a variety of problems related to planetary evolution. One important focus has been on questions related to the role of chemical buoyancy in planetary evolution with application to both Venus and the Moon. We have developed a model for the evolution of the Moon (Hess and Parmentier, 1995) in which dense, highly radioactive, late stage magma ocean cumulates sink forming a core. This core heats the overlying, chemically layered mantle giving rise to a heated, chemically well-mixed layer that thickens with time. This Mixed layer eventually becomes hot enough and thick enough that its top begins to melt at a pressure low enough that melt is buoyant, thus creating mare basalts from a high pressure source of the correct composition and at an appropriate time in lunar evolution. In work completed during the last year, numerical experiments on convection in a chemically stably stratified fluid layer heated from below have been completed. These results show us how to calculate the evolution of a mixed layer in the Moon, depending on the heat production in the ilmenite- cumulate core and the chemical stratification of the overlying mantle. Chemical stratification of the mantle after its initial differentiation is would trap heat in the deep interior and prevent the rapid rise of plumes with accompanying volcanism. This trapping of heat in the interior can explain the thickness of the lunar lithosphere as a function of time as well as the magmatic evolution. We show that heat transported to the base of the lithosphere at a rate determined by current estimates of radioactivity in the Moon would not satisfy constraints on elastic lithosphere thickness from tectonic feature associated with basin loading. Trapping heat at depth by a chemically stratified mantle may also explain the absence of global compressional features on the surface that previous models predict for an initially hot lunar interior. For Venus, we developed a model in which the chemical buoyancy of crust and a depleted mantle layer stabilizes the lithosphere for long periods of time and provides a mechanism of episodic planetary evolution (Parmentier and Hess, 1992). Continued thickening of a residual depleted mantle layer eventually suppresses pressure release melting and the creation of depleted mantle. Continued cooling then allows the lithosphere to become heavier than the underlying hotter, undepleted mantle. This repeated instability can occur on time scales appropriate for episodic global resurfacing on Venus. We have also examined the role of the gabbro-eclogite phase transformation on crust and lithosphere stability and as a mechanism of crustal recycling in the absence of plate tectonics. Our work thus far concentrates on the scale of instability that would occur due to cooling or crustal thickening associated with horizontal shortening. Whether repeated overturn can explain the evolution of Venus depends in part on whether sufficient heat transfer can occur between overturns and on constraints provided by understanding observed surface features and evolution.
Author
Geophysics; Planetary Evolution; Tectonics; Stratified Flow; Phase Transformations; Heat Transfer; Lunar Evolution

19990004643 California Univ., Space Sciences Lab., Berkeley, CA USA
Earth and Planetary Science Letters
Nishiizumi, K., California Univ., USA; Klein, J., Pennsylvania Univ., USA; Middleton, R., Pennsylvania Univ., USA; Masarik, J., Los Alamos National Lab., USA; Reedy, R. C., Los Alamos National Lab., USA; Arnold, J. R., California Univ., San Diego, USA; Fink, D., Australian Nuclear Science and Technology Organisation, Australia; Earth and Planetary Science Letters; 1997; ISSN 0012-821X; Volume 148, pp. 545-552; In English
Contract(s)/Grant(s): W-7405-eng-36; NAG9-22; NAGw-3514
Report No.(s): NASA/CR-1997-207717; NAS 1.26:207717; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
Systematic measurements of the concentrations of cosmogen Ca-41 (half-life = 1.04 x 10(exp 5) yr) in the Apollo 15 long core 15001-15006 were performed by accelerator mass spectroscopy. Earlier measurements of cosmogenic Be-10, C-14, Al-26, CL-36, and Mn-53 in the same core have provided confirmation and improvement of theoretical models for predicting production profiles of nuclides by cosmic ray induced spallation in the Moon and large meteorites. Unlike these nuclides, Ca-40 in the lunar

surface is produced mainly by thermal neutron capture reactions on Ca-40. The maximum production of Ca-41, about 1 dpm/g Ca, was observed at a depth in the Moon of about 150 g/sq cm. For depths below about 300 g/sq cm, Ca-41 production falls off exponentially with an e-folding length of 175 g/sq cm. Neutron production in the Moon was modeled with the Los Alamos High Energy Transport Code System, and yields of nuclei produced by low-energy thermal and epithermal neutrons were calculated with the Monte Carlo N-Particle code. The new theoretical calculations using these codes are in good agreement with our measured Ca-41 concentrations as well as with Co-60 and direct neutron fluence measurements in the Moon.
Author
Calcium Isotopes; Depth; Neutrons; Radioactive Isotopes; Thermal Neutrons; Energy Transfer; Nuclides; Cobalt 60

19990005111 George Washington Univ., Joint Inst for Advanced of Flight Sciences, Hampton, VA USA
Operational Data Reduction Procedure for Determining Density and Vertical Structure of the Martian Upper Atmosphere from Mars Global Surveyor Accelerometer Measurements
Cancro, George J., George Washington Univ., USA; Tolson, Robert H., George Washington Univ., USA; Keating, Gerald M., George Washington Univ., USA; Oct. 1998; 104p; In English
Contract(s)/Grant(s): NCC1-104; RTOP 865-10-03-01
Report No.(s): NASA/CR-1998-208721; NAS 1.26:208721; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The success of aerobraking by the Mars Global Surveyor (MGS) spacecraft was partly due to the analysis of MGS accelerometer data. Accelerometer data was used to determine the effect of the atmosphere on each orbit, to characterize the nature of the atmosphere, and to predict the atmosphere for future orbits. To interpret the accelerometer data, a data reduction procedure was developed to produce density estimations utilizing inputs from the spacecraft, the Navigation Team, and pre-mission aerothermodynamic studies. This data reduction procedure was based on the calculation of aerodynamic forces from the accelerometer data by considering acceleration due to gravity gradient, solar pressure, angular motion of the MGS, instrument bias, thruster activity, and a vibration component due to the motion of the damaged solar array. Methods were developed to calculate all of the acceleration components including a 4 degree of freedom dynamics model used to gain a greater understanding of the damaged solar array. The total error inherent to the data reduction procedure was calculated as a function of altitude and density considering contributions from ephemeris errors, errors in force coefficient, and instrument errors due to bias and digitization. Comparing the results from this procedure to the data of other MGS Teams has demonstrated that this procedure can quickly and accurately describe the density and vertical structure of the Martian upper atmosphere.
Author
Upper Atmosphere; Mars (Planet); Mars Atmosphere; Vertical Distribution; Aerodynamic Forces; Data Reduction

19990008050 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Cosmic Dust Analyzer for Cassini
Bradley, James G., Jet Propulsion Lab., California Inst. of Tech., USA; Gruen, Eberhard, Max-Planck-Inst. fuer Kernphysik, Germany; Srama, Ralf, Max-Planck-Inst. fuer Kernphysik, Germany; SPIE Proceedings Series; 1996; Volume 2803, pp. 108-117; In English; Cassini/Huygens: A Mission to the Saturian Systems, 5-6 Aug. 1996, Denver, CO, USA; Sponsored by International Society for Optical Engineering, USA; Sponsored in part by national funding agencies in Czech Republic, France, Germany, Netherlands, Norway and UK; ISBN 0-8194-2191-X; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Cosmic Dust Analyzer (CDA) is designed to characterize the dust environment in interplanetary space, in the Jovian and in the Saturnian systems. The instrument consists of two major components, the Dust Analyzer (DA) and the High Rate Detector (HRD). The DA has a large aperture to provide a large cross section for detection in low flux environments. The DA has the capability of determining dust particle mass, velocity, flight direction, charge, and chemical composition. The chemical composition is determined by the Chemical Analyzer system based on a time-of-flight mass spectrometer. The DA is capable of making full measurements up to one impact/second. The HRD contains two smaller PVDF detectors and electronics designed to characterize dust particle masses at impact rates up to 10(exp 4) impacts/second. These high impact rates are expected during Saturn ring, plane crossings.
Author
Cosmic Dust; Analyzing; Cassini Mission; Design Analysis; Apertures

19990008063 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Mars Pathfinder Mission
Golombek, Matthew P., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Feb. 25, 1997; ISSN 0148-0227; Volume 102, No. E2, pp. 3953-3965; In English; Original contains color illustrations
Report No.(s): Paper-96JE02805; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Mars Pathfinder, one of the first Discovery-class missions (quick, low-cost projects with focused science objectives), will land a single spacecraft with a microrover and several instruments on the surface of Mars in 1997. Pathfinder will be the first mission to use a rover, carrying a chemical analysis instrument, to characterize the rocks and soils in a landing area over hundreds of square meters on Mars, which will provide a calibration point or ”ground truth” for orbital remote sensing observations. In addition to the rover, which also performs a number of technology experiments, Pathfinder carries three science instruments: a stereoscopic imager with spectral filters on an extendable mast, an alpha proton X ray spectrometer, and an atmospheric structure instrument/meteorology package. The instruments, the rover technology experiments, and the telemetry system will allow investigations of the surface morphology and geology at submeter to a hundred meters scale, the petrology and geochemistry of rocks and soils, the magnetic properties of dust, soil mechanics and properties, a variety of atmospheric investigations, and the rotational and orbital dynamics of Mars. Landing downstream from the mouth of a giant catastrophic outflow channel, Ares Vallis at 19.5 deg N, 32.8 deg W, offers the potential of identifying and analyzing a wide variety of crustal materials, from the ancient heavily cratered terrain, intermediate-aged ridged plains, and reworked channel deposits, thus allowing first-order scientific investigations of the early differentiation and evolution of the crust, the development of weathering products, and tile early environments and conditions on Mars.
Author
Mars Pathfinder; Chemical Analysis; Crusts; Mars Environment; Soil Mechanics; Magnetic Properties; Product Development

19990008064 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Selection of the Mars Pathfinder Landing Site
Golombek, M. P., Jet Propulsion Lab., California Inst. of Tech., USA; Cook, R. A., Jet Propulsion Lab., California Inst. of Tech., USA; Moore, H. J., Geological Survey, USA; Parker, T. J., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Feb. 25, 1997; ISSN 0148-0227; Volume 102, No. E2, pp. 3967-3988; In English
Report No.(s): Paper-96JE03318; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Mars Pathfinder spacecraft will land on a depositional fan near the mouth of the catastrophic outflow channel, Ares Vallis (19.5 deg N, 32.8 deg W). This site offers the prospect of analyzing a variety of rock types from the ancient cratered highlands, intermediate-age ridged plains, and reworked channel deposits. Analyses of these rocks by Pathfinder instruments will enable first-order scientific questions to be addressed, such as differentiation of the crust, the development of weathering products, and the nature of the early environment, as well as their subsequent evolution on Mars. Constraints imposed by: (1) spacecraft and rover designs (which are robust), (2) entry, descent, and landing, (3) scientific potential at various sites, and (4) safety were important considerations in site selection. Engineering constraints require a 70 km by 200 km smooth, flat (low slopes) area located between 10 deg and 20 deg N that is below 0 km elevation, with average radar reflectivity, little dust, and moderate rock abundance. Three regions on Mars are between 10 deg and 20 deg N and below 0 km elevation: Chryse, Amazonis, and Isidis-Elysitun. Science considerations favor sites at the mouths of outflow channels (grab bag sites offer an assay of rock types on Mars), highland sites (early crustal differentiation and climate), and sites covered with dark (unoxidized) material. Sites are considered safe if they are clearly below 0 km elevation, appear acceptably free of hazards in high-resolution (less than 50 m/pixel) Viking orbiter images and have acceptable reflectivity and roughness at radar wavelengths, thermal inertia, rock abundance, red to violet ratio, and albedo. Recent 3.5-cm wavelength radar observations were used to verify elevation, reflectivity, and roughness within the landing ellipses. Three sites meet all of these criteria: Ares Vallis, Tritonis Lacus, and Isidis. Although Isidis appears to be safer than Tritonis and Ares, the greater scientific potential at Ares Vallis resulted in its selection. Comparisons of the Grand Coulee (channel) and the depositional Ephrata Fan of the Channeled Scabland in eastern Washington, with Ar-es Vallis and its depositional fan also suggest the Ares Vallis landing site is safe and scientifically interesting.
Author
Crusts; Hazards; Landing Sites; Mars Pathfinder; Mars Photographs; Mars Surface; Product Development; Radar Tracking; Site Selection; Surface Roughness; Viking Orbiter Spacecraft

19990008247 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
An Unusual Rotationally Modulated Attenuation Band in the Jovian Hectometric Radio Emission Spectrum
Gurnett, D. A., Iowa Univ., USA; Kurth, W. S., Iowa Univ., USA; Menietti, J. D., Iowa Univ., USA; Persoon, A. M., Iowa Univ., USA; Geophysical Research Letters; Jun. 01, 1998; ISSN 0094-8534; Volume 25, No. 11, pp. 1841-1844; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS9-58779
Report No.(s): Paper-98GL01400; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A well-defined attenuation band modulated by the rotation of Jupiter has been found in the spectrum of Jovian hectometric radiation using data from the Galileo plasma wave instrument. The center frequency of this band usually occurs in the frequency

range from about 1 to 3 MHz and the bandwidth is about 10 to 20 percent. The center frequency varies systematically with the rotation of Jupiter and has two peaks per rotation, the first at a system III longitude of about 50 deg, and the second at about 185 deg. It is now believed that the attenuation occurs as the ray path from a high-latitude cyclotron maser source passes approximately parallel to the magnetic field near the northern or southern edges of the Io L-shell. The peak at 50 deg system 3 longitude is attributed to radiation from a southern hemisphere source and the peak at 185 deg is from a northern hemisphere source. The attenuation is thought to be caused by coherent scattering or shallow angle reflection from field-aligned density irregularities near the Io L-shell. The narrow bandwidth indicates that the density irregularities are confined to a very narrow range of L values (Delta L = 0.2 to 0.4) near the Io L-shell.
Author
Radio Emission; Spectra; Bandwidth; Attenuation; Rotation; Plasma Waves; Frequency Ranges; Emission Spectra

19990008249 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Dynamics of the Trans-Neptune Region: Apsidal Waves in the Kuiper Belt
Ward, William R., Jet Propulsion Lab., California Inst. of Tech., USA; Hahn, Joseph M., Lunar and Planetary Inst., USA; Astronomical Journal; Jul. 1998; Volume 116, pp. 489-498; In English
Contract(s)/Grant(s): NAGw-4575
Report No.(s): LPI-Contrib-944; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The role of apsidal density waves propagating in a primordial trans-Neptune disk (i.e., Kuiper belt) is investigated. It is shown that Neptune launches apsidal waves at its secular resonance near 40 AU that propagate radially outward, deeper into the particle disk. The wavelength of apsidal waves is considerably longer than waves that might be launched at Lindblad resonances, because the pattern speed, g(sub s), resulting from the apsis precession of Neptune is much slower than its mean motion, Omega(sub s). If the early Kuiper belt had a sufficient surface density, sigma, the disk's wave response to Neptune's secular perturbation would have spread the disturbing torque radially over a collective scale lambda(sub *) approx. = r(2(mu)(sub d)Omega/ absolute value of r dg/dr)(sup 1/2), where mu(sub d)equivalent pi(sigma)r(exp 2)/(1 solar mass) and Omega(r) and g(r) are respectively the mean motion and precession frequency of the disk particles. This results in considerably smaller eccentricities at resonance than had the disk particles been treated as noninteracting test particles. Consequently, particles are less apt to be excited into planet-crossing orbits, implying that the erosion timescales reported by earlier test-particle simulations of the Kuiper belt may be underestimated. It is also shown that the torque the disk exerts upon the planet (due to its gravitational attraction for the disk's spiral wave pattern) damps the planet's eccentricity and further inhibits the planet's ability to erode the disk. Key words: celestial mechanics, stellar dynamics - comets: general minor planets, asteroids
Author
Apsides; Density (Mass/Volume); Kuiper Belt; Comets; Neptune (Planet)

19990008250 Lunar and Planetary Inst., Houston, TX USA
Bulk and Stable Isotopic Compositions of Carbonate Minerals in Martian Meteorite Allan Hills 84001: No Proof of High Formation Temperature
Treiman, Allan H., Lunar and Planetary Inst., USA; Romanek, Christopher S., Savannah River Ecology Lab., USA; Meteoritics and Planetary Science; Mar. 25, 1998; Volume 33, pp. 737-742; In English
Contract(s)/Grant(s): NAGw-5098
Report No.(s): LPI-Contrib-938; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Understanding the origin of carbonate minerals in the Martian meteorite Allan Hills (ALH) 84001 is crucial to evaluating the hypothesis that they contain traces of ancient Martian life. Using arguments based on chemical equilibria among carbonates and fluids, an origin at greater than 650 C (inimical to life) has been proposed. However, the bulk and stable isotopic compositions of the carbonate minerals are open to multiple interpretations and so lend no particular support to a high-temperature origin. Other methods (possibly less direct) will have to be used to determine the formation temperature of the carbonates in ALH 84001.
Author
Mars (Planet); Isotopic Labeling; Composition (Property); Stability; Carbonates; Minerals

19990008251 Lunar and Planetary Inst., Houston, TX USA
The History of Allan Hills 84001 Revised: Multiple Shock Events
Treiman, Allan H., Lunar and Planetary Inst., USA; Meteoritics and Planetary Science; Aug. 27, 1998; Volume 33, pp. 753-764; In English
Contract(s)/Grant(s): NAGw-5098
Report No.(s): LPO-Contrib-937; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The geologic history of Martian meteorite Allan Hills (ALH) 84001 is more complex than previously recognized, with evidence for four or five crater-forming impacts onto Mars. This history of repeated deformation and shock metamorphism appears to weaken some arguments that have been offered for and against the hypothesis of ancient Martian life in ALH 84001. Allan Hills 84001 formed originally from basaltic magma. Its first impact event (I1) is inferred from the deformation (D1) that produced the granular-textured bands (”crush zones”) that transect the original igneous fabric. Deformation D1 is characterized by intense shear and may represent excavation or rebound flow of rock beneath a large impact crater. An intense thermal metamorphism followed D1 and may be related to it. The next impact (I2) produced fractures, (Fr2) in which carbonate ”pancakes” were deposited and produced feldspathic glass from some of the igneous feldspars and silica. After I2, carbonate pancakes and globules were deposited in Fr2 fractures and replaced feldspathic glass and possibly crystalline silicates. Next, feldspars, feldspathic glass, and possibly some carbonates were mobilized and melted in the third impact (I3). Microfaulting, intense fracturing, and shear are also associated with 13. In the fourth impact (I4), the rock was fractured and deformed without significant heating, which permitted remnant magnetization directions to vary across fracture surfaces. Finally, ALH 84001 was ejected from Mars in event I5, which could be identical to I4. This history of multiple impacts is consistent with the photogeology of the Martian highlands and may help resolve some apparent contradictions among recent results on ALH 84001. For example, the submicron rounded magnetite grains in the carbonate globules could be contemporaneous with carbonate deposition, whereas the elongate magnetite grains, epitaxial on carbonates, could be ascribed to vapor-phase deposition during I3.
Author
Mars (Planet); Meteorites; Crystallinity; Deposition; Magma; Magnetization; Metamorphism (Geology); Paleontology; Photogeology; Silicon Dioxide; Vapor Phases

19990008252 Lunar and Planetary Inst., Houston, TX USA
Coronagraphic Observations of the Lunar Sodium Exosphere Near the Lunar Surface
Potter, A. E., Lunar and Planetary Inst., USA; Morgan, T. H., Southwest Research Inst., USA; Journal of Geophysical Research; Apr. 25, 1998; ISSN-0148-0227; Volume 103, No. E4, pp. 8581-8586; In English; Original contains color illustrations
Contract(s)/Grant(s): NASw-4574
Report No.(s): Paper-98JE00059; LPI-Contrib-946; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
The sodium exosphere of the Moon was observed using a solar coronagraph to occult the illuminated surface of the Moon. Exceptionally dust-free atmospheric conditions were required to allow the faint emission from sunlight scattered by lunar sodium atoms to be distinguished from moonlight scattered from atmospheric dust. At 0300 UT on April 22, 1994, ideal conditions prevailed for a few hours, and one excellent image of the sodium exosphere was measured, with the Moon at a phase angle of 51 deg, 81 % illuminated. Analysis of the image data showed that the weighted mean temperature of the exosphere was 1280 K and that the sodium column density varied approximately as cosine-cubed of the latitude. A cosine-cubed variation is an unexpected result, since the flux per unit area of solar photons and solar particles varies as the cosine of latitude. It is suggested that this can be explained by a temperature dependence for the sputtering of sodium atoms from the surface. This is a characteristic feature of chemical sputtering, which has been previously proposed to explain the sodium exosphere of Mercury. A possible interaction between chemical sputtering and solar photons is suggested.
Author
Coronagraphs; Observation; Lunar Surface; Sodium; Exosphere

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SOLAR PHYSICS

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

19990004135 Academy of Sciences of the Ukraine, Dept. of Decametric Radio Astronomy, Kharkov, Ukraine
The Use of High Frequency Solar Radar to Detect Coronal Mass Ejections *Final Report*
Konovalenko, Alexander A.; Jan. 1998; 16p; In English
Contract(s)/Grant(s): F61708-97-W-0230
Report No.(s): AD-A353796; EOARD-SPC-97-4079; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report results from a contract tasking Institute of Radio Astronomy (RIAN) as follows: The contractor will investigate the usable frequencies and effective radiated powers required to penetrate the ionosphere, reach the sun and return at detectable levels; the best duty cycles and waveforms needed to coordinate Sura radar operations with the UTR-2 antenna and the ionospheric effect on transmitted radar waves. Radar tests planned for the Sura and UTR-2 facilities will be correlated with various solar moni-

toring observatories providing images of the solar corona and the solar disk. All work is to be performed as described in the proposal.
DTIC
Solar Observatories; Solar Corona; Solar Physics; Radio Astronomy; Solar Radiation; Stellar Mass Ejection

19990004157 NASA Marshall Space Flight Center, Huntsville, AL USA
The Sun and the Solar Wind Close to the Sun
Suess, Steven T., NASA Marshall Space Flight Center, USA; 1998; 11p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the benefits from the Ulysses, SOHO, and YOHKOH missions has been a strong stimulus to better understand the magnetohydrodynamic processes involved in coronal expansion. Three topics for which this has been especially true are described here. These are: (i) The observed constancy of the radial interplanetary magnetic field strength (as mapped to constant radius). (ii) The geometric spreading of coronal plumes and coronal holes, and the fate of plumes. (iii) The plasma P in streamers and the physics of streamer confinement.
Author
Ulysses Mission; Solar Wind; Plumes; Plasmas (Physics); Magnetohydrodynamics; Magnetic Flux; Interplanetary Magnetic Fields

19990004171 Academy of Sciences (USSR), Radiophysical Research Inst., Nizhny Novgorod, USSR
The Use of High Frequency Solar Radar to Detect Coronal Mass Ejections *Final Report*
Polyakov, S. V.; 1998; 12p; In English
Contract(s)/Grant(s): F61708-97-W-0231
Report No.(s): AD-A353482; EOARD-SPC-97-4078; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking Radiophysical Research Institute (NTRFI) as follows: The contractor will investigate techniques of high frequency solar radars and receiving antennas to detect mass motions in the solar corona such as solar mass ejections. Testing will be accomplished and solar data taken using the Sura Radar Facility and the UTR-2 Receiving Antenna as described in the proposal.
DTIC
High Frequencies; Solar Corona; Stellar Mass; Stellar Mass Ejection

19990004377 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Search for r-Modes from 1825 to the Present
Wolff, Charles L., NASA Goddard Space Flight Center, USA; 1998; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Global oscillations (r-modes) of the Sun's outer convective envelope with periods approximately 1 month and longer have been detected in several short data strings of several years duration. to test whether r-modes might persist beyond one 11 year cycle, the daily sunspot numbers from 1825 to the present were analyzed. Good evidence, but confidence level less than 3sigma, was found for most of the 14 r-modes with spherical harmonic index lambda less than or equal to 5 that can exist in the presence of solar differential rotation. The characteristic rotation rate of almost every such r-mode was detected, displaced systematically from its expected value by only 0.15%. If this probable detection is real, then most low harmonic r-modes have lifetimes exceeding one century and the rotation of the Sun's outer layers varies by less than 0.05%, except possibly at solar minimum.
Author
Oscillations; Sunspots; Solar Activity Effects; Solar Rotation

19990008038 NASA Marshall Space Flight Center, Huntsville, AL USA
Rendering Three-Dimensional Solar Coronal Structures
Gary, G. Allen, NASA Marshall Space Flight Center, USA; Solar Physics; 1997; ISSN 0038-0938; Volume 174, pp. 241-263; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An X-ray or EUV image of the corona or chromosphere is a 2D representation of an extended 3D complex for which a general inversion process is impossible. A specific model must be incorporated in order to understand the full 3D structure. We approach this problem by modeling a set of optically-thin 3D plasma flux tubes which we render these as synthetic images. The resulting images allow the interpretation of the X-ray/EUV observations to obtain information on (1) the 3D structure of X-ray images, i.e., the geometric structure of the flux tubes, and on (2) the internal structure using specific plasma characteristics, i.e., the physical structure of the flux tubes. The data-analysis technique uses magnetograms to characterize photospheric magnetic fields and

extrapolation techniques to form the field lines. Using a new set of software tools, we have generated 3D flux tube structures around these field lines and integrated the plasma emission along the line of sight to obtain a rendered image. A set of individual flux-tube images is selected by a non-negative least-squares technique to Provide a match with an observed X-ray image. The scheme minimizes the squares of the differences between the synthesized image and the observed image with a non-negative constraint on the coefficients of the brightness of the individual flux-tube loops. The derived images are used to determine the specific photospheric foot points and physical data, i.e., scaling laws for densities and loop lengths. The development has led to Computer efficient integration and display software that is compatible for comparison with observations (e.g., Yohkoh SXT data, NIXT, or EIT). This analysis is important in determining directly the magnetic field configuration, which provides the structure of coronal loops, and indirectly the electric currents or waves, which provide the energy for the heating of the plasma. We have used very simple assumptions (i.e., potential magnetic fields and isothermal corona) to provide an initial test of the techniques before complex models are introduced. We have separated the physical and geometric contributions of the emission for a set of flux tubes and concentrated, in this initial study, on the geometric contributions by making approximations to the physical contributions. The initial results are consistent with the scaling laws derived from Yohkoh SXT data.
Author
Solar Corona; Extreme Ultraviolet Radiation; X Rays; Chromosphere; Magnetic Flux; Plasma Radiation

19990008044 NASA Marshall Space Flight Center, Huntsville, AL USA
Ultraviolet Events Observed in Active Regions, 2, An Interpretation of Flaring Arches and Associated Small Flares
Fontenla, J., Fontenla (J.), USA; Rovira, M., Instituto de Astronomia y Fisica del Espacio, Argentina; Tandberg-Hanssen, E., NASA Marshall Space Flight Center, USA; Astronomical Journal; Dec. 20, 1997; Volume 491, pp. 925-932; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We analyze Hz, UV, and X-ray emissions in and around the spectacular arch system seen in the corona on 1980 March 27 during the Solar Maximum Mission. The flaring of the arch plasma is studied, and its dependence on triggering mechanisms related to the observed small limb flare in the arch footpoint is analyzed. to drive these events, we propose a mechanism in which small electric current circuits and the localized magnetic free energy are continuously generated at a magnetic null by a pressure gradient, which then compress or expand the plasma. This free energy dissipates by Joule effect and upward transport.
Author
Gamma Rays; Ultraviolet Radiation; X Rays; Plasmas (Physics); Solar Flares

19990008125 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Solar wind Acceleration from the Upper Chromosphere to the Corona in Coronal Hole Regions ***Final Report, 1 Jul. 1997 - 30 Jun. 1998***
Esser, Ruth, Smithsonian Astrophysical Observatory, USA; Nov. 1998; 8p; In English
Contract(s)/Grant(s): NAG5-6183; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The dynamic behavior of the plasma in the chromosphere/transition region /inner corona is vital for the acceleration of the solar wind. With new theoretical descriptions of the solar atmosphere and corona, and the increased observational possibilities provided by the SOHO spacecraft, it is possible to conduct an integrated study of the solar atmosphere and corona using observational and theoretical approaches. Over the past few years a series of observational techniques have been used to estimate the solar wind densities, temperatures and flow speed in the inner corona. These estimates suggest that the solar wind has higher outflow speeds in the inner corona and lower densities than previously assumed. A comparison with densities derived from atmospheric models support these lower densities.
Author
Chromosphere; Coronal Holes; Coronas; Plasmas (Physics); Solar Atmosphere; Solar Wind

19990008197 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Wide Band Decimetric Digital Spectroscope and Investigations of Solar Flares in Decimetric Band and X-Rays ***Espectrografo Digital Decimetrico de Banda Larga e Investigacoes de "Flares" Solares em Ondas Decimetricas e Raios-X***
Fernandes, Francisco Carlos Rocha, Instituto Nacional de Pesquisas Espacias, Brazil; Jun. 1997; 212p; In Portuguese
Report No.(s): INPE-6396-TDI/612; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Here we present the author's contribution in the development of the two phases of the Wide Band (200-2500 MHz) Digital (100 channels) Decimetric Spectroscope (WDDHRS) with high time (10-1000 ms) and frequency (3-10 MHz) resolutions and with high sensitivity (approximately 2 sfu), unique in the southern hemisphere, which is in regular operation since May 1996, at INPE in Sao Jose dos Campos. The WDDHRS has flexibility to choose the frequency range of the observations and resolutions. Patch-like emission showing a split in frequency was discovered for the first time. An emission mechanism based on the

coalescence between Langmuir waves excited by electron beams and ion-acoustic waves is suggested, which accounts for the observed properties of this type of emission. For the first time a statistical analysis of 102 decimetric type III solar bursts observed in the (1600 +/- 50/100) MHz range is presented. Observed properties suggested that the decimetric type III bursts are generated by beam plasma interaction at the second harmonic. In continuation of the analysis of the decimetric III burst, 160 individual type III bursts, the majority of which were observed above 1000 MHz, observed by the PHOENIX Radio Spectrometer, were also analysed in detail. The most important result is that 2/3 of the decimetric type III bursts showed reverse slope drift rate. Considering the average energy associated with the electron beam and assuming the beam loss energy mainly by collision with the ambient plasma, the height of the injection of the electron beam above the photosphere is determined. The YOHKOH satellite offers high spectral resolution and high energy solar X-ray bursts observations. Analysis of the 13 solar flares associated with radio emission also is presented for various aspects such as spectral analysis, ratio of low to high energy photons, imaging at various energies, and association with type III bursts. The time evolution of the spectral analysis showed that the typical trend is soft-hard-soft and in general the spectrum is best fitted by a double power law with a break in energy at approximately 100 keV. Higher energies are delayed in comparison with low energies. Impulsive acceleration/injection due to an electrical field explains most of the observed and estimated source parameters. The investigation of the association between the radio and X-rays showed that in two flares, at the beginning X-rays are better correlated with low frequency. However, during the time evolution of the flare X-rays are better correlated with higher frequencies, suggesting that the acceleration region travels downward towards the photosphere. In three flares it was observed that radio emissions occur before the peak of the X-rays confirming the hypothesis that decimetric emission is occurring near the acceleration

Author

X Ray Sources; Frequency Ranges; Broadband; Electric Fields; Imaging Techniques; Ion Acoustic Waves; Radio Emission; Spectral Resolution; Spectrum Analysis; Solar Radio Bursts; Statistical Analysis; X Rays

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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.

19990005058 New Hampshire Univ., Physics Dept., Durham, NH USA

Guest Investigator Studies with the Compton Gamma Ray Observatory ***Final Report***

Vestrand, W. T., New Hampshire Univ., USA; Sep. 22, 1998; 7p; In English

Contract(s)/Grant(s): NAG5-1561; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The cumulative all-sky survey by the Compton Gamma Ray Observatory (CGRO), composed of data acquired during the first three years of the mission, included a number of regions of very limited exposure. The most glaring deficiency in coverage was toward the region of the South Galactic Pole (SGP), which received significantly less exposure than other directions- by a factor of at least 2 to 3. Furthermore, nearly all of the SGP exposure was accumulated during the first year of the mission. Since blazars are known to be time-variable, and of unknown duty cycle, a pointing of the CCRO in that direction was considered highly desirable, and long overdue. In addition, data gathered from a pointing toward the SGP and its comparison with comprehensive data available for the North Galactic Pole would be extremely valuable to investigators studying the extragalactic diffuse emission. The reasons outlined above prompted our initiation of a Cycle 4 campaign to systematically search with EGRET and COMPTEL for gamma-ray emission from sources near the South Galactic Pole. The Cycle 4 SGP campaign consisted of tnvo 14-day observations separated in in time by approximately 10 months. The temporal separation of the observations was requested to allow a test for possible variations in the detected sources. Our primary targets were 38 FSRQs which lie within 30 degrees of the SGP, and which satisfy the basic criteria for candidate gamma-ray AGNs,flat-spectrum radio sources, many of which exhibit blazar-type properties). These targets were selected from the standard references, and from the available on-line databases (e.g., the NASA Extragalactic Database, NED), as the most promising AGN targets in the vicinity of the SGP. A 30 radius from the SGP was chosen as the boundary of our survey, since the selected targets would then fall within the most sensitive portion of the fields of view of EGRET and COMPTEL (i.e., within a 30 zenith angle), for a CGRO pointing directed exactly at the SGP. Our South Galactic Pole Survey yielded a number of exciting results. The EGRET data were analyzed using the maximum likelihood techniques to estimate the intensity, spectrum, and position of gamma-ray sources in the field of view. Our analysis revealed four sources at energies greater than 100 MeV with likelihood ratios corresponding to greater than 30 detections (Vestrand et al. 1996). One of the sources is associated with the well known gamma-ray blazar PKS 0208-512, but the other three were previously unknown. Among the new detections was PKS 2155-304 which is often considered a prototype of the x-ray selected BL Lacs. PKS 2155-304, which was also detected at hard x-ray energies by CGRO/OSSE, is one of the brightest BL Lac objects in the sky at optical through

x-ray energies and has a history of rapid, strong multiwavelength variability. As such, it has been the subject of intensive, contemporaneous, multiwavelength monitoring covering radio frequencies to x-ray energies.
Author
Active Galactic Nuclei; BL Lacertae Objects; Field of View; Gamma Ray Observatory; Gamma Ray Spectra; Gamma Ray Telescopes; Gamma Rays

19990005105 NASA Goddard Space Flight Center, Greenbelt, MD USA
Photodisintegration of Ultrahigh Energy Cosmic Rays: A New Determination
Stecker, F. W., NASA Goddard Space Flight Center, USA; Salamon, M. H., Utah Univ., USA; Sep. 23, 1998; 18p; In English
Report No.(s): NASA/TM-1998-208609; NAS 1.15:208609; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present the results of a new calculation of the photodisintegration of ultrahigh energy cosmic-ray (UHCR) nuclei in intergalactic space. The critical interactions for energy loss and photodisintegration of UHCR nuclei occur with photons of the 2.73 K cosmic background radiation (CBR) and with photons of the infrared background radiation (IBR). We have reexamined this problem making use of a new determination of the IBR based on empirical data, primarily from IRAS galaxies, consistent with direct measurements and upper limits from TeV gamma-ray observations. We have also improved the calculation by including the specific threshold energies for the various photodisintegration interactions in our Monte Carlo calculation. With the new smaller IBR flux, the steepness of the Wien side of the now relatively more important CBR makes their inclusion essential for more accurate results. Our results indicate a significant increase in the propagation time of UHCR nuclei of a given energy over previous results. We discuss the possible significance of this for UHCR origin theory.
Author
Background Radiation; Cosmic Rays; Gamma Rays; Infrared Radiation; Energy Dissipation

19990005981 Oxford Univ., Dept. of Physics, Astrophysics, Oxford, UK
An Outside-in Outburst of Aql X-1
Shahbaz, T., Oxford Univ., UK; Bandyopadhyay, R. M., Oxford Univ., UK; Charles, P. A., Oxford Univ., UK; Wagner, R. M., Ohio State Univ., USA; Muhli, P., Helsinki Univ., Finland; Hakala, P., Helsinki Univ., Finland; Casares, J., Instituto de Astrofisica de Canarias, Spain; Greenhill, J., Tasmania Univ., Australia; Jul. 09, 1998; 11p; In English
Contract(s)/Grant(s): PB-1995-1132-02-01
Report No.(s): OUAST/98/12; Copyright; Avail: Issuing Activity (Oxford Univ., Dept. of Physics, Astrophysics, Keble Road, Oxford, OX1 3RH, England), Hardcopy, Microfiche

We present optical spectroscopy and optical and infrared photometry of the neutron star soft X-ray transient Aql X-1 during its X-ray outburst of August 1997. by modelling the X-ray, optical, and IR light curves, we find a 3 day delay between the IR and X-ray rise times, analogous to the UV-optical delay seen in dwarf novae outbursts and black hole X-ray transients. We interpret this delay as the signature of an ”outside-in” outburst, in which a thermal instability in the outer disc propagates inward. This outburst is the first of this type definitively identified in a neutron star X-ray transient.
Author
Neutron Stars; Black Holes (Astronomy); Astronomical Photometry; Signatures; Thermal Instability; X Ray Optics; Infrared Photometry; Dwarf Novae

19990007781 Massachusetts Inst. of Tech., Dept. of Physics, Cambridge, MA USA
ROSAT Observations of a New X-ray Transient in the Small Magellanic Cloud
Clark, George W., Massachusetts Inst. of Tech., USA; Remillard, Ronald A., Massachusetts Inst. of Tech., USA; Woo, Jonathan W., Massachusetts Inst. of Tech., USA; Astrophysical Journal; Jan. 10, 1997; Volume 474, pp. L111-L114; In English
Contract(s)/Grant(s): NAG5-1656
Report No.(s): NASA/CR-1997-207812; NAS 1.26:207812; Copyright Waived (NASA); Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe ROSAT observations of a new X-ray transient and its probable optical companion in the Small Magellanic Cloud. The transient, designated RX J0117.6-7330, appeared at a position approximately 5 min southeast of the X-ray pulsar, SMC X-1, in 1992 October 1-2 PSPC observations centered on the pulsar. It was detected again in a similar observation 246 days later at a counting rate diminished by a factor of 270, which corresponds to an average epsilon-folding decay time of 44 days. No periodic pulsations have been detected. The average 1992 flux level would be produced by a source radiating isotropically with a

luminosity of 1.6 X 10(exp 37)(D/50 kpc)(exp 2) ergs/s in the energy range 0.2-2.5 keV. The 5 sec radius positional error circle includes the probable optical counterpart in the form of a magnitude V = 14.2 star with the spectral characteristics of type Be.
Author
Magellanic Clouds; X Rays; X Ray Binaries; ROSAT Mission; Luminosity; Cataclysmic Variables; Pulsars

19990008016 Colorado Univ., Joint Inst. for Lab. Astrophysics, Boulder, CO USA
Periodic X-Ray Emission from the O7 V Star Theta(sup 1) Orionis C
Gagne, Marc, Colorado Univ., USA; Caillault, Jean-Pierre, Georgia Univ., USA; Stauffer, John R., Harvard-Smithsonian Center for Astrophysics, USA; Linsky, Jeffrey L., Colorado Univ., USA; Astrophysical Journal; Apr. 01, 1997; ISSN 0004-637X; Volume 478, pp. L87-L90; In English
Contract(s)/Grant(s): NAG5-1610; NAG5-2075; NAGw-2698; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We report the discovery of large-amplitude, periodic X-ray emission from the O7 V star Theta(sup 1) Orionis C, the central star of the Orion Nebula. Ten ROSAT HRI snapshots of the Trapezium cluster taken over the course of 21 days show that the count rate of Theta(sup 1) Ori C varies from 0.26 to 0.41 counts/ s with a clear 15 day period. The soft X-ray variations have the same phase and period as H(alpha) and He II (lambda)4686 variations reported by Stahl et al. and are in antiphase with the C(sub iv) and Si(sub iv) ultraviolet absorption features. We consider five mechanisms which might explain the amplitude, phase, and periodicity of the X-ray variations: (1) colliding-wind emission with an unseen binary companion, (2) coronal emission from an unseen late-type pre-main-sequence star, (3) periodic density fluctuations, (4) absorption of magnetospheric X-rays in a corotating wind, and (5) magnetosphere eclipses. The ROSAT data rule out the first three scenarios but cannot rule out either of the latter two which require the presence of an extended magnetosphere, consistent with the suggestion of Stahl et al. that Theta(sup 1) Ori C is an oblique magnetic rotator. As such, Theta(sup 1) Ori C may be the best example of a high-mass analog to the chemically peculiar, magnetic Bp stars.
Author
X Rays; Emission; Orion Nebula; Magnetic Stars; B Stars

19990008248 Iowa Univ., Dept. of Physics and Astronomy, Iowa City, IA USA
Auroral Kilometric Radiation and the Auroral Electrojet Index for the January 1997 Magnetic Cloud Event
Kurth, W. S., Iowa Univ., USA; Murata, T., Ehime Univ., Japan; Lu, G., National Center for Atmospheric Research, USA; Gurnett, D. A., Iowa Univ., USA; Matusmoto, H., Kyoto Univ., Japan; Geophysical Research Letters; Aug. 01, 1998; ISSN 0094-8534; Volume 25, No. 15, pp. 3027-3030; In English; Original contains color illustrations
Report No.(s): Paper-98GL00404; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Auroral kilometric radiation (AKR) observations by Polar and Geotail are compared with the auroral electro jet index for the January 1997 magnetic cloud event. These two-spacecraft measurements are complementary in covering the AKR emission cones throughout the event and,together,reasonably represent the auroral electrojet AE index. We point out, however, limitations of both the AKR index and the AE index in providing truly global measurements of substorm activity.
Author
Auroral Electrojets; Geomagnetic Tail; Observation; Electromagnetic Measurement

19990008341 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Nature of the Optical "Jets" in the Spiral Galaxy NGC 1097
Wehrle, Ann E., Jet Propulsion Lab., California Inst. of Tech., USA; Keel, William C., Alabama Univ., USA; Jones, Dayton L., Jet Propulsion Lab., California Inst. of Tech., USA; Astronomical Journal; Jul. 1997; ISSN 0004-6256; Volume 114, No. 1, pp. 115-121, 422-425; In English
Contract(s)/Grant(s): NSF AST-85-09822; NSF AST-88-14544; NSF RII-86-10669; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present new observations of the jet features in the barred spiral galaxy NGC 1097, including optical spectroscopy of the brightest jet features, two-color optical imagery, new VLA mapping at 327 MHz, and archival 1.4 GHz VLA data reprocessed for improved sensitivity. No optical emission lines appear to an equivalent width limit of 15-30 A (depending on the line wavelength). The jets are uniformly blue, with B - V = 0.45 for the two well-observed jets R1 and R2. No radio emission from the jets is detected at either frequency; the 327-MHz data set particularly stringent limits on "fossil" emission from aging synchrotron electrons. The morphology of the jets is shown to be inconsistent with any conical distribution of emission enhanced by edge-brightening; their combination of transverse profile and relative narrowness cannot be reproduced with cone models. The optical colors, lack of radio emission, and morphology of the features lead us to conclude that they are tidal manifestations, perhaps produced by multiple encounters of the small elliptical companion NGC 1097A with the disk of NGC 1097. We present photometric

and morphological comparisons to the tail of NGC 465 1, which is similar in scale and morphology to the northeast ”dogleg” feature R1 in NGC 1097.
Author
Observation; Barred Galaxies; Optical Emission Spectroscopy; Color; Imagery

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GENERAL

19990008383 Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn, Germany
Information Technology Research Center ***Annual Report, 1995 - 1996***
May 1996; 77p; In German; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Only if one manages, in selected fields, to pursue long-term strategies to marshal resources, and to blend them into efficient partnerships can one achieve internationally leading positions in scientific, technological, and operational areas. This principle applies as basic requirement for programmed and specialized development of DLR in view of ever tighter finances. The following requirements from the area of space travel for the year covered by the report may serve as examples. DLR can claim a share of the success represented by the spectacular results of the Galileo Mission to the Planet Jupiter. DLR is the only non-American institution, together with 11 partner facilities in the USA of America and thus participates in the scientific analysis of the multispectral image data. DLR was able to secure a comparably central role in other international missions. DLR is contributing the two most important experiments for the mission to Mars, scheduled for the autumn of 1996 and under Russian project management, by supplying two high-resolution cameras.
Derived from text
Project Management; Information Systems; Galileo Project; Finance

Subject Term Index

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