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STAR

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Space Administration
Langley Research Center

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- 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.

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Subject Divisions

Document citations are grouped first by the following divisions. Select a division title to view the category-level Table of Contents.

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G. Mathematical and Computer Sciences
H. Physics
I. Social Sciences
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K. General

Indexes

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

Subject Term Index

Personal Author Index

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Subject Categories of the Division A. Aeronautics

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

01 Aeronautics (General) 1

02 Aerodynamics 3

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

03 Air Transportation and Safety 5

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

04 Aircraft Communications and Navigation 16

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 20

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 31

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 31

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 32

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) 34

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

Subject Categories of the Division B. Astronautics

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

12 Astronautics (General) 36

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

13 Astrodynamics 37

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

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

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

15 Launch Vehicles and Space Vehicles N.A.

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 37

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 N.A.

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 39

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 N.A.

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

20 Spacecraft Propulsion and Power 42

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

Subject Categories of the Division C. Chemistry and Materials

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

23 Chemistry and Materials (General) 44

24 Composite Materials 46

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

25 Inorganic and Physical Chemistry 51

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

26 Metallic Materials 53

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

27 Nonmetallic Materials 56

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 63

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 N.A.

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

Subject Categories of the Division D. Engineering

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

31 Engineering (General) 64

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

32 Communications and Radar 66

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 72

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 76

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 81

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 86

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

37 Mechanical Engineering 89

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

38 Quality Assurance and Reliability 90

Includes product sampling procedures and techniques; and quality control.

39 Structural Mechanics 93

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

Subject Categories of the Division E. Geosciences

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

42 Geosciences (General) 96

43 Earth Resources and Remote Sensing 103

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 106

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 107

Includes atmospheric, noise, thermal, and water pollution.

46 Geophysics 116

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

47 Meteorology and Climatology 118

Includes weather forecasting and modification.

48 Oceanography 122

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

Subject Categories of the Division F. Life Sciences

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

51 Life Sciences (General) 125

52 Aerospace Medicine 127

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

53 Behavioral Sciences 133

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

54 Man/System Technology and Life Support 134

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

55 Space Biology N.A.

Includes exobiology; planetary biology; and extraterrestrial life.

Subject Categories of the Division G. Mathematical and Computer Sciences

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

59 Mathematical and Computer Sciences (General) 137

60 Computer Operations and Hardware 140

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

61 Computer Programming and Software 140

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

62 Computer Systems 149

Includes computer networks and special application computer systems.

63 Cybernetics 152

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 154

Includes iteration, difference equations, and numerical approximation.

65 Statistics and Probability 156

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

66 Systems Analysis 157

Includes mathematical modeling; network analysis; and operations research.

67 Theoretical Mathematics N.A.

Includes topology and number theory.

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

70 Physics (General) 159

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 159

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

72 Atomic and Molecular Physics 161

Includes atomic structure, electron properties, and molecular spectra.

73 Nuclear and High-Energy Physics 173

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

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75 Plasma Physics 180

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

76 Solid-State Physics 194

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

77 Thermodynamics and Statistical Physics 198

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) N.A.

Includes educational matters.

81 Administration and Management 199

Includes management planning and research.

82 Documentation and Information Science 199

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

83 Economics and Cost Analysis N.A.

Includes cost effectiveness studies.

84 Law, Political Science and Space Policy 201

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

85 Urban Technology and Transportation N.A.

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) 201

89 Astronomy 202

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

90 Astrophysics N.A.

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 209

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

92 Solar Physics 231

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

93 Space Radiation 233

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 234

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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01
AERONAUTICS (GENERAL)

19990046095 Society of Experimental Test Pilots, Lancaster, CA USA
1997 Report to the Aerospace Profession: Forty First Symposium Proceedings
Forty First Symposium Proceedings; Sep. 1997; ISSN 0742-3705; 454p; In English; Report to the Aerospace Profession, 25-27 Sep. 1997, Beverly Hills, CA, USA; Sponsored by Society of Experimental Test Pilots, USA; See also 19990046096 through 19990046114; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The objectives of these proceedings contain the following: Promote air safety by presenting pilot's opinion; Strengthen the influence of the test pilot on aeronautical progress; Continuously evaluate the adequacy of flight equipment; Exchange information for the development of improved testing techniques; Exchange ideas, experiences, and information concerning techniques of escape and survival; Discuss newly experienced phenomena in the realm of flight; Further professional advancement through lectures and displays-, Stimulate interest in aviation careers through scholarships and other projects among the youth of the world; Broaden professional and fraternal relationships.
Author
Conferences; Aircraft Safety; Test Pilots; Survival

19990046200 NASA Langley Research Center, Hampton,VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 402
Jun. 11, 1999; 45p; In English
Report No.(s): NASA/SP-1999-7037/Suppl402; NAS 1.21:7037/Suppl402; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.
Author
Data Bases; Bibliographies; Indexes (Documentation); Aeronautical Engineering

19990046347 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Exploitation of Structural Loads/Health Data for Reduced Life Cycle Costs ***Exploitation des Donnees Relatives aux Efforts Structuraux et a l'Integrite des Structures en vue de la Diminution des Couts Globaux de Possession***
Exploitation of Structural Loads/Health Data for Reduced Life Cycle Costs; November 1998; 252p; In English, 11-12 May 1998, Brussels, Belgium; See also 19990046348 through 19990046366
Report No.(s): RTO-MP-7; AC/323(AVT)TP/4; ISBN 92-837-1005-3; Copyright Waived; Avail: CASI; A12, Hardcopy; A03, Microfiche

Contains the papers presented at a Specialists' Meeting on Exploitation of Structural Loads/Health Data for Reduced Life Cycle Costs, organized by the Applied Vehicle Technology Panel (AVT) of RTO, in Brussels, Belgium, 11-12 May 1998. The papers highlight the potential benefits from the exploitation of the information derived from modem and future monitoring systems in terms of improved airworthiness and preventative maintenance. The meeting concentrated on the collection, analysis and use of loads/health data by the military for fleet maintenance and logistics planning. Systems and techniques for data gathering and automated analysis were described by authors from a number of NATO nations to provide a valuable insight into how such systems contribute to reducing life cycle costs of military hardware. The papers are presented under the following headings: Current and future structural monitoring; Engine/helicopter hums; Current military/civil experience; Monitoring systems and analysis.
Author
Logistics; Loads (Forces); Life Cycle Costs; Health; Aircraft Reliability; Conferences; Maintenance

19990046348 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany

Requirements on Future Structural Health Monitoring Systems

Neumair, M., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Exploitation of Structural Loads/Health Data for Reduced Life Cycle Costs; November 1998; 10p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Due to the higher structural complexity of combat aircraft the time and costs for inspections and modifications are increasing. For economic and operational reasons, it is more and more important to carry through a modern aircraft maintenance and life extension program, which directly depends on the individual in service usage of combat aircraft. As a result of the rapid progress in the development and production of new powerful data acquisition units, the use of complex onboard structural health monitoring systems for each individual aircraft, which directly monitors the point of time for inspections and modifications for life extension programs, is the future of economic maintenance. This paper provides an overview of the experiences with previous and existing in-service life monitoring systems, i.e. the OLMOS system of TORNADO. Based on this experience the hard- and software requirements for a new in-service structural health monitoring system, which is necessary for an economic usage of combat aircraft, will be discussed within the scope of the actual technical and operational limits. Due to such complex structural health monitoring systems, rearrangements are necessary in planning and carrying out depot maintenance. This paper will point out some important alterations.

Author

Service Life; Health; Monitors; Complex Systems; Costs; Inspection

19990046349 Royal Air Force, Wyton, UK

Future Fatigue Monitoring Systems

Armitage, Steve R., Royal Air Force, UK; Holford, Dorothy M., Defence Evaluation Research Agency, UK; November 1998; 14p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The RAF, in common with most of today's air forces, operates a wide range of aircraft, of varying sizes, roles and ages. At the one extreme, the Canberra fleet is now 50 years old and still providing sterling service in the photo-recce role. At the other extreme, Harrier II has been in service for 10 years, and has proven itself to be a highly capable ground-attack fighter. Moreover, EF2000, Nimrod 2000 and C-130J are all due to enter service within the next 5 years or so. The operation of all of our fleets has been underpinned by the close monitoring of fatigue, the aims of which have been to improve the management of structural integrity and to ensure that we can safely operate our aircraft up to their design lives. Despite advances in aircraft technology, our fatigue monitoring effort continues to rely upon some relatively aged equipment, with correspondingly aged analysis techniques. In recent years, advances in IT and data processing have revolutionized the aircraft designer's ability to install onboard sensors and systems, and the software designer's ability to generate compact and rapid airborne and ground-based processing equipment. The RAF is now looking closely at the procurement of state-of-the-art fatigue monitoring and processing equipment, and the formulation of a strategy by which such equipment can be adapted for use across as many fleets as require it. This paper will review the RAF's current fatigue monitoring effort and the emerging systems, with particular reference to Harrier Il's Fatigue Monitoring and Computing System (FMCS) and EF2000's Structural Health Monitoring (SHM) system. Finally, future system requirements and options will be Although the paper's emphasis is firmly upon fixed-wing aircraft systems, some consideration will be given to emerging helicopter Fatigue Usage Monitoring Systems (FUMS). FUMS is a development of Health and Usage Monitoring Systems (HUMS), currently being introduced into MOD service.

Author

Airborne Equipment; Health; Structural Failure; Computer Systems Programs; Fatigue Life; Monitors

19990046351 National Defence Headquarters, Directorate Technical Airworthiness, Ottawa, Ontario Canada

CF-188 Fatigue Life Management Program

Caron, Y., National Defence Headquarters, Canada; Richard, Yves, Bombardier, Inc., Canada; November 1998; 12p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Canadian CF-188 Fatigue Life Management Program (FLMP) has been in place for over 10 years. This program has been successful in controlling fatigue accumulation on the CF-188 airframe. This had a major impact on the life cycle management cost of the aircraft. The solutions to the challenges encountered operating this program will be discussed. Lessons learned are summarized.

Author

Fatigue Life; Airframes; Management Planning

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.

19990045849 European Organization for the Safety of Air Navigation, Bretigny-sur-Orge France
User Manual for the Base of Aircraft Data (BADA). Revision 3.1
Baulleret, P.; Nov. 1998; 108p; In English
Report No.(s): PB99-136178; EEC/NOTE-25/98; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The Base of Aircraft Data (BADA) provides a set of ASCII files containing performance and operating procedure coefficients for 151 different aircraft types. The coefficients include those used to calculate thrust, drag, and fuel low and those used to specify nominal cruise, climb and descent speeds. The Manual for Revision 3.1 of BADA provides definitions of each of the coefficients and then explains the file formats. Instructions for remotely accessing the files via Internet are also given.
NTIS
Aircraft Models; User Manuals (Computer Programs); Real Time Operation; Flight Operations; Aircraft Performance; Data Bases

19990045850 European Organization for the Safety of Air Navigation, Bretigny-sur-Orge France
Study of the Acquisition of Data from Aircraft Operations to Aid Trajectory Prediction Calculation
Mykoniatis, G.; Martin, P.; Sep. 1998; 112p
Report No.(s): PB99-136152; EEC/NOTE-18/98; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Several aircraft operators were consulted to determine if they could supply flight data to ATS which would make a significant difference to the trajectories calculated by flight data processing systems, particularly in the initial climb phase. In parallel, simulations were carried out using a typical trajectory prediction simulator to assess the benefits which might be obtained from this data. The study then went on to investigate when and how this data could by supplied.
NTIS
Data Acquisition; Flight Operations; Data Processing; Trajectory Planning

19990045881 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Survey on the Aerodynamics of Battle-Damaged Combat Aircraft
Erm, Lincoln P., Defence Science and Technology Organisation, Australia; June 1998; 11p; In English; Original contains color illustrations
Report No.(s): DSTO-GD-0184; DODA-AR-010-563; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

A literature survey on the aerodynamics of battle-damaged combat aircraft is presented in this report. The survey considers experimental investigations carried out in wind tunnels using either scaled or full-sized models of complete aircraft or components of aircraft that have either simulated damage or actual gunfire damage. The survey could assist in the planning of a possible experimental program at AMRL to obtain aerodynamic data for battle-damaged aircraft. The data could be used in modelling the flight-dynamic behaviour of damaged aircraft.
Author
Aerodynamics; Damage; Fighter Aircraft; Experimentation; Surveys

19990045972 DYNACS Engineering Co., Inc., Brook Park, OH USA
Highlights of Aeroacoustics Research in the U.S. 1998
Raman, Ganesh, DYNACS Engineering Co., Inc., USA; McLaughlin, Dennis K., Pennsylvania State Univ., USA; March 1999; 20p; In English; Aeroacoustics, 10-12 May 1999, Seattle, WA, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS3-98008; RTOP 530-03-11
Report No.(s): NASA/CR-1999-208888; NAS 1.26:208888; E-11632; AIAA Paper 99-1915; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Highlights of aeroacoustics research in the USA of America during 1998 are reported in a summary compiled from information provided by members of the Aeroacoustics Technical Committee of the American Institute of Aeronautics and Astronautics (AIAA) and other leading research groups in industry, national laboratories, and academia. The past few years have seen significant progress in aeroacoustics. Research has steadily progressed toward enhanced safety, noise benefits, and lower costs. Since industrial progress is generally not published in the archival literature, it is particularly important to highlight these accomplish-

ments. This year we chose to report on five topics of great interest to the aerospace industry including a synopsis of fundamental research at universities and national laboratories. The topics chosen are: (1) Advanced Subsonic Technology (AST), (2) High Speed Research (HSR), (3) Rotorcraft, (4) Weapons bay aeroacoustics control and (5) Academic research including Computational AeroAcoustics (CAA). Although the information presented in this review is not all encompassing we hope that the topics covered will provide some insights into aeroacoustics activity in the U.S.
Author
Research; Aeroacoustics; Subsonic Speed; Rotary Wing Aircraft; Progress

19990046091 National Aerospace Lab., Tokyo Japan
Releasing, Approach and Landing Results of the ALFLEX First Landing Trial
May 1998; 42p; In English
Report No.(s): PB99-141491; NAL-TR-1352T; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
The flight experiment of the ALFLEX (Automatic Landing Flight Experiment) vehicle, a scaled model of HOPE, was conducted to establish unmanned guidance, navigation and control technologies for automatic landing of HOPE. The first landing of the ALFLEX vehicle was made on July 6, 1996 followed by 12 more landings until August 15, 1996. This first landing was achieved after a series of hanging flight trials with a helicopter that confirmed the vehicle functions and calibrated the sensors. Also, prior to these flight tests in Australia, hanging flights had been repeated in Japan as preliminary tests. to provide examples of the experiences and lessons from the unmanned landing tests, this report summarizes the detailed procedures, results and problems with the first landing trial, which has yielded useful results.
NTIS
Flight Tests; Approach Control; Automatic Landing Control; Approach; Helicopters

19990046425 Naval Postgraduate School, Monterey, CA USA
Stability and Control Module for Joint Army/Navy Rotorcraft Analysis and Design (JANRAD) Software and Graphical User Interface (GUI)
Heatborn, David A.; Mar. 1999; 268p; In English
Report No.(s): AD-A361823; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche
The Joint Army/Navy Rotorcraft Analysis and Design (JANRAD) computer program has been developed at the Naval Postgraduate School to aid in the preliminary design of rotorcraft and has been updated to include a Graphical User Interface (Gul). This thesis is a continuation of the program focusing on stability and control analysis. The trim solution for a specified flight condition is computed from the Performance module of the program. This trim solution is then used to compute stability derivatives for the specified flight condition and a linear state space model is created. This solution can then be used to perform various time and frequency domain analyses or can be saved to a file for future use.
DTIC
Flight Control; Aerodynamic Stability; Graphical User Interface; Aircraft Design; Flight Conditions

19990046426 Naval Postgraduate School, Monterey, CA USA
Modeling the Coupled Rotor/Fuselage Response of the H-3 Sea King Utilizing the NPS Full Nonlinear Response
Rafanello, Salvatore P.; Mar. 1999; 93p; In English
Report No.(s): AD-A361824; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Adapting the Naval Postgraduate School full nonlinear simulation model of coupled rotor/fuselage response to the 11-3 Sea King, the concentration of this work rests on validating the rotor simulation against an actual rotorcraft. The parameters of the 11-3 from the characteristic equation of a modeled mass-spring- damper system are inputted into a five-bladed model initially utilizing MAPLE to process LaGrange's equation defining the helicopter's full set of nonlinear equations of motion. Results are converted to MATLAB and are then processed in SIMULINK returning time history plots of blade/fuselage motion. Conclusions are in accordance with literature of Coleman, Fein old and Deutsch.
DTIC
Computerized Simulation; Fuselages; Rotary Wing Aircraft; Eigenvectors; Rotary Wings

19990046427 Naval Surface Warfare Center, Dahlgren Div., Dahlgren, VA USA
A Simplified Method for Predicting Aerodynamics of Multi-Fin Weapons ***Final Report***
Moore, Frank G.; McInville, Roy M.; Robinson, David I.; Mar. 1999; 78p; In English
Report No.(s): AD-A361829; NSWCDD/TR-99/19; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A new semiempirical method was developed to compute aerodynamics of multi-fin missile configurations using cruciform missile aerodynamics as a baseline. The method was developed using full Euler Computational Fluid Dynamics codes to compare computations with wind tunnel data bases for cruciform missiles as a function of Mach number, angle of attack, and aspect ratio. The Euler codes were then used for the same free stream conditions and missile configurations except the number of fins were increased from four to six and eight respectively. A table of coefficients was then formed for the aerodynamics of six- and eight-fin configurations compared to that of four-fin cases for use in the aeroprediction code or other semiempirical codes. It was concluded that this approach worked well except for subsonic Mach numbers at moderate to large angles of attack, where the Euler codes failed to predict the leeward plane flow field adequately. It is believed that full Navier-Stokes solutions could be used to improve upon this semiempirical model. Engineering judgement, in conjunction with low angle-of-attack Euler solutions were used in the regions where Euler solutions were suspect. In comparing the new semiempirical method to a limited amount of wind tunnel data on several configurations, it was concluded that the model worked well at all the conditions where data was available. However, additional wind tunnel data at higher angles of attack on six- and eight-fin configurations is needed before the method can be truly validated.
DTIC
Aerodynamic Configurations; Missile Configurations; Aerodynamic Characteristics

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.

19990045788 Royal Aeronautical Society, London, UK
Rotorcraft Flight Safety: Proceedings
1998; In English; Rotorcraft Flight Safety, 3 Nov. 1998, London, UK; See also 19990045789 through 19990045795; ISBN 1-85768-079-0; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The underlying theme of today's conference is what we can do to improve Rotorcraft flight safety in the future. It is interesting to note that, on the operational side, we have speakers on Public Transport operations in the very hostile areas of the emergency services sector and the military. On the airworthiness side we'll learn of the regulation and management of airworthiness and of safety assessments. The increasingly important topic of Human factors will be covered by my colleagues from the Safety Regulation Group (SRG), and, finally, two other eminent speakers in the fields of rotorcraft handling qualities and human engineering will conclude.
Derived from text
Aircraft Reliability; Conferences; Flight Safety; Human Factors Engineering; Rotary Wing Aircraft; Helicopter Performance

19990045789 Shell Aircraft Ltd., London, UK
A Customer Perspective on Helicopter Safety in North Sea Operations
Clark, Eric, Shell Aircraft Ltd., UK; 1998; In English; See also 19990045788
Report No.(s): Paper-1; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The UK CAA records a steady improvement over the past ten years in the overall accident rate fore helicopters in offshore operations, although this has levelled off in the past 2 years, and may have achieved the plateau in safety which is currently worrying the airline industry. One of our concerns as a customer is that the helicopter industry is not necessarily learning from the airlines at a time when the baseline accident rate for the airline industry is generally at least an order better than that of helicopters. The paper highlights the need to set safety, both strategic and localized, and to focus efforts on developing a coherent program to meet these targets. This requires a deeper understanding of causal factors of accidents and, in particular, how human error contributes; it also requires the use of techniques, such as flight data analysis, from other parts oft eh industry and a willingness to share knowledge to a greater than at present. However, any breakthrough in safety performance must be sustained by a systematic approach to the management of safety, supported by a hazard analysis and risk assessment appropriate to each operation. This should eventually become part of the culture to achieve continuous improvement in safety performance.
Author
Flight Training; Helicopters; North Sea; Civil Aviation; Flight Safety; Aircraft Safety; Aircraft Hazards; Risk; Aircraft Reliability

19990045790 Ministry of Defence, Airworthiness Design Requirements and Procedures, Bristol, UK

The Regulation and Management of Airworthiness by MoD

Dallimore, Colin, Ministry of Defence, UK; Rotorcraft Flight Safety: Proceedings; 1998; In English; See also 19990045788

Report No.(s): Paper-4; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper reviews the means by which the airworthiness of military aircraft is regulated and managed by the UK Ministry of Defense (MOD). Following a summary of the legal environment within which MOD operates the MOD airworthiness organization is introduced along with the basic principles used to establish and maintain the required standard of air worthiness. The process by which safety management initiatives are taken forward is addressed and future development identified.

Author

Aircraft Reliability; Safety Management; Military Aircraft; Aircraft Survivability

19990045791 Westland Helicopters Ltd., System Safety Engineering, Yeovil, UK

A Contractor Perspective on Helicopter Airworthiness and Safety Analysis Developments

Allen, Roger J., Westland Helicopters Ltd., UK; 1998; In English; See also 19990045788

Report No.(s): Paper-5; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Today's approach to aircraft safety within GKN Westland Helicopters (GKN WHL) reflects the rigorous demands made by today's operator and society in general. The paper begins by suggesting that the number of rotorcraft accidents should not increase in similar manner to that pessimistically predicted for airliners. The background to GKN WHL's airworthiness effort is described by taking the wider view of the design process and contributory disciplines. The paper goes on to describe some of the initiatives which will help to shape the operational side of aircraft safety. GKN WHL's experience with formal safety analysis is discussed, noting the use of a new concept to assess the aircraft as a complete entity. The benefits of safety analysis and some further observations based on experience are included. Finally the paper looks ahead to what the future holds with regard to helicopter safety initiatives.

Author

Aircraft Reliability; Aircraft Safety; Helicopters; Safety Management; Structural Reliability; Helicopter Performance; Quality Control

19990045794 Defence Evaluation Research Agency, Flight Management and Control Dept., Bedford, UK

Controlling Tension Between Performance and Safety in Helicopter Operations: The Contribution of Handling Qualities to Flight Safety

Padfield, Gareth D., Defence Evaluation Research Agency, UK; Rotorcraft Flight Safety: Proceedings; 1998; In English; Rotorcraft, Sep. 1998, Marseilles, France; See also 19990045788

Report No.(s): Paper-8; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

As twin goals in the design and operation of aircraft, performance and safety often struggle together for prominence. This struggle creates a tension that runs throughout the design, development and qualification process. The tension is felt most when missions are stressed, in the sense of being at the extremes of the requirements; for example, operations into degraded visual conditions in poor weather or when the degree of urgency increases, in emergency maneuvers or when the pilot is required to divide attention between flying and other mission duties. Two important contributions assist the pilot in managing this tension. First, designs which confer the aircraft with sufficiently good handling characteristics, such that even in emergency conditions, the attentional demands of control workload are acceptable. Second, providing sufficient spatial awareness relative to the surrounding airspace and surface/obstacle layout that the pilot is able to maintain an adequate safety margin. In this paper, mission oriented flying qualities engineering is described within the system framework of Aeronautical Design Standard-33 (ADS-33), utilizing concepts like the mission task element, usable cue environment, and dynamic response criteria. The paper argues that the requirements for what constitutes safe and easy, Level 1 flying qualities now exist and are well substantiated. New flying qualities now exist and safety standards, and existing aircraft can be upgrade with integrated flight management systems featuring advanced control/flying management technologies. Good flying qualities provide critical support to the pilot in the management of the performance-safety tension. This paper will examine this tension in more detail, drawing on results of probabilistic analysis of the impact of flying qualities on flight safety.

Author

Aircraft Performance; Flight Management Systems; Flight Safety; Helicopters; Safety; Pilot Performance

19990045795 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK

Safety Related Technology at the Man/Machine Interface

Rood, G. M., Defence Evaluation Research Agency, UK; 1998; In English; See also 19990045788

Report No.(s): Paper-9; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

As with their fixed wing counterparts, the technology of avionic and other systems in helicopters is increasing in complexity, and this increase generally results in the aircfre2w being provided with increasing amounts of data - not necessarily in the right information format for easy digestion. The pilot is often flying in poor weather that may be marginal for the aircraft safety limits and has to take this data, process to get a form that is relevant and interact with the displays which s/he will need to ensure the the correct inputs are entered at the right time and quickly enough, to get the operationally relevant information out. It is most unlikely, that the helicopter avionics, navigation or other systems will become less complex and with this increasing complexity and number of systems generally comes the need to process more outputs and ensure that the entry of a greater number of inputs is both timel;y and correct, and the additional time required to carry out these tasks is not always available. This is so certainly for military helicopters, and will be increasingly so for civil systems as the military technologies and systems are transferred to the civil market.

Author

Aircraft Safety; Avionics; Display Devices; Man Machine Systems; Helicopter Control; Helicopter Design; Helicopters; Helicopter Performance

19990045796 Nebraska Univ., Aviation Inst., Omaha, NE USA

The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society, Volume 1

Oum, Tae Hoon, Editor, British Columbia Univ., Canada; Bowen, Brent D., Editor, Nebraska Univ., USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; 352p; In English; Triennial World Conference on Transportation Research, 12-17 Jul. 1998, Antwerp, Belgium; Sponsored by World Conference on Transportation Research Society, Unknown; See also 19990045797 through 19990045815; Sponsored in part by the NASA Nebraska Space Grant Consortium and the NASA National Space Grant College and Fellowship Program

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

Report No.(s): UNOAI-98-6; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

This report (Volume 1) is comprised of 5 sessions of the Air Transport Research Group (ATRG) Conference held in Antwerp, Belgium, July 1998. The sessions contain 3-4 papers (presentations) each. The session numbers and their respective headings are: (1) Airline alliances; (2) Airline Competition and Market Structure; (4) Liberalization, Open Skies, and Policy Issues; (5) Yield Management and Other Models; and (11) Air Traffic Control (ATC) and Air Navigational Systems (ANS).

Author

Conferences; Air Transportation; Airline Operations; Air Traffic; Aeronautics; Aircraft Safety

19990045797 City Univ. of Hong Kong, Dept. of Economics and Finance, Kowloon, Hong Kong

Strategic Airline Alliances: Complementary Versus Parallel Alliances

Park, Jong-Hun, City Univ. of Hong Kong, Hong Kong; Zhang, Anming, City Univ. of Hong Kong, Hong Kong; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 33p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Strategic alliances have occurred in a broad spectrum of industries including the airline industry. This paper presents a model that examines the effects on market outcome and welfare of two types of strategic alliances: complementary vs parallel alliances. It is identified that the two alliances have different effects on total output and consumer surplus. The complementary alliance is likely to increase total output, while the parallel alliance is likely to decrease it. We find sufficient conditions under which each type of alliance improves total welfare. The empirical test results from the trans-Atlantic alliance routes for the 1990-1994 period, confirm the theoretical predictions on partners' outputs and total output.

Author

Airline Operations; Routes; Cost Reduction; Air Transportation; Mathematical Models; Market Research

19990045798 Sydney Univ., Inst. of Transport Studies, Australia

Strategic Alliances Among International Airlines and Their Implications for Organisational Changes

Brewer, Ann, Sydney Univ., Australia; Hooper, Paul, Sydney Univ., Australia; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 13p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Globalization has resulted in international trade progressing beyond the stage where national firms specialize in finished products. Specialization now occurs in the production of components and the modern trading enterprise engages in global sourcing. Improvements in communications and transport have made this possible, but competition, rising customer expectations and the need to expand markets beyond national boundaries leave many businesses with no alternatives but to ”go global”. Against this background, researchers have paid increasing attention to the attempts in the airline industry to globalize. While it is true that the larger international carriers compete simultaneously in several inter-continental markets, restriction on foreign investment and commercial operating rights generally deny airlines the opportunity to become global businesses in their own rights. Airlines do not have free access to markets, nor do they have the freedom to invest and operate wherever they want. The principles of comparative advantage do not prevail in the trade in airline services and consequently, airlines are prevented from developing efficient global networks. Alliances allow airlines to circumvent restrictions on market access while simultaneously permitting them to co-ordinate schedules, and to pursue other practices designed to reduce cost and improve customer service. The strategic alliance has become the key instrument for global expansion.
Derived from text
Airline Operations; Competition; Cost Reduction; Economics; Market Research

19990045799 George Mason Univ., Inst. of Public Policy, Fairfax, VA USA
Aviation Safety and the Increase in Inter-Airline Operating Agreements
Button, Kenneth, George Mason Univ., USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 20p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Aviation is becoming increasingly internationalized not only because international traffic is itself growing rapidly but also because airlines are themselves beginning to lose their national identity as cross-equity holdings expand and as airline alliances grow in number. These changes affect the commercial and the regulatory environment in which aviation services are provided but they also have potential implications for air transport safety. Although air transport safety is often treated as a part of public policy it is also influenced by the commercial interests of the airlines themselves. While there has been a recognition of the need for a public policy response to the new world of globalization and strategic alliances that are now part of the air transport market, this policy response needs to be made in the context of changing private incentives affecting airlines own attitudes to safety. This paper focuses on the changes in private incentives that the growth in airline alliances in particular may have on safety.
Author
Air Transportation; Aircraft Safety; Airline Operations; Commercial Aircraft; Flight Safety; Policies

19990045800 Alberta Univ., Dept. of Economics, Edmonton, Alberta Canada
Schedule Competition, Fare Competition and Predation in a Duopoly Airline Market
Lindsey, Robin, Alberta Univ., Canada; Tomaszewska, Ewa, Alberta Univ., Canada; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 18p; In English; See also 19990045796 Report No.(s): Paper-92-Rev; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Since deregulation of the U.S. airline market, airline competition has been the subject of intensive research. Interest has been sustained by the ongoing evolution of the U.S. market, deregulation in Canada, and the evolutionary process of deregulation underway in Europe. Competition between airlines occurs in various dimensions, including fares, capacity, flight schedules, frequent flier programs, computer reservations systems, code-sharing agreements and alliances. This paper focuses on competition in fares and flight schedules. Fare competition has been the subject of many studies in the literature. The importance of schedule frequency has also been recognized. The timing of flights is clearly another important factor determining the attractiveness of an airline because of traveler’s preferences for when they depart and/or arrive. Another focus of this paper is predation in airline markets.
Derived from text
Airline Operations; Competition; Schedules; Cost Reduction; Operating Costs; Operational Problems; Market Research

19990045801 Maison Rhone-Alpes des Sciences de l’Homme, Lab. d’Economie des Transports, Lyon, France
A Model of Air Transport Duopoly in Price and Service Quality
Molin, Benedicte, Maison Rhone-Alpes des Sciences de l’Homme, France; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 12p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The liberalization process of the air transport industry in Europe, which officially ended in April 1977, echoes the American Air Deregulation Act (ADA) that was passed some twenty years earlier, in 1978. Quite logically the european observers try to

infer from the American experience what the evolution of the industry can be on their own continent. In particular, one of the most spectacular consequences, of the ADA was the continent-wide development of hub-and-spoke systems, in which all passengers, whatever their origins and destinations are channeled to a hub airport, where they find convenient intraline connections to reach their final destination. Such networks were initially developed by the major air carriers to minimize their operating costs (owing to the flow consolidation on the spokes); hubbing also gave them the opportunity to monopolize the hub airport's resources by the concentration of incoming and outgoing flights on a short time span and is therefore an interesting tool to lower the contestability of the hub markets. Although the American experience has been extensively analyzed, very little can be learned to forecast the future of the European flag carriers' networks. In this purpose a two stage duopoly model is proposed in this paper, which considers both prices and network patterns as endogenous variables. This model structure is suggested by the American experience - that made it clear that a carrier's network can act as a strategic tool just like other more classic devices, such as marketing or prices - and by the industry practices themselves: the two-period structure is meant to more or less reproduce the fact that at every season for the next one the carriers choose the slots they will need at the airports they want to serve, publish their timetables, while their prices generally keep on varying until the last ticket is sold. The paper is organized as follows : section I presents the model, which is then solved in section II; the emperical test of the model is conducted in section III on American data.
Author
Air Transportation; Europe; Airline Operations; Mathematical Models; Market Research; Operating Costs; Networks; Services

19990045802 Vrije Univ., Tinbergen Inst., Amsterdam, Netherlands
Frequency Equilibria and External Costs in Duopoly Airline Markets
Schipper, Youdi, Vrije Univ., Netherlands; Nijkamp, Peter, Vrije Univ., Netherlands; Rietveld, Piet, Vrije Univ., Netherlands; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 22p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

As a result of the strong growth of air transport over the past decades, the external costs of aviation have become an important concern in public policy. In order to analyze the problem of externalities and formulate policy responses, one needs to know how decisions made in airline markets affect other sectors of the economy. It can be argued that in many transport markets, frequency of service is one of the main factors determining the external cost total in a market. In airline markets, for example, the size of externalities as noise and emission of pollutants depends largely on the number of landings and take-offs. On the other hand, frequency of service is also a measure of quality in transport and as such affects consumer welfare. In order to analyze these conflicting effects on welfare, the paper models frequency equilibria in duopoly air transport markets.
Derived from text
Market Research; Air Transportation; Airline Operations; Costs; Mathematical Models; Computerized Simulation; Demand (Economics)

19990045803 Monash Univ., Dept. of Economics, Clayton, Australia
The Use of Market Power in International Aviation and Tourism
Forsyth, Peter J., Monash Univ., Australia; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 22p; In English; See also 19990045796
Report No.(s): Paper-1225; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In order to make international trips, visitors must use some form of transport, such as aviation. Countries possess a degree of market power over tourism within their borders, and they often seek to use this. This market power also transfers over to aviation; they control air routes jointly with their trading partners, and they often restrict supply, sometimes with the intention of generating profits. However, they must share traffic and profits with their partners. Governments also levy taxes on tourism, but these affect domestic toursist and residents. A model is developed which combines all these features. It is possible to use it to characterize the best possible combination of aviation and tourism policies from the perspective of an individual country. A country typically does not have full control over aviation policies, and this can be allowed for. What is desirable from the perspective of an individual country is not desirable from a world perspective. In tourism, and to a lesser extent, countries are able to levy optimum tariffs, which benefit themselves but lessen overall world welfare. There is evidence that countries are becoming more aware of their market power as international aviation becomes increasingly liberalized, countries are imposing more taxes on tourism.
Author
Governments; Policies; Airline Operations; Air Transportation; Tourism; Mathematical Models; Operations Research

19990045804 Texas A&M Univ., Dept. of Management, College Station, TX USA

A Preliminary Assessment of the 1995 Canada-US Transborder Air Services Agreement

Pustay, Michael W., Texas A&M Univ., USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 14p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

While trade in most goods and services between the USA and Canada is generally open, such was not the case for transborder airline services for most of the post-war period. Indeed, for almost three decades the accord governing Canada-U.S. airline service was among the most restrictive of all such pacts entered into by the USA. At the 1985 Shamrock Summit, Prime Minister Mulroney and President Reagan recognized the inappropriateness of that state of affairs and that promotion of transborder air travel should be encouraged. Yet it took the two nations a decade to remedy the problem; only in February 1995 did they sign a new air services agreement (ASA) that significantly liberalized trade in airline services between them. The purpose of this paper is to explore the impact of the February 1995 ASA on the market for transborder airline services. The issue is of particular importance because past regulatory policies have affected the ability of individual carriers to benefit from the new ASA. As a result, the likelihood that competition in certain markets could be hindered is a real concern. to assess these effects, the paper begins by reviewing the domestic, international and transborder aviation policies of the two countries. After discussing the provisions of the new ASA, it then examines its impact on competition and concentration in the transborder air services market.

Derived from text

Air Transportation; Airline Operations; Policies; International Relations

19990045805 British Columbia Univ., Faculty of Commerce and Business Administration, Vancouver, British Columbia Canada

An Analysis of Profitability of the World's Major Airlines

Oum, Tae Hoon, British Columbia Univ., Canada; Yu, Chun-Yan, British Columbia Univ., Canada; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 20p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Airline profitability depends on airlines' cost competitiveness and their ability to price above costs, the ability to set prices above cost depends on market power and the firm's ability to make use of innovative pricing techniques and market information. In the past, some carriers have been profitable without being cost competitive because they were able to charge exorbitant prices to consumers. Increased competition in the international air transport markets have put pressures on carrier's ability to raise prices. At the same time, input prices have been increasing continuously. to counter-act such trends, airlines have made tremendous efforts to improve efficiency and productivity in order to cut costs. Using a yearly panel of 22 major airlines over the 1986-95 period, this paper examines airlines' profitability changes by examining changes in productivity and their ability to price above cost. The study found that European and Asian carriers consistently improved productivity throughout the period even during the time of rising profitability, achieving higher productivity growth than North American carriers. However, European and Asian carriers experienced much faster decline under the pressures of increased competition. Overall, airline profitability have improved during the 1990s.

Author

Air Transportation; Airline Operations; Competition; Mathematical Models

19990045806 University of Southern Illinois, Carbondale, IL USA

Airlines, Governments and the Distribution of Air Travel Services in a Changing Global Economy

Tarry, Scott E., University of Southern Illinois, USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 22p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper is distilled from a more comprehensive project on the implications of globalization and liberalization in air transport. It is organized to give the reader with some background in the political economy of the air transport industry, but perhaps a limited knowledge of the concept of globalization, a sufficient foundation of knowledge to make sense of the analysis and arguments about the current trends and probable future of the industry. Thus, after an initial discussion of the concept of globalization, the second section of the paper briefly outlines the history of the international air transport industry. The third section discusses the American roots of current international liberalization efforts and the particular role that American airlines play in the political and economic transformation of this industry. This discussion is followed by an update of the industry, which is changing quickly, and, in some cases, quite dramatically. The final two sections offer some analysis and conclusions about the ramifications of the current trends in liberalization of the air transport industry with special attention on the impact of these trends on policy making and economic growth and development in both the industrialized and developing worlds. Two cases, one focusing narrowly on

St. Louis, an American city and the other focusing broadly on Africa, help bring the theoretical and abstract discussion into the real world of policy making and commerce.
Derived from text
Air Transportation; Airline Operations; Civil Aviation; Economics; Governments; Policies; International Cooperation

19990045807 Kobe Univ., Dept. of Civil Engineering, Japan
Domestic Aviation Network Analysis and Aviation Policy Scenario
Kuroda, Katsuhiko, Kobe Univ., Japan; Takebayashi, Mikio, Kobe Univ., Japan; Hirai, Kazuto, Kobe Univ., Japan; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 16p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The recent tendency of globalization and /or internationalization stimulates the air-demand more and more. In Japan, 66.9 million passengers used domestic flights in 1995. About 56.4 million passengers, 81% of domestic air passengers, used either Tokyo International Airport (henceforth called as TKY) or Osaka International Airport (henceforth called as OSA) or both. Only 19% of domestic air passengers used other local flights. The flight number of both airports reaches the limit of their capacity, and that of Kansai International Airport (henceforth called as KIX) opened in 1994, is also estimated to be saturated in the near future. Thus, New Chubu International Airport is being planned. Under these situations, it is necessary to develop suitable and easy tools to analyze the impact on the air passengers' flow by the construction of the new airport. There has been much research in the field of demand forecast under a given aviation network. Research by Morichi et al (1993), and Furuichi et al (1993) are examples of introducing the logic type models. However, these do not consider the strategic behavior of airlines. Todoroki et al (1992), Kita et al (1995) and Takase et al (1995) developed models to consider the behavior of airlines and passengers. These are quite interesting in the sense that they include the objective functions of both of airlines and passengers. However, they lack the approach to an "equilibria" between airlines and passengers. Ohashi et al (1996) formulated the equilibrium between airlines and passengers as the "general equihbrium" considering the aviation fee and flight frequency. The model is very precise from the theoretical viewpoint. However, when that model is applied to the real aviation network, it may be difficult to take the equilibrium solution because it requires the a large amount of computation. Taking these into account, the present paper aims to develop an easier analytical tool to obtain the equilibrium flow in the air transportation network. In the real air transportation market, (1) the flow of passengers and/or goods is the resultant equilibrium in the market through strategic behaviors of transportation agencies (henceforth called carrier) and passengers or shippers (henceforth called user) under the governmental policies which include airport construction and its management, (2) the carrier has the perfect information about the users' behavior, but users have the limited information provided by the carrier, (3) the relationship between the carriers and users is not interactive. This situation of air transportation market constituted of the government, the carrier, and the user can be regarded as the game referred to as the Stackelberg Problem. Under these conditions, Kuroda and Takebayashi (1996, 1997) developed a model to obtain the Stackelberg equilibria among carriers (airlines and railways) and passengers under given inter-regional O.D. distribution of demand. The present paper analyzes the impact of the construction of New Chubu International Airport on the air passengers' flow based on their model.
GISS
Network Analysis; Air Transportation; Airline Operations; Civil Aviation; Transportation Networks; Mathematical Models

19990045808 Boeing Commercial Airplane Co., Seattle, WA USA
Spill Modeling for Airlines
Swan, William M., Boeing Commercial Airplane Co., USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 16p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Spill models estimate average passenger loads when demand occasionally exceeds capacity. Such models have been in use for over 20 years. The shape of the distribution of demand is discussed from both theory and observation. Sources of variance are identified and calibrated. Measurement problems and techniques are discussed. Two alternate spill formulas are presented based on normal distributions of demand. A revision is presented which responds to changes in process caused by computer reservation system and revenue management. The concept that the spill losses should be valued at discount fares is discussed. The recapture of spilled demand is presented as well as when such a phenomenon is relevant. Comparison of various sources of error is included. Finally, the use of spill models in reverse to imply demand from load is shown to have poor accuracy. The paper is meant to offer to the literature a reference for basic use. It is the result of 15 years' involvement in spill model derivation, calibrations and applications.
Author
Airline Operations; Air Transportation; Mathematical Models; Demand (Economics); Distribution Functions

19990045809 Nanyang Technological Inst., Nanyang Business School, Singapore

Airline Spill Analysis: Beyond the Normal Demand

Li, Michael Z. F., Nanyang Technological Inst., Singapore; Oum, Tae Hoon, British Columbia Univ., Canada; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 18p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Most research on airline passenger spill has assumed the normal distribution of the nominal demand. But, there are plenty of empirical observations showing that the normal distribution does not fit very well in many occasions. This is true especially for the demand for business and first class compartments. In this paper, we derive formulae for calculating the expected number of spilled passengers for a group of flights for the cases where the nominal demand is assume to follow a normal, a logistic, a lognormal and a gamma distribution. The spills under the alternative distributional assumptions are compared numerically. Finally, the paper demonstrates that for each of the four distributions, one can construct a generic observed load factor table, which does not depend on aircraft seating capacity.

Author

Airline Operations; Distribution Functions; Mathematical Models; Demand (Economics); Statistical Distributions

19990045810 National Cheng Kung Univ., Dept. of Transportation and Communication Management, Tainan, Taiwan, Province of China

An Airline Dynamic Multiple-Fare Overbooking Strategy Model

Chang, Yu-Hern, National Cheng Kung Univ., Taiwan, Province of China; Cheng, Jao-Hong, I-Shou Univ., Taiwan, Province of China; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 12p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is standard practice for airline companies to allow passengers to cancel reservations booked in advance without penalty. In these circumstances, the likelihood is high that even with a given flight booked solid, seats would remain empty at take-off because of cancellation or passenger no-shows. In order to reduce the number of empty seats, airline companies resort to overbooking. Through carefully controlled overbooking, the airline companies can reduce the number of empty seats and at the same time serve the public interest by accommodating more passengers. A number of conventional airline overbooking models have been developed in the past several decades. Various techniques have been attempted, yielding different degrees of success in their experiments. These include recognition approaches, such as a single overbooking level of single fare model, a comprehensive non-nested seat allocation and overbooking model, and a comprehensive nested seat allocation and overbooking model. The model this paper describes is a more comprehensive and exact treatment of the airline reservation process than any of the foregoing.

Derived from text

Cancellation; Passengers; Mathematical Models; Airline Operations

19990045811 Columbia Energy Group, Gas Management Services, Columbus, OH USA

Assigning Arriving and Departing Transporters at Transfer Facilities

Allman, William P., Columbia Energy Group, USA; Mount-Campbell, Clark A., Ohio State Univ., USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 12p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

There are many facility operational planning scheduling situations for which, within a given time window, arriving and/or departing transporters carrying units originating at the facility, terminating at the facility, continuing through on the same transporter, or transferring to another transporter over some intra-facility transfer route, must be assigned physical locations within the facility. The assignment of transporters to locations must consider the feasibility of each transporter being serviced at the alternative locations. This paper deals with the assignment of transporters to locations according to a quantitative criterion. Suggested criteria consider measures for the transfer of originating units from the facility entrance(s) to their departing locations, plus the transfer of all terminating units from their arriving locations to the facility exit(s), plus the transfer of all transferring units over intra-facility location-to-location transfer routes. Such measures can be time, distance, or some combination thereof.

Derived from text

Operational Problems; Scheduling; Airline Operations; Air Transportation; Mathematical Models; Airfield Surface Movements

19990045813 Technical Univ. of Warsaw, Faculty of Transport, Warsaw, Poland

The Optimization Problem Formulation and Algorithm of Eliminating Flight Collisions

Ambroziak, T., Technical Univ. of Warsaw, Poland; Drabik, D., Technical Univ. of Warsaw, Poland; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 14p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The formulation of the optimization and an algorithm for eliminating flight collisions is presented in this paper. The optimization problem is addressed first: input data is described, the decision variables, and the restrictions are reviewed. The method of solving the optimization problem is also reviewed. The criterion of the optimization problem is that the total cost of all aircraft flights taking place in a given area be minimized, only after insuring flight schedules are free from collisions. The method of solving the optimization problem is to construct a flight graph. The implementation of the algorithm ensuring flights free from collisions is described. A block diagram of the process is presented, and the input data form is described. A computational example is described, which illustrates the process, which is used to illustrate the workings of the process, and illustrate a coordinated flight plan.
CASI
Algorithms; Costs; Flight Plans; Schedules; Air Traffic Control; Optimization; Collision Avoidance; Flight Paths

19990046009 Federal Aviation Administration, Washington, DC USA
Notices to Airmen, Domestic/Internationnal, March 25, 1999
Mar. 25, 1999; 252p; In English
Report No.(s): PB99-139578; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche
Contents include the following: 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 Airmean; Graphic Notices.
NTIS
Air Navigation; Runways; Airports; Graphs (Charts)

19990046013 Massachusetts Univ., Applied Science and Technology, Amherst, MA USA
Anaerobic Treatment of Aircraft Deicing Wastes: A Technology Assessment ***Final Report***
Sep. 1998; 224p; In English
Report No.(s): PB99-137846; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
The work contained in the study documents the fact that deicing wastes containing ethylene glycol (EG) and propylene glycol (PG) may be effectively treated using an anaerobic biological process. In the report, the treatment of aircraft deicing wastes under anaerobic methanogenic conditions is examined in detail. The major project tasks were: airport sampling to define the characteristics of waste from deicing operations; testing of EG and PG degradation using laboratory-scale reactors and then by means of serum bottle tests; operation of an anaerobic fluidized bed reactor (AFBR); and analysis of the energy aspects of anaerobic processes with cost comparisons to traditional aerobic processes.
NTIS
Technology Assessment; Anaerobes; Deicing; Waste Treatment; Antiicing Additives

19990046106 Irvin Aerospace, Inc., Santa Ana, CA USA
Recent Advances in Spin/Stall Recovery Parachute System Technology
Delurgio, Phillip R., Irvin Aerospace, Inc., USA; Taylor, Anthony P., Irvin Aerospace, Inc., USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 267-283; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche
This paper presents recent advances in Spin/Stall Recovery Parachute System (SSRPS) technology, as advanced by Irvin Aerospace, Inc. and its customers. Specific discussions focus on the value of providing the entire system, rather than piece parts and the development of SSRPS controls which are simple and intuitive, incorporation of built-in test, some simple rules for sizing SSRPS's for commercial aircraft, and the use of digital simulations for analysis of aircraft recovery.
Author
Recovery Parachutes; Digital Simulation; Size Determination; Control Boards

19990046107 Lockheed Martin Astronautics, Huntsville, AL USA
First Flight Preparation and Testing the F-22A Raptor
Metz, Paul, Lockheed Martin Astronautics, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 284-290; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche
A successful first flight of the F-22A, Raptor, was conducted on 7 September 1997. Initial handling qualities were rated as Level 1 for takeoff, formation and landing tasks. There was very high correlation between test data and engineering prediction for the air data system, engines, performance and stability and control. Simulation proved to be useful tool for refining control

laws and handling qualities as well as subsystem operation. The test program now moves into a four-year development effort centered at Edwards Air Force Base.
Derived from text
Controllability; Flight Tests; Aircraft Stability; F-22 Aircraft; Flight Simulation

19990046109 Test Squadron (0416th), Edwards AFB, CA USA
The Development of Nuisance Warning Criteria for Ground Collision Avoidance Systems: Preliminary Findings
Prosser, K. E., Test Squadron (0416th), USA; Fergione, J. A., Lockheed Martin Tactical Aircraft Systems, USA; Skoog, M. A., Test Squadron (0416th), USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 307-318; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The USA Air Force (USAF) has been actively pursuing ground collision avoidance system (GCAS) technology for the past decade. Despite this effort, controlled flight into terrain (CFIT) remains the number one cause oF aircraft losses in the USAF. Research suggests that the primary limitation of current GCAS technology is the excessive occurrence of nuisance warnings. Pilots quickly learn to ”tune out” GCAS warnings or turn the systems off entirely to avoid these false warnings. Currently, no criteria exists to indicate the threshold between valid warnings and those that will be considered nuisances by the pilots. The purpose of this nuisance criteria study was to develop just such a criteria that GCAS designers can use to optimize their systems to avoid nuisance warnings.
Author
Flight Control; Collision Avoidance; Research

19990046379 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA USA
Optimizing Simulator-Aircraft Mix for U.S. Army Initial Entry Rotary Wing Training ***Final Report, Mar. 1998 - Mar. 1999***
Stewart, John E., III; Dohme, John A.; Nullmeyer, Robert T.; Mar. 1999; 53p; In English
Report No.(s): AD-A361814; ARI-TR-1092; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Early fixed wing research demonstrated that potential cost and training benefits could be derived from simulation-augmented primary flight training. Unfortunately, more recent research in this area has been the exception, not the rule. This is especially true in the case of rotary wing (helicopter) aircrew training research. The present report reviewed the research literature on military aviation transfer of training (TOT) research, and examined the current U.S. Army Initial Entry Rotary Wing (IERW) Program of Instruction. An in-depth review was also conducted on the recent lERW simulation research performed by the Army Research Institute (ARI) Rotary Wing Aviation Research Unit (RWARU). Review of the IERW TOT research showed that a combination of synthetic flight simulation and criterion-based training had the potential for saving training time and costs in the aircraft. Adaptive training aids such as the ARI RWARU Intelligent Flight Trainer, also showed promise. A research program, focusing on revising the current IERW program to optimize the use of simulation, was proposed. This program would include (a) criterion-based instructional strategies, (b) low cost simulation, and (c) investigation of different combinations of simulator vs. aircraft training events, in order to determine the optimal simulator/aircraft training ”mix”.
DTIC
Helicopters; Flight Simulation; Flight Training

19990046424 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Value Focused Approach to Determining the Top Ten Hazards in Army Aviation
Sperling, Brian K.; Feb. 25, 1999; 209p; In English
Report No.(s): AD-A361821; AFIT/GOR/ENS/99M-16; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The USA Army Safety Center is challenged with identifying the top ten most severe hazards in Army Aviation. This research utilizes value-focused thinking and multiattribute preference theory concepts to produce a decision analysis model designed to aid decision-makers in their analysis process. The severity model is based on the Army’s Risk Management doctrinal manual and has been tailored specifically for aviation related accidents and hazards. The model determines the severity and risk ranking for 65 categories of accidents and 24 existing hazards. A sensitivity analysis is conducted to examine the effects of variations in the weights of the top-level criteria for accident and hazard severity. Recommendations are presented for ways to use the information contained in this report to assist in developing risk reduction controls focused on force protection. The model provides the decision-makers with a decision analysis methodology that is consistent with Army doctrine and the values of the current chain of command at the Army Safety Center. Furthermore the model can be adjusted for different leadership levels or situations.
DTIC
Hazards; Decision Theory; Safety

19990046579 Boeing Co., Saint Louis, MO USA

4TH Generation Escape System Technologies Demonstration, Phase II ***Final Report, Jul. 1995 - Feb. 1998***

McDonald, A. Blair; Jul. 1998; 224p; In English

Contract(s)/Grant(s): F33615-92-C-2290; AF Proj. 2868

Report No.(s): AD-A361827; MDC-97-K-0154; AFRL-HE-WP-TR-1998-0130; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The Fourth Generation Escape System Technologies Demonstration Program was conducted to develop and demonstrate technologies that will enable the expansion of the escape envelope beyond that of current, third generation escape systems. The areas of the escape envelope in which expansion was demonstrated were escape under low-altitude, adverse-attitude conditions and escape at extremely high speed. The primary technologies that were developed for demonstration were: controllable propulsion, digital flight controls, and devices for crew member protection at high speed. The program was a two-phase program. In Phase I, two competing controllable propulsion subsystems were designed, developed, and demonstrated. A trade study was used to select the propulsion system, the digital flight control system, and the high-speed protection devices to demonstrate in Phase II. In Phase II, the new technology systems were integrated into an ejection seat test vehicle and a series of ten ejection tests were conducted at a high-speed test track. The tests successfully demonstrated safe escape at speeds up to 700 knots equivalent airspeed and at adverse conditions as severe as 20 degrees of yaw at 450 knots equivalent airspeed. The system also successfully demonstrated an upward-seeking trajectory resulting in a ground avoidance capability.

DTIC

Escape Systems; Ejection Seats; Flight Control

19990046603 Nebraska Univ., Aviation Inst., Omaha, NE USA

The UNO Aviation Monograph Series: The Airline Quality Rating 1997, ***1997***

Bowen, Brent D., Nebraska Univ., USA; Headley, Dean E., Nebraska Univ., USA; 1997; 50p; In English

Report No.(s): UNOAI-97-9; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Airline Quality Rating (AQR) was developed and first announced in early 1991 as an objective method of comparing airline performance on combined multiple factors important to consumers. Development history and calculation details for the AQR rating system are detailed in The Airline Quality Rating 1991 issued in April, 1991, by the National Institute for Aviation Research at Wichita State University. This current report, Airline Rating 1997, contains monthly Airline Quality Rating scores for 1996. Additional copies are available by contacting Wichita State University or the University of Nebraska at Omaha. The Airline Quality Rating (AQR) 1997 is a summary of a month-by-month quality ratings for the nine major domestic U.S. airlines operating during 1996. Using the Airline Quality Rating system and monthly performance data for each airline for the calendar year of 1996, individual and comparative ratings are reported. This research monograph contains a brief summary of the AQR methodology, detailed data and charts that track comparative quality for major domestic airlines across the 12 month period of 1996, and industry average results. Also comparative Airline Quality Rating data for 1991 through 1995 are included to provide a longer term view of quality in the industry.

Author

Airline Operations; Quality; Ratings; Civil Aviation; Commercial Aircraft; Passenger Aircraft

19990046775 Research Triangle Inst., Hampton, VA USA

An Assessment of Technical and Production Risks of Candidate Low-Cost Attitude/Heading Reference Systems(AHRS)

Yuchnovicz, Daniel, Research Triangle Inst., USA; Burgess, Malcolm, Research Triangle Inst., USA; Hammers, William, Optimal Solutions, USA; February 1999; 66p; In English

Contract(s)/Grant(s): NCA1-130; RTOP 538-11-11-01

Report No.(s): NASA/CR-1999-209096; NAS 1.26:209096; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report provides an assessment of technical and production risks of candidate low-cost attitude/heading reference systems (AHRS) for use in the Advanced General Aviation Transport Experiments (AGATE) airplanes. A low-cost AHRS is a key component of modem ”glass cockpit” flight displays for General Aviation (GA) aircraft. The technical capabilities of several candidate low-cost AHRS were examined and described along with the technical issues involved with using all solid-state components for attitude measurement. An economic model was developed which describes the expected profit, rate of return, and volume requirements for the manufacture of low-cost AHRS for GA aircraft in the 2000 to 2020 time frame. The model is the result of interviews with GA airframe manufacturers, avionics manufacturers and historical analysis of avionics of similar complexity. The model

shows that a manufacturer will break even after three years of AHRS production, realizing an 18 percent rate of return (23 percent profit) on an investment of $3.5M over the 20 year period. A start-up production estimate showed costs of $6-12M for a new company to build and certify an AHRS from scratch, considered to be a high-risk proposition, versus $0.25-0.75M for an experienced avionics manufacturer to manufacture a design under license, a low-risk proposition.
Author
Attitude Control; Risk; General Aviation Aircraft; Attitude (Inclination); Avionics

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.

19990044104 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Integrated UPS/INS Precision Approach Landing with M3AE Interference Avoidance
Chastain, Stephan H.; Mar. 1999; 148p; In English
Report No.(s): AD-A361703; AFIT/GE/ENG/99M-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Several past research efforts have developed methods to take advantage of Global Positioning System (UPS) positioning and apply it to a precision landing system (PLS). There have been proposals to phase out the current Instrument Landing System (ILS) in favor of a more cost-efficient and effective system. Accomplishments have been made in detailing a system implementing an INS aided with differential UPS, a UPS pseudolite, and a radar altimeter to handle the critical PLS requirements. This research applies the newly developed Modified Multiple Model Adaptive Estimation (M3AE) architecture in an attempt to enhance the performance of a PLS in an environment involving UPS interference. The M3AE uses Multiple Model Adaptive Estimation (MMAE) and Kalman filtering techniques to estimate the levels of interference and the navigation performance of the aircraft simultaneously. In addition, in the original development of M3AE, the truth and filter model used were of the same order. This research serves as a demonstration of M3AE applied to system where the truth model is of a higher order than the filter model.
DTIC
Global Positioning System; Landing Aids; Precision

19990045723 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Efficient GPS Position Determination Algorithm
Colon, Carlos R.; Mar. 1999; 81p; In English
Report No.(s): AD-A361729; AFIT/GE/ENG/99M-33; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The use of detect, or closed-form solutions of the trilateration equations used to obtain the position fix in GPS receivers is investigated. The paper is concerned with the development of an efficient new position determination algorithm that uses the closed-form solution of the trilateration equations and works in the presence of pseudorange measurement noise and for an arbitrary number of satellites. in addition, an initial position guess is not required and good estimation performance is achieved even under high GDOP conditions. A two step GPS position determination algorithm which 1) entails the solution of a linear regression problem and, 2) an update of the solution based on one nonlinear measurement equation is developed. The closed-form solution of the linear regression in step 1 provides an estimate of the GPS solution, viz., user position and user clock bias, as well as the estimation error covariance. in the update step 2, only two to three iterations are required, as opposed to five iterations which are normally required in the standard iterative least square algorithm currently used in GPS. The two step algorithm also provides a data driven prediction of the pseudorange measurement noise strength and the estimation error covariance. The mathematical derivation of the novel and efficient solution algorithm for the GPS pseudorange equations using stochastic modeling is validated in a realistic simulation experiment based on 5000 Monte Carlo runs. The algorithm's performance is discussed and compared to the conventional iterative least squares algorithm currently used in GPS.
DTIC
Global Positioning System; Algorithms; Covariance; Geometric Dilution of Precision

19990045724 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Analysis of Radio Frequency Interference Effects on a Modern Coarse Acquisition Code Global Positioning System (GPS) Receiver. Volume 1

Johnston, Kenneth D.; Mar. 1999; 131p; In English

Report No.(s): AD-A361736; AFIT/GSO/ENG/99M-02; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The purpose of this thesis was to investigate the performance of a twelve channel Standard Positioning Service (SPS) based (Global Positioning System (GPS) receiver using an eight state Kalman filter in a hostile radio frequency (RF) environment and to develop instructional tools for teaching RF interference on GPS receivers. The two types of jamming signals generated included Continuous Wave (CW) and Swept CW. Actual GPS and jamming signals were used in the research. The signals received from GPS satellites exhibit a Doppler shift which vary between approximately plus six Kilohertz. The Doppler shift frequency can be reasonably predicted for a given time of day, for a given satellite, and for a known receiver location using GPS satellite almanac or ephemeris data. Additionally, the Pseudorandom Noise (PRN) Coarse Acquisition (C/A) code for each satellite exhibits specific maximum amplitude spectral lines. by tailoring the jamming signals to match with the Doppler shifted satellite frequencies and offsetting the jamming to a maximum spectral line, it was shown that individual Navstar XR5-M receiver channels for specific satellites could be selectively jammed/spoofed. Swept CW jamming resulted in pulling the XRS-M receiver tracking channels off frequency by up to 20 Kilohertz but resulted in a maximum position error of only 220 meters. The CW jamming of at least one of the XR5-M receiver channels resulted in position errors in the receiver in excess of 12 kilometers.

DTIC

Global Positioning System; Radio Receivers; Artificial Satellites; Line Spectra

19990045725 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Analysis of Radio Frequency Interference Effects on a Modern Coarse Acquisition Code Global Positioning System (GPS) Receiver. Volume 2

Johnston, Kenneth D.; Mar. 1999; 284p; In English

Report No.(s): AD-A361737; AFIT/GSO/ENG/99M-02; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The purpose of this thesis was to investigate the performance of a commercial-off-the-shelf twelve channel Standard Positioning Service (SPS) based Global Positioning System (GPS) receiver using an eight state Kalman filter in a hostile radio frequency (RF) environment and to develop instructional tools for teaching RF interference on GPS receivers. The two types of jamming signals generated included Continuous Wave (CW) and Swept CW. Actual GPS and jamming signals were used in the research. The signals received from GPS satellites exhibit a Doppler shift which vary between approximately plus six Kilohertz. The Doppler shift frequency can be reasonably predicted for a given time of day, for a given satellite, and for a known receiver location using GPS satellite almanac or ephemeris data. Additionally, the Pseudorandom Noise (PRN) Coarse Acquisition (CIA) code for each satellite exhibits specific maximum amplitude spectral lines. by tailoring the jamming signals to match with the Doppler shifted satellite frequencies and offsetting the jamming to a maximum spectral line, it was shown that individual Navstar XR5-M receiver channels for specific satellites could be selectively jammed/spoofed. Swept CW jamming resulted in pulling the XR5-M receiver tracking channels off frequency by up to 20 Kilohertz but resulted in a maximum position error of only 220 meters. The CW jamming of at least one of the XR5-M receiver channels resulted in position errors in the receiver in excess of 12 kilometers.

DTIC

Global Positioning System; Radio Receivers; Artificial Satellites; Jamming; Radio Frequency Interference

19990045726 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

GPS Signal Offset Detection and Noise Strength Estimation in a Parallel Kalman Filter Algorithm

Vanek, Barry J.; Mar. 08, 1999; 99p; In English

Report No.(s): AD-A361773; AFIT/GE/ENG/99M-30; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Measurements from Global Positioning System (GPS) satellites are subject to corruption by signal interference and induced offsets. This thesis presents two independent algorithms to ensure the navigation system remains uncorrupted by these possible GPS failures. The first is a parameter estimation algorithm that estimates the measurement noise variance of each satellite. A redundant measurement differencing (RMD) technique provides direct observability of the differenced white measurement noise samples. The variance of the noise process is estimated and provided to the second algorithm, a parallel Kalman filter structure, which then adapts to changes in the real-world measurement noise strength. The parallel Kalman filter structure detects and isolates signal offsets in individual GPS satellites. The offset detection algorithm calculates test statistics on each of the filters and

makes decisions on whether to remove satellites from the solution based on these statistics. The two algorithms contain several user-defined parameters that have significant effects when adjusted. The various effects of parameter variation are described and a parameter set is chosen at which to evaluate the algorithms. The combined algorithm performs quite well in computer simulations.
DTIC
Kalman Filters; Global Positioning System; Inertial Navigation

19990045732 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Integrated Synthetic Aperture Radar/Global Positioning System/Inertial Navigation System for Target Geolocation Improvement
Young, Brian J.; Mar. 1999; 172p; In English
Report No.(s): AD-A361800; AFIT/GE/ENG/99M-32; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This thesis explores a potential integration technique to fuse information from an inertial navigation system (INS) and global positioning system (GPS) with synthetic aperture radar target measurements. Using Kalman filtering techniques, an INSIGPS/SAR integrated system was simulated in a single Kalman filter to analyze the SAR target geolocation accuracy benefits. Three different GPS receiver models were used in the integrated system: stand-alone (SGPS), differential (DGPS), and carrier-phase differential GPS (CPGPS). Each of these GPS models were integrated with a common INSISAR combination to determine the target geolocation accuarcy improvements due only to GPS receiver type. Thesis results show that SAR targeting can be enhanced, through tight integration of an INS/GPS navigation system, without increasing the SAR resolution. This work represents some of the first integrations work of only SAR range and range rate measurements into an INS/GPS integrated system to provide better accuracy in estimating ground target geolocation errors.
DTIC
Synthetic Aperture Radar; Global Positioning System; Inertial Navigation

19990045812 Government of the Northwest Territories, Canada
NAV CANADA's Provision of Air Navigational Services in Northern and Remote Areas
Kaduck, Raymon J., Government of the Northwest Territories, Canada; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 18p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In 1996, Canada became the first nation to fully commercialize its air navigational system. Other jurisdictions had placed their ANS under a government controlled and owned entity, but the Canadian solution went further. The assets and personnel were transferred from Transport CANADA to a non-share corporation called NAV Canada, governed by a board of directors drawn from stakeholder groups. Transport Canada retained a purely regulatory role, ensuring that safety standards were maintained. In the process of negotiating the transfer, some argued that the nascent ANS corporation should only be responsible for the southern airspace, while TC should continue to manage the northern and remote areas, where low traffic densities and high operating costs make full cost recovery for the system not feasible. This view was rejected and the ANS transferred in its entirety. Northern stakeholder groups were alarmed that this might mean that full cost recovery should be implemented in their fragile economy. They lobbied for exemptions in the bill which would protect northern interest. This paper concerns the lobbying process, the safeguards in the ANS Act, and the early issues in implementing a commercialized ANS in the Northern and remote regions.
Derived from text
Canada; Remote Regions; Air Navigation; Flight Management Systems; Air Traffic Control; Commercialization

19990045815 National Cheng Kung Univ., Dept. of Transportation and Management Science, Tainan, Taiwan, Province of China
Developing an On-Line Air Traffic Flow Management System
Dai, Melody D. M., National Cheng Kung Univ., Taiwan, Province of China; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 12p; In English; See also 19990045796
Contract(s)/Grant(s): NSC-86-2621-E-006-020; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Air traffic has increased significantly in Taiwan, especially domestic flights. Most of the domestic traffic is distributed in the west coast corridor, operating as city-pair shuttle services. The Sung Shan Airport, servicing Taipei, is the largest and busiest airport in Taiwan. The airport has only one runway, causing serious delays. During adverse meteorological conditions, the situation gets even worse. Thus traffic flow management is required. Due to limited airspace, ground holding is the most effective method of traffic flow management. The effectiveness of the ground holding policy depends on the timing. This involves the recognition

of congestion. This study develops a real time operating system to help the air traffic controllers determine when and how to implement the ground holding policy.
CASI
Air Traffic Control; Management Systems; Real Time Operation; Flight Plans; Aircraft Guidance; Aircraft Approach Spacing; Approach Control

19990045846 European Organization for the Safety of Air Navigation, Bretigny-sur-Orge France
SAPPHIRE: First Results
Bondarenco, N.; Lipp, A.; Tiemeyer, B.; Watt, A.; Jun. 1998; 42p
Report No.(s): PB99-136202; EEC-330; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
This report presents first results on the availability of Receiver Autonomous Integrity Monitoring (RAIM) onboard of commercial aircraft derived from the EUROCONTROL Flight Trial Programme SAPPHIRE (Satellite and Aircraft Database Programme for System Integrity Research). The objective of this program is to develop a statistically representative database of regular GNSS and other navigation sensor measurements to investigate system integrity, availabity and continuity of service aspects in order to contribute of service aspects in order to contribute to the GNSS certification process. The data evaluation process is explained together with the set of navigation performance requirements which will be initially used before first results are presented and discussed.
NTIS
Navigation Satellites; Data Recording; Global Positioning System; Data Bases; Navigation Instruments

19990045871 Civil Aeromedical Inst., Oklahoma City, OK USA
Optimizing Blink Parameters for Highlighting an Air Traffic Control Situation Display ***Final Report***
Milburn, Nelda J.; Mertens, Henry W.; Mar. 1999; 26p; In English
Report No.(s): AD-A362158; DOT/FAA/AM-99/8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Research suggests blinking targets are more alerting than steady targets; however, several factors can interact with blinking to either improve or degrade its attention-getting value. Those factors include target size, color, brightness contrast, frequency of blink, and the time the blink is at maximum brightness relative to the time it is off or dim during the blink cycle. No guidelines were found for determining the optimal attention-getting blink amplitude (the percentage of decrease in target brightness from a standard) and the interaction of blink amplitude with the other blink characteristics mentioned above. Thirty-six participants were asked to locate and select blinking blocks of text on a simulated air traffic control display to examine the interaction of blink frequencies, amplitudes, and duration with size of text. Our results support the use of amplitudes 75% or greater combined with frequencies from 2 to 4 Hertz and text size 0.15 inch or greater for optimum highlighting value in visual search tasks.
DTIC
Air Traffic Control; Human Factors Engineering; Display Devices

19990046605 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Self-Tuning Kalman Filter for Autonomous Navigation Using the Global Positioning System (GPS)
Truong, Son H., NASA Goddard Space Flight Center, USA; 1999; In English; Flight Mechanics, 18-20 May 1999, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche
Most navigation systems currently operated by NASA are ground-based, and require extensive support to produce accurate results. Recently developed systems that use Kalman filter and GPS (Global Positioning Systems) data for orbit determination greatly reduce dependency on ground support, and have potential to provide significant economies for NASA spacecraft navigation. These systems, however, still rely on manual tuning from analysts. A sophisticated neuro-fuzzy component fully integrated with the flight navigation system can perform the self-tuning capability for the Kalman filter and help the navigation system recover from estimation errors in real time.
Author
Space Navigation; Autonomous Navigation; Global Positioning System; Control Systems Design; Automatic Flight Control

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.

19990045624 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Introduction of Group Iteration and its Application to Designing of UAVs
Nagasaki, Shuji, Kyushu Univ., Japan; Asano, Tetsuya, Kyushu Univ., Japan; Sakurai, Akira, Kyushu Univ., Japan; Technology Reports of Kyushu University; Jul. 1998; Volume 71, No. 4, pp. 251-254; In Japanese; See also 19990045622; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

A new method of global optimization called GI (Group Iteration) is proposed. It is an extension of GA (Genetic Algorithm) with conserving some of the key features and utilizes generalized iterative scheme without being limited by the genetic metaphor of GA. This new method is applied to a problem of simplified conceptual design of a UAV (Unmanned Aerial Vehicle), and Gl is an effective optimization method for non-analytic, complicated problems.
Author
Design Analysis; Procedures; Technology Assessment; Optimization

19990045847 European Organization for the Safety of Air Navigation, Bretigny-sur-Orge France
Aircraft Performance Summary Tables for the Base of Aircraft Data (BADA). Revision 3.1
Baulleret, P.; Nov. 1998; 92p; In English
Report No.(s): PB99-136194; EEC/NOTE-27/98; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

A set of aircraft performance summary tables are presented for the 67 aircraft tuypes modelled by the Base of Aircraft Data (BADA) Revision 3.1. For each aircraft type, the performance tables specify the true air speed, rate of climb/descent and fuel flow for conditions of climb, cruise and descent at various flight levels. The performance figures contained within the tables are calculated based on a total energy model and BADA 3.1 performance coefficents.
NTIS
Aircraft Performance; Aircraft Models; Flight Operations; Real Time Operation; Data Bases

19990045848 European Organization for the Safety of Air Navigation, Bretigny-sur-Orge France
Revision Summary Document for the Base of Aircraft Data (BADA). Revision 3.1
Baulleret, P.; Nov. 1998; 36p; In English
Report No.(s): PB99-136186; EEC/NOTE-26/98; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This Revision Summary Document (RSD) describes all changes made to BADA files in Revision 3.1 since the previous release, Revision 3.0. Configuration management procedures for BADA trace all changes through Configuration Change Orders (CCOs). The RSD thus presents a list of all 12 CCOs implemented for BADA 3.1 along with a description for each CCO.
NTIS
Data Bases; Aircraft Configurations; Aircraft Models

19990045905 NASA Lewis Research Center, Cleveland, OH USA
Load Distribution in Transmissions "Split" ***La Ripartizione del Carico Nelle Transmissioni "Split"***
Krantz, Timothy L., NASA Lewis Research Center, USA; Delgado, Irebert R., NASA Lewis Research Center, USA; Organi di Transmissione; January 1998, No. 1, pp. 64-72; In Italian; Power Transmission and Gearing, 1996, Unknown
Contract(s)/Grant(s): RTOP 581-20-13; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The transmission system of a helicopter must meet particularly critical requirements. It must transmit engine power to the rotor, at the same time ensuring a typical speed reduction of 60 to 1. It must also be safe, reliable, light, and reach a high level of performance while, at the same time, it must produce few vibrations and little noise. Helicopter transmissions have achieved high-level performances thanks to the combination of analyses, experiments, and the application of practical field experience. However, the new generation of helicopters will require transmission systems that are even safer, lighter, less noisy, and more reliable.
Author
Helicopters; Rotors; Transmissions (Machine Elements); Loads (Forces); Helicopter Design; Gears; Torque

19990046080 NASA Ames Research Center, Moffett Field, CA USA
System and Method for Finite Element Simulation of Helicopter Turbulence
McFarland, R. E., Inventor, NASA Ames Research Center, USA; Dulsenberg, Ken, Inventor, NASA Ames Research Center,

USA; Jan. 19, 1999; 18p; In English
Patent Info.: Filed 22 Apr. 1996; NASA-Case-ARC-14053-1-LE; US-Patent-5,860,807; US-Patent-Appl-SN-656145; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

The present invention provides a turbulence model that has been developed for blade-element helicopter simulation. This model uses an innovative temporal and geometrical distribution algorithm that preserves the statistical characteristics of the turbulence spectra over the rotor disc, while providing velocity components in real time to each of five blade-element stations along each of four blades. for a total of twenty blade-element stations. The simulator system includes a software implementation of flight dynamics that adheres to the guidelines for turbulence set forth in military specifications. One of the features of the present simulator system is that it applies simulated turbulence to the rotor blades of the helicopter, rather than to its center of gravity. The simulator system accurately models the rotor penetration into a gust field. It includes time correlation between the front and rear of the main rotor, as well as between the side forces felt at the center of gravity and at the tail rotor. It also includes features for added realism, such as patchy turbulence and vertical gusts in to which the rotor disc penetrates. These features are realized by a unique real time implementation of the turbulence filters. The new simulator system uses two arrays one on either side of the main rotor to record the turbulence field and to produce time-correlation from the front to the rear of the rotor disc. The use of Gaussian Interpolation between the two arrays maintains the statistical properties of the turbulence across the rotor disc. The present simulator system and method may be used in future and existing real-time helicopter simulations with minimal increase in computational workload.
Official Gazette of the U.S. Patent and Trademark Office
Helicopters; Turbulence; Real Time Operation; Computerized Simulation; Finite Element Method

19990046090 NASA Langley Research Center, Hampton, VA USA
Non-Linear Finite Element Modeling of THUNDER Piezoelectric Actuators
Taleghani, Barmac K., Army Research Lab., USA; Campbell, Joel F., Science Applications International Corp., USA; May 1999; 18p; In English
Contract(s)/Grant(s): RTOP 522-32-41-01
Report No.(s): NASA/TM-1999-209322; L-17834; NAS 1.15:209322; ARL-TR-1977; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A NASTRAN non-linear finite element model has been developed for predicting the dome heights of THUNDER (THin Layer UNimorph Ferroelectric DrivER) piezoelectric actuators. to analytically validate the finite element model, a comparison was made with a non-linear plate solution using Von Karmen's approximation. A 500 volt input was used to examine the actuator deformation. The NASTRAN finite element model was also compared with experimental results. Four groups of specimens were fabricated and tested. Four different input voltages, which included 120, 160, 200, and 240 Vp-p with a 0 volts offset, were used for this comparison.
Author
Finite Element Method; Mathematical Models; Piezoelectricity; Actuators; Aircraft Design

19990046096 Boeing Co., Canoga Park, CA USA
F/A-18E/F High AOA Testing Update
Madenwald, Fred, Boeing Co., USA; Niewoehner, Rob, Naval Air Station, USA; Heller, Mike, Boeing Co., USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 5-13; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The high angle of attack control laws for the F/A-18E/F were designed with several goals in mind. Some goals were requirements - spelled out in the military specification. Other goals were considered "stretch goals" - goals above and beyond what were called out in the specification. The general design goals for the E/F were: (1) Highly Departure Resistant - Ensure aircraft controllability for all possible control inputs. Controllability should not come at the expense of performance. A variety of specifications require departure resistance mainly up to stall AOA. (2) Roll Performance with Centerline Tank as Good as F/A-18C without Tank - This is a specification. Time-to-90?-bank values for various angles of attack at 19 .6M/25K were specified based on F/A-1 8C performance without a centerline tank. (3) No AOA/CG Placards for Air-to-Air Loadings - The C/D aircraft have AOA placards as a function of CG location and loading - primarily to guard against high angle ot attack hang-up and falling leaf motion. The specification states that the E/F should be no more restrictive than the C/D. The design goal was to have no restrictions. (4) Relaxed AOA/CG Placards for Air-to-Ground Loadings - As stated above, the specification states that the E/F shall be no more restrictive than the C/D. The goal for Air-to-Ground loadings was to have an expanded AOA envelope compared to the C/D, ultimately having no AOA restriction. (5) No Falling Leaf Motion - The C/D aircraft is prone to falling leaf motion, which is characterized by in-phase roll/yaw motion that produces a strong nose-up coupling moment. At aft CG, the C/D aircraft have been known to have

severely delayed recoveries. The goal for the E/F was to eliminate this mode. (6) Good Spin Characteristics - The specification states that a simple recovery technique be adequate for spin recovery. The goal for the E/F was to have similar spin characteristics to the C/D, which exhibits good recovery characteristics. (7) Better Lateral Weight Asymmetry Envelope than the C/D - The specification states that the E/F shall be no less restrictive than the C/D. The E/F goal was to have a substantially improved AOA/asymmetry envelope, with unlimited maneuvering to 12,000 ft-lbs compared to the C/D unlimited maneuvering level of 6,000 ft-lbs. and (8) No Two-Place Restrictions - The specification states that the two-place aircraft shall not incur Mach/AOA restrictions as they exist on the B/D aircraft, which was the E/F goal.
Author
Angle of Attack; Design Analysis; Specifications; Controllability; Experiment Design

19990046097 Naval Air Station, Patuxent River, MD USA
F/A-18E/F Initial Sea Trials
Gurney, Tom, Naval Air Station, USA; Morley, Frank, Naval Air Station, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 14-20; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The objective of the Initial Sea Trials (IST) phase of F/A-18E/F Engineering and Manufacturing Development (EMD) was to provide an early assessment of the airplane in the aircraft carrier environment. The combined military specification (addendum 131 and ML-D-8708B) outlined the shorebased and shipboard tests required for completion of IST. Shorebased testing comprised the majority of work and included evaluation of PA flying qualities, high angle of attack characteristics, field of view and hook to eye measurements, suitability of recommended approach angle of attack and associated airspeeds, approach, bolter and waveoff performance characteristics, trim transients with configuration changes, single engine and degraded engine handling qualities and performance, catapult launch and arrested landing characteristics and loads, and ground handling qualities. Shipboard testing included evaluation of catapult launch flyaway characteristics at various CG locations and trim conditions, flying qualities and performance characteristics during approach at different wind over deck conditions and various CG locations, and flight deck and hangar deck handling and support equipment compatibility. Aircraft F1, the first two-seater produced, was assigned as the carrier suitability test airplane. Shipboard testing was conducted aboard USS JOHN C. STENNIS (CVN 74) from 18 to 23 January, 1997. The final demonstration point for the carrier suitability clean aircraft loading was completed on 9 June 1997.
Author
Assessments; Flight Characteristics; Aerodynamic Characteristics; Product Development; Specifications

19990046098 NASA Johnson Space Center, Houston, TX USA
A Low-Cost Design and Flight Test of the T-38 Inlet
Johnson, Greg, NASA Johnson Space Center, USA; Ess, Robert, NASA Johnson Space Center, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 21-45; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

An inlet redesign of the T-38 was completed and flight tested by NASA Johnson Space Center (JSC), Houston Texas. The redesign will allow full gross weight takeoffs from high altitude airports such as El Paso, Texas (ELP) with runway temperatures up to 99 degrees F, an increase of 9 degrees F over the current performance. This project was completed in-house using innovative test techniques. The static thrust of the T-38 was increased 20% with this new inlet.
Author
Flight Tests; T-38 Aircraft; Supersonic Inlets

19990046099 Tybrin Corp., Edwards AFB, CA USA
B-1B Weapons Conventionalization: A SEEK EAGLE Perspective
Pixley, Greg, Tybrin Corp., USA; Lockwood, Ken, Air Force Seek Eagle Office, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 46-62; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

This paper presents B-IB weapon certification programs from the Air Force SEEK EAGLE office (AFSEO) managerial and engineering perspectives. Three methods of flight testing are used for weapon certification: endpoint demonstration, brute force, and verification. The MK-62, GBU-10/27, and the CBU-87/89/97 programs are discussed as examples of each. Engineering analysis varies for each type of program from simple analogies to complete wind tunnel programs. The HQ ACC requirements often drive and always influence the method of certification.
Author
Certification; Weapon Systems

19990046100 Sino Swearingen Aircraft Co., San Antonio, TX USA

Status of the SJ30-2: Flight Test Overview

Beeler, Carroll, Sino Swearingen Aircraft Co., USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 63-102; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

We are in the midst of a fairly aggressive flight test development program and this paper is a brief overview of the program to date. The SJ30-2 is being developed as a light weight, entry level, efficient business class jet aircraft. The current configuration is for I or 2 pilots and cabin seating for 4 or 5. The aircraft will be certificated for single pilot operation. The original SJ30 prototype aircraft (Serial 001A) flew its first flight on November 11, 1990. The aircraft underwent a 400+ hour research program consisting of systems development, envelope expansion, handling qualities and performance evaluation. We will discuss the prototype, it's recent modification history and the test program to date.

Author

Flight Tests; Systems Engineering; Performance Tests; Evaluation

19990046101 Aerospace Industrial Development Corp., Taichung, Taiwan, Province of China

IDF Flight Test Program Overview

Chu, Charles, Aerospace Industrial Development Corp., Taiwan, Province of China; Wueng, Fwu-Lai, Aerospace Industrial Development Corp., Taiwan, Province of China; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 103-150; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The Indigenous Defensive Fighter (IDF) is the first advanced fighter built in Taiwan, Republic of China, specifically designed to take advantage of the most advanced technology available including both digital flight control system and advanced avionics system. Over 2600 test flights have been conducted during the last 8 years using four full scale development test aircraft. With so much new design technology and the need for new test flight concepts to be developed, it was inevitable that several design faults would and were identified during flight test maneuvers. This resulted in both the flight test team and the designer group benefiting greatly from the experience gained in system design / integration, flight test planning and, nor least of all, problem solving.

Author

Flight Tests; Full Scale Tests; Flight Control

19990046102 Naval Weapons Test Squadron, Point Mugu, CA USA

The Digital Transformation of the F-14B

Martins, John, Naval Weapons Test Squadron, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 151-182; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

When the F-14 Tomcat was introduced into the fleet in the early 1970's, it was the undisputed king of the "air-to-air" hill. In fact, its greatest competition were the Mig-23 and Mig-25 which couldn't approach the Tomcat's ability to track 24 targets at one time and simultaneously engage six of them with long range missiles. The platform was actually designed around the AWG-9 radar and AIM-54 missile, which was a great way of producing a state of the art weapon system at that time. In 1978, an innovation was adopted by the DOD which changed the way aircraft were designed: The Mil-Std-1553 data bus. This digital architecture, common to all modern aircraft, allowed the growth potential and flexibility for aircraft to adopt new avionics and weapons as they are developed. Both the F-14A and F-14B models lack the flexibility of a common data bus architecture. This paper will outline how the F-14B's entire old fashioned avionics architecture was successfully gutted and replaced with a modern digital data bus system. In the process, it will focus on lessons learned during the F-14B Upgrade program and will span the project's life from inception to fleet introduction.

Author

Channels (Data Transmission); Digital Data; Weapon Systems; Data Collection Platforms; Design Analysis

19990046103 Westland Helicopters Ltd., Yeovil, UK

EH101: Airfield Performance Testing of a Three-Engine Helicopter

Swales, Michael R., Westland Helicopters Ltd., UK; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 183-210; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

In November 1994, the EH101 was the first helicopter to achieve simultaneously a preliminary Type Certification from three airworthiness agencies, the UK CAA, the FAA and the Italian RAI. In continuation of the full certification process, an airfield performance trial was conducted at the EH101 production facility of Vergiate, near Milan, Italy during Summer 1996. Fifty five hours were flown evaluating the handling and performance of the helicopter in Category A take off and landing profiles and in ground level heliport operations. This paper discusses these tests, emphasising the idiosyncrasies of the three engine configuration and the choice of techniques flown. Results are presented which match a mathematical model from a Helicopter Airfield Performance Simulation (HAPS) program to actual performance achieved. After a satisfactory correlation is obtained, then HAPS will be used to generate the Flight Manual dynamic performance charts.
Author
Helicopter Performance; Mathematical Models; Performance Tests; Aircraft Reliability; Flight Characteristics

19990046105 Lockheed Aeronautical Systems Co., Thousand Oaks, CA USA
Automatic VMC Protection in the C-130J
Schaefer, Lyle H., Lockheed Aeronautical Systems Co., USA; Roberts, Wayne, Lockheed Aeronautical Systems Co., USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 235-252; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The C-130J design has incorporated many new features which will make a positive contribution to flight safety. Among those features are dual heads up display system (HUD's), an angle of attack based stall warning and prevention system, aural and visual alerts for excessive sideslip, a ground proximity warning system, a predictive windshear alerting system, as well as takeoff configuration alerts. In addition to all these, the C-130J possess a unique system which has the potential of making a major contribution to flight safety; an Automatic Thrust Control System (ATCS). This paper will explain how this ATCS system functions how it was developed, and will define the contribution the system makes to both performance and safety.
Author
Flight Safety; Automatic Control; Display Devices; Angle of Attack; Warning Systems; Thrust Control

19990046111 Boeing AS and T Phantom Works, Saint Louis, MO USA
Flight Testing the X-36: The Test Pilot's Perspective
Walker, Laurence A., Boeing AS and T Phantom Works, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 338-348; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

From the beginnings of aviation, designers have sought ways to create faster, lighter, more maneuverable designs. Tailless designs have had the promise of reducing structural weight, aerodynamic drag and cost, but at the increased complexity of a complicated control system and non-traditional control surfaces. Recently, stealth has also become an important design consideration. Fortunately two key enabling technologies have made a blend of these attributes possible. These are digital flight control technology and the vast advances in computational analysis which permit integration of low observable technologies and advanced aerodynamic design. The X-36 represents a radical integration of these technologies into a practical research aircraft.
Author
X-36 Aircraft; Aerodynamic Drag; Control Surfaces; Flight Tests; Structural Weight; Maneuverability

19990046112 Cessna Aircraft Co., Wichita, KS USA
Citation X: Development and Certification of a 0.9 Mach+ Business Jet
Schlegel, Mark O., Cessna Aircraft Co., USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 349-368; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The Cessna Citation X (CE750) was announced by Cessna Chairman Russ Meyer during a press conference at the 1990 National Business Aircraft Association (NBAA) convention. The Citation X was to be the first business jet to cruise at 0.88 Mach, with a maximum speed of 0.90 Mach. The aircraft description and flight test program highlights are presented.
Derived from text
Cessna Aircraft; Flight Tests; Mach Number; Aircraft Performance

19990046113 Sikorsky Aircraft, Stratford, CT USA
RAH-66 Comanche Flight Test *Progress Report*
Stiles, Lorren, Sikorsky Aircraft, USA; Murrell, Reginald, Boeing Helicopter Co., USA; Armbrust, John, Department of the Army, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 369-392; In English;

See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The Comanche has been in flight test status since its First Flight on 4 Jan. 96. After an extensive update following First Flight, testing resumed on Aug. 24, 1996 and has continued to the present time. Significant progress has been made in shakedown of the structural and propulsion envelopes, development of the fly-by-wire control system and systems integration.

Author

Flight Tests; Vibration Effects; Helicopter Control

19990046193 National Aerospace Lab., Amsterdam, Netherlands

Residual Strength Test on Stiffened Panels with Multiple-Site Damage ***Final Report***

tenHoeve, H. J.; Michielsen, A. L. P. J.; Vlieger, H.; Schra, L.; Feb. 1999; 86p; In English

Report No.(s): PB99-139586; NLR-CR-96792L; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In Federal Aviation Administration and the Netherlands Department of Civil Aviation (FAA/RLD) collaboration, residual strength tests were carried out on stiffened panels with multiple-site damage (MSD). The main purpose of this test program was to generate experimental data to verify tools to predict the residual strength of such panels. In this report these tests are described and the results are presented in such a way they they can be used to verify new and existing models.

NTIS

Civil Aviation; Residual Strength; Damage; Stiffness; Panels; Flight Tests

19990046214 National Aerospace Lab., Tokyo Japan

Structural Weight Estimation Method for Winged Vehicles

Kanno, Y.; Iwasaki, K.; Aug. 1998; 54p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB99-141509; NAL-TR-1351; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This research aims at developing a structural weight estimation computer program which is useful for parametric studies, etc. The weight estimation methods uses the process of piling up structural elements' (skin, stinger, etc) weights which are determined by strength analysis. The input parameters are vehicle geometry, structure arrangements, load conditions and material data. This weight estimation method is compared to an FEM weight analysis with the same condition. The estimated estimated weight difference between this method and FEM weight analysis is about 15%. This weight estimation computer program can calculate the structural weight's change against the input parameter's change quickly. Therefore, this program is useful not only for one point weight estimation but also for parametric studies.

NTIS

Structural Weight; Weight Measurement; Computer Programs; Estimating

19990046352 Defence Evaluation Research Agency, Structural Materials Centre, Farnborough, UK

An Overview of PEP WG28: Recommended Practices for Monitoring Gas Turbine Engine Life Consumption

Harrison, G. F., Defence Evaluation Research Agency, UK; November 1998; 12p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The terms of reference for PEP WG28 provide the framework for ongoing activities. The Working Group has been tasked to examine methodologies used to predict engine life consumption rates for currently deployed fleets and to understand the limitations of these methods. Within this task, consideration has been given to fracture-critical components of the propulsion system namely, discs, impellers and spacers in both hot and cold ends. Methodologies by which mission profiles are translated into low cycle fatigue (LCF) life consumption have been addressed. The various operational usage data acquisition techniques such as gating, and continuous recording also form part of the study. ge Each methodology has been elaborated with respect to its development and validation and to its capabilities in operational usage tracking, in identifying parts life consumption and in application to maintenance strategies. Experience gained using the various methodologies and strategies is documented and major practices identified. Where these conflict or are not congruent, each is discussed. Recommendations for future development are included as appropriate. Primary emphasis of the effort focused on the user viewpoint by addressing the benefits of fleet-wide usage monitoring, the experience from actual field use and the impact of manufacturing quality standards. The study is aimed at fighter aircraft, helicopters and military transport however, Civil experience is also taken into account.

Author

Gas Turbine Engines; Mission Planning; Monitors; Life (Durability); Fatigue Life; Fracturing

19990046353 Motoren- und Turbinen-Union G.m.b.H., Dept. TPMM, Munich, Germany

Methods of Modern Lifing Concepts Implemented in On-Board Life Usage Monitoring Systems

Broede, Juergen, Motoren- und Turbinen-Union G.m.b.H., Germany; Koehl, Manfred, Motoren- und Turbinen-Union G.m.b.H., Germany; November 1998; 10p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Modern lifing concepts for fracture critical parts include safe crack initiation life and safe crack propagation life. In military aero engine applications, a portion of the safe crack propagation life is more and more utilized to extend the usage period beyond the limits set by the concept of safe crack initiation life. to really use the benefits of such life extension without reduction of flight safety, it is essential that all engines involved are monitored with respect to individual life consumption. Thus, on-board life usage monitoring systems need to address the crack propagation phase in the same manner as the crack initiation phase. It is shown how the calculations of fracture mechanics parameters and the resulting crack propagation process are integrated into the algorithms of on-board life usage monitoring software. Applicability of the methods is underlined by results obtained with OLMOS - the on-board life usage monitoring system of the German Tornado fleet.

Author

Flight Safety; Crack Propagation; Aircraft Engines; Life (Durability); Procedures

19990046354 Cranfield Univ., Bedford, UK

The Contribution of Health and Usage Monitoring Systems to Calculations of Damage State and Future Life of Helicopter Components Under Safe Life and Damage Tolerant Designs

Irving, P. E., Cranfield Univ., UK; Hudson, R. A., Cranfield Univ., UK; November 1998; 12p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Techniques for calculation of fatigue damage on rotor components of helicopters are assessed and investigated using service flight load data. Fatigue damage for the dog bone blade linkage on the GKN-Westland Lynx has been calculated from loads measured during flight for a range of maneuvers. It is found that variability of non-zero damage for individual maneuvers is between 100 and 1,000 times. The difference in damage per flight hour between worst case damage and an upper limit for the most probable damage is a factor of 7.5. The contribution to damage of the loads scatter factor of 1.2 is quantitatively assessed. Finally the proportions of damage which occurs during a flight within maneuvers and that which is between maneuvers has been investigated. The results are discussed for both flight load synthesis and flight condition recognition approaches to indirect FUMS techniques.

Author

Health; Monitors; Computation; Life (Durability); Helicopters; Structural Members

19990046355 Naval Air Warfare Center, Propulsion and Power Dept., Patuxent River, MD USA

SH-60 Helicopter Integrated Diagnostic System (HIDS) Program Experience and Results of Seeded Fault Testing

Hess, Andrew J., Naval Air Warfare Center, USA; Hardman, Bill, Naval Air Warfare Center, USA; Neubert, Chris, Naval Air Warfare Center, USA; November 1998; 22p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The evolution of automated diagnostic systems for helicopter mechanical systems has been aided by a Navy program of systematic testing of drive train components having known anomalies (seeded faults) while simultaneously executing a suite of diagnostic techniques to identify and classify the mechanical anomalies. This program, called the Helicopter Integrated Diagnostic System (HIDS) has been carried out using an iron bird test stand (SH-60) at NAWC - Trenton, and SH-60B/F flight vehicles at NAWC - Patuxent River. The SH-60 HIDS program has been the Navy's cornerstone effort to develop, demonstrate, and justify integrated mechanical diagnostic system capabilities for its helicopter fleets. The objectives of the program were to: 1. Acquire raw data for multiple cases of "good" and seeded fault mechanical components on a fully instrumented drive train to support the evaluation of diagnostic algorithms and fault isolation matrices. Data is being acquired from 32 vibration channels simultaneously at 100 kHz per channel while a continuous usage monitoring system records parametric steady state data from the power plant and airframe. 2. Analyze vibration and other diagnostic indicators to evaluate sensitivity and performance of all available diagnostic methods when analyzing well-documented parts. Evaluate relative effectiveness of these various diagnostic methods, indicators, and their associated algorithms to identify and optimize sensor location combinations. 3. Demonstrate the ability to integrate and automate the data acquisition, diagnostic, fault evaluation and communication processes in a flightworthy system. 4. Integrate and evaluate comprehensive engine monitoring, gearbox and drivetrain vibration diagnostics, advanced oil debris monitoring, inflight rotor track and balance, parts life usage tracking, automated flight regime recognition, power assurance checks and trending, and automated maintenance forecasting in a well coordinated on-board and ground-based system. 5. Provide an extensive library of high quality vibration data on baseline and seeded fault components. This data can be made available to anyone wanting to prove their diagnostic techniques or develop new capability. 6. Provide a "showcase", state-of-the-art fully functional Integrated

Mechanical Diagnostic system to act as a catalyst demonstration which might lead to interest in a fleet wide production application. This paper will describe the overall program, the goals and objectives, the facilities used, the system evaluated, the accomplishments and the results and conclusions obtained to date. The results of extensive gearbox and powertrain ”seeded fault” testing will be presented. Lessons learned which can be applied to future Helicopter Usage Monitoring Systems (HUMS) and/or Integrated Mechanical Diagnostic (IMD) systems will also be discussed.
Author
Automatic Control; Diagnosis; Rotary Wings; Rotor Aerodynamics; Performance Tests; Data Acquisition

19990046357 Federal Aviation Administration, Hampton, VA USA
HUMS Loads Monitoring and Damage Tolerance: An Operational Evaluation
Basehore, Michael L., Federal Aviation Administration, USA; Dickson, William, Textron Bell Helicopter, USA; November 1998; 14p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the results of a research program to evaluate structural usage monitoring and damage tolerance methodology using data collected concurrently during a helicopter flight program. The helicopter, a Bell Model 412 equipped with a Health and Usage Monitoring System (HUMS) and data recorder, was operated by Petroleum Helicopters Inc. (PHI) during the 1996 Summer Olympic Games in Atlanta, Georgia, as a part of Project HeliSTAR. This effort was conducted by Bell Helicopter Textron Inc. (BHTI) under the cognizance of the Federal Aviation Administration (FAA), the U.S. Army, and NASA. The helicopter was flown in what is referred to in this paper as the Atlanta Short Haul Mission (ASHM). This mission involved numerous short flights to pick up and deliver packages and freight. Data recorded during the period, together with pilot flight records and maintenance records were furnished by PHI to BHTI for analysis. The results of the analysis of the ASHM were compared to results from an offshore oil support Gulf Coast Mission (GCM) which involved longer level flights at cruise airspeed. The purpose of the program was to acquire usage data for the ASHM and to perform component fatigue life calculations and damage tolerance evaluations for selected critical dynamic components, referred to here as Principal Structural Elements (PSE’s). Although the usage was more severe for the ASHM than the GCM, the results of the comparison showed that usage monitoring would provide benefits in extending retirement times or inspection intervals, compared to certification, especially if high/low altitude effects were considered. In addition to usage monitoring evaluations, guidelines for HUMS certification are discussed along with simplified ”mini-HUMS” approaches to provide low cost systems with high return on investment. The lives and inspection intervals determined for purposes of this study should not be used to draw any conclusions concerning certification or continued airworthiness of the Model 412 helicopter.
Author
Monitors; Research; Evaluation; Loads (Forces); Tolerances (Mechanics); Fatigue (Materials)

19990046358 Industrial Marine Products Group Ltd., Aerospace Div., Halifax, Nova Scotia Canada
CP140 (P3) Structural Data Recording System
Oore, M., Industrial Marine Products Group Ltd., Canada; Crocker, D. H., National Defence Headquarters, Canada; November 1998; 12p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Each of the Canadian CP140/CP140A aircraft, variants of the Lockheed P-3C, has been equipped with a Structural Data Recording System (SDRS) to facilitate Individual Aircraft Tracking (IAT). One of the objectives of the system is to provide usage monitoring data that will enable the Canadian Forces (CF) to quantify individual aircraft fatigue usage and crack growth rates from which optimized inspection times can be calculated. Thus inspection frequency and costs can be reduced while the safety of the aircraft is ensured. This article provides a brief description of the SDRS and related experience acquired during the five years of system usage and data collection. An overview of the parameters recorded by the SDRS is presented as well as examples of data recorded in flight and their significance. Strain sensor recording rise/fall criteria are discussed in the context of minimizing the volume of recorded data while capturing significant data. A rise/fall criteria sensitivity study, conducted to optimize selection of the triggering gate value, is presented. Since the SDRS zeros strain sensor readings at the beginning of each flight, a strain offset determination method was developed in order to calculate absolute strain values. This method has been substantiated by calibration tests that included validation of a Finite Element (FE) model of the wing and verification of the SDRS strain measuring system. Studies performed to assess the adequacy of the SDRS strain resolution are also presented. Overall it is demonstrated that SDRS data can be used to generate sufficiently accurate stress spectra for fatigue and crack growth analyses.
Author
Safety; Data Recording; Data Acquisition; Crack Propagation; Aircraft Detection; Inspection; Dynamic Structural Analysis

19990046359 Sabena Belgian World Airlines, Brussels, Brabant, Belgium

NATO TCA Cycle Counting Study and its Applications

Moyson, E., Sabena Belgian World Airlines, Brussels, Belgium; November 1998; 8p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Three former Sabena 707-329c's were modified and transferred to NATO as AWACS trainer and transport aircraft. Compared to commercial B707's the Trainer Cargo Aircraft (TCA) accumulate more cycles including touch and go landings. One engine out landings and aerial refueling training are significantly more damaging in some structural areas. For operational flexibility, no mission profiles are defined. TCA missions are variable combinations of different mission events. Available data in the area of loads, stresses, fatigue and fracture mechanics are used to develop a comparative crack growth relation between TCA events and commercial B707-320c flights. After adjustment of cycle intervals i.a.w. the cycle counting study, all structural inspection requirements were consolidated in a calendar based integrated maintenance program. The design service objectives are extended and major structural modifications can significantly be postponed.

Author

Crack Propagation; Damage; Education; Fatigue (Materials); Training Devices; Transport Aircraft; Research

19990046360 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands

F-16 Loads/Usage Monitoring

Spiekhout, D. J., National Aerospace Lab., Netherlands; November 1998; 10p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Load monitoring of the F-16 fleet of the RNLAF has been carried out by NLR as a routine program since 1990. At that time the old system was replaced by an electronic device capable of analysing in flight the signal of a strain gage bridge. In later years, updates of the hardware have been implemented in order to record also some flight and engine parameters. Furthermore, collecting of administrative data has been integrated in the routine RNLAF maintenance debriefing procedures. In recent years development of a complete new load monitoring system took place. This system is fully integrated in the operational- and maintenance- procedures of the RNLAF. Main characteristics are an increase of the number of strain gage bridges to five and a fleet wide implementation. Besides flight parameters, engine and avionics parameters are being measured. Ground stations for data handling are located at the squadrons and at NLR. by using up to date data base management programs, results are presented to the RNLAF on a weekly basis.

Author

Loads (Forces); Monitors; F-16 Aircraft; Strain Gages

19990046361 National Defence Headquarters, Directorate of Technical Airworthiness, Ottawa, Ontario Canada

CC130 Data Analysis System for OLM/IAT

vandenHoeven, A. M., National Defence Headquarters, Canada; November 1998; 8p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Canadian CC130 fleet was fitted with a Operational Loads Monitoring and Individual Aircraft Tracking (OLM/IAT) system to assess usage severity. This article details the project that assembled the system to analyze the data and interpret the trends of aircraft structural fatigue. The CC130 Data Analysis System (DAS) was developed to process and analyze both parametric and strain data and assess usage severity using a fracture mechanics basis. The DAS development included innovative ideas on processing complex aircraft loads data by using an "engineer in the loop" process. Quick look analysis was also enabled by pre-processing validation data and plotting all parameters. The transfer functions were developed using a finite element model and flight test calibration data. The fracture mechanics models were validated through a comprehensive coupon testing program. Fleet management tools were developed to allow component based tracking of inspection requirements, usage severity trending and prediction of future aircraft role assignments. The DAS system has provided a sound engineering solution to the problem of assessing operational loads data for the CC130. This paper concludes with some of the lessons learned in achieving a solution to integrating a new manner of processing OLM data.

Author

Data Processing; Fatigue (Materials); Trends; Plotting; Mathematical Models; Fracture Mechanics; Flight Tests; Aircraft Structures

19990046362 Boeing North American, Inc., Seal Beach, CA USA

Service Life Monitoring of the B-1B and the Impact on Flight Operations and Structural Maintenance

Denyer, Anthony G., Boeing North American, Inc., USA; November 1998; 12p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The paper reviews the B-1 B Bomber fleet monitoring program that records the service environment and tracks individual aircraft for potential damage. The entire 100 aircraft fleet was equipped with a solid state flight data recorder that monitors both flight parameters and loads. The paper will describe the onboard data collection system and outline the analytic tools used to translate the recorded data into inspection and maintenance requirements as well as assessing the economic life of the structure. The paper will compare service usage with the design specification usage showing that usage to date is significantly more severe than that for which the aircraft was designed. Due to the severity of the recorded usage data the entire structure was reanalyzed during the 1993 to 1995 time period with the results showing a reduction in the economic life and a potential need for a reduction in inspection intervals. Implemented and proposed actions to offset the impact of the current severity of flight operations are described. These include a review of the analytic methodology, continued individual aircraft monitoring, a test program to provide data in support of inspection intervals, proposed operational changes, analytical condition inspections and a revised fuel management schedule. Finally the paper will discuss the lessons learned in efficiently handling large quantities of recorded data and the importance of monitoring service usage for early detection of usage severity that will impact the structural integrity.
Author
Life (Durability); Service Life; Monitors; B-1 Aircraft; Bomber Aircraft; Structural Failure; Maintenance; Data Acquisition

19990046363 British Aerospace Defence Ltd., Military Aircraft and Aerostructures, Preston, UK
Eurofighter 2000: An Integrated Approach to Structural Health and Usage Monitoring
Hunt, S. R., British Aerospace Defence Ltd., UK; Hebden, I. G., British Aerospace Defence Ltd., UK; November 1998; 12p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper outlines the Structural Health Monitoring system being developed for Eurofighter 2000. The system is designed as an integral part of the avionics system, both on and off-aircraft, enabling the customer to perform fleet-wide monitoring of fatigue life and significant structural loading events.
Author
Fatigue Life; Monitors; Structural Stability

19990046416 NASA Langley Research Center, Hampton, VA USA
Modeling and Validation of a Navy A6-Intruder Actively Controlled Landing Gear System
Horta, Lucas G., NASA Langley Research Center, USA; Daugherty, Robert H., NASA Langley Research Center, USA; Martinson, Veloria J., NASA Langley Research Center, USA; May 1999; 32p; In English
Contract(s)/Grant(s): RTOP 522-18-11-04
Report No.(s): NASA/TP-1999-209124; NAS 1.60:209124; L-17817; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Concepts for long-range air travel are characterized by airframe designs with long, slender, relatively flexible fuselages. One aspect often overlooked is ground-induced vibration of these aircraft. This paper presents an analytical and experimental study of reducing ground-induced aircraft vibration loads by using actively controlled landing gear. A facility has been developed to test various active landing gear control concepts and their performance, The facility uses a Navy A6 Intruder landing gear fitted with an auxiliary hydraulic supply electronically controlled by servo valves. An analytical model of the gear is presented, including modifications to actuate the gear externally, and test data are used to validate the model. The control design is described and closed-loop test and analysis comparisons are presented.
Author
Active Control; Control Theory; Landing Gear; Servomechanisms; Valves; Vibration; Mathematical Models; Control Systems Design; Dynamic Control; Dynamic Tests

19990046430 Naval Postgraduate School, Monterey, CA USA
Naval Command and Control for Future UAVs
Majewski, Stephen E.; Mar. 1999; 62p; In English
Report No.(s): AD-A361851; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The primary purpose of this thesis is to examine the requirements of naval command and control for future Unmanned Aerial Vehicles (UAV) and to propose solutions for current limitations. Currently, UAVs co-exist as a collection of independent systems that have poor interoperability and limited functionality beyond strategic reconnaissance. As UAVs mature, they will increasingly be deployed at the unit level and employed tactically, increasing the need for coordination and the dissemination of information. Command and control systems must evolve to keep pace with this development. A description of contemporary and proposed

UAV systems is presented, and this Thesis uses a scenario to illustrate current limitations and develop the requirements for UAV command and control.
DTIC
Pilotless Aircraft; Deployment; Command and Control

19990046485 Congressional Budget Office, Washington, DC USA
Options for Enhancing the Department of Defense's Unmanned Aerial Vehicle Programs
Sep. 1998; 80p; In English
Report No.(s): AD-A361671; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Department of Defense spends about $600 million a year on various programs to develop unmanned aerial vehicles (UAVs). Historically, however, the department has had trouble developing and fielding UAV systems. Currently, two UAVs have been deployed or are in production (Pioneer and Predator), and three more are in development (Outrider, Global Hawk, and Darkstar). This Congressional Budget Office (CBO) paper reviews the plans, requirements, and costs for the Department of Defense's UAV programs. It also examines five options intended either to address problems in those programs or to make greater use of UAVs' potential as cheap, unmanned reconnaissance systems. The analysis was requested by the Ranking Minority Member of the Senate Committee on Armed Services. In keeping with CBO's mandate to provide objective and nonpartisan analysis, this paper makes no recommendations.
DTIC
Congressional Reports; Reconnaissance Aircraft; Pilotless Aircraft

19990046584 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Workshop on Helicopter Health and Usage Monitoring Systems
Forsyth, Graham F., Editor; Feb. 1999; 234p; In English, Feb. 1999, Melbourne, Australia
Report No.(s): AD-A361854; DSTO-GD-0197; DODA-AR-010-812; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Over the last 10 years, helicopter Health and Usage Monitoring Systems (HUMS) have moved from the research environment to being viable systems for fitment to civil and military helicopters. In the civil environment, the situation has reached the point where it has become a mandatory requirement for some classes of helicopters to have HUMS fitted. Military operators have lagged their civil counterparts in implementing HUMS, but that situation appears set to change with a rapid increase expected in their use in military helicopters. A DSTO-sponsored Workshop was held in Melbourne, Australia, in February 1999 to discuss the current status of helicopter HUMS and any issues of direct relevance to military helicopter operations.
DTIC
Military Helicopters; Aircraft Maintenance; Systems Health Monitoring

19990046618 Army Vehicle Technology Center, Hampton, VA USA
Damage Tolerance Issues as Related to Metallic Rotorcraft Dynamic Components
Everett, R. A., Jr., Army Vehicle Technology Center, USA; Elber, W., Army Vehicle Technology Center, USA; 1999; In English; Aging Systems: Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft, 21-22 Apr. 1999, Corfu, Greece; Sponsored by North Atlantic Treaty Organization, Belgium; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

In this paper issues related to the use of damage tolerance in life managing rotorcraft dynamic components are reviewed. In the past, rotorcraft fatigue design has combined constant amplitude tests of full-scale parts with flight loads and usage data in a conservative manner to provide "safe life" component replacement times. In contrast to the safe life approach over the past twenty years the USA Air Force and several other NATO nations have used damage tolerance design philosophies for fixed wing aircraft to improve safety and reliability. The reliability of the safe life approach being used in rotorcraft started to be questioned shortly after presentations at an American Helicopter Society's specialist meeting in 1980 showed predicted fatigue lives for a hypothetical pitch-link problem to vary from a low of 9 hours to a high in excess of 2594 hours. This presented serious cost, weight, and reliability implications. Somewhat after the U.S. Army introduced its six nines reliability on fatigue life, attention shifted towards using a possible damage tolerance approach to the life management of rotorcraft dynamic components. The use of damage tolerance in life management of dynamic rotorcraft parts will be the subject of this paper. This review will start with past studies on

using damage tolerance life management with existing helicopter parts that were safe life designed. Also covered will be a successful attempt at certifying a tail rotor pitch rod using damage tolerance, which was designed using the safe life approach. The FAA review of rotorcraft fatigue design and their recommendations along with some on-going U.S. industry research in damage tolerance on rotorcraft will be reviewed.
Author
Helicopters; Research Aircraft; Tolerances (Mechanics); Damage

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.

19990045975 Civil Aeromedical Inst., Oklahoma City, OK USA
A Usability Survey of Global Positioning System Avionics Equipment: Some Preliminary Findings ***Final Report***
Joseph, Kurt M., Civil Aeromedical Inst., USA; Nendick, Michael D., Newcastle Univ., Australia; Jahns, Dieter W., SynerTech Associates, USA; St.George, Ross, Civil Aviation Authorty, New Zealand; March 1999; 12p; In English
Report No.(s): DOT/FAA/AM-99/9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The rapid introduction of Global Positioning System (GPS) receivers for airborne navigation has outpaced the capacity of international aviation authorities to resolve human factors issues that concern safe and efficient use of such devices. Current certification technical standards appear to have had little influence on standardizing receiver architectures, interfaces, and operating manuals-despite evidence from research simulation and flight tests that lack of standardization may undermine safety. The present research used factor-analytic techniques to reduce 308 pilots' ratings from a 163-item survey to 24 factors. These factors are suitable for identifying human factors issues related to GPS receiver displays and controls, operating procedures, navigation performance, training, and other topical areas. Multivariate analysis of variance revealed that GPS experience and receiver type influenced pilot ratings for several of these factors. The results of this limited survey are consistent with previous research, and their application to certification procedures and standards is discussed.
Author
Global Positioning System; Surveys; Standardization; Multivariate Statistical Analysis; Flight Simulation; Certification; Analysis of Variance; Air Navigation

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.

19990046104 Alenia Aeronautica, Turin, Italy
Initial Engine Relight Test on Eurofighter 2000
Bragagnolo, N., Alenia Aeronautica, Italy; Ferretti, A., Alenia Aeronautica, Italy; Venanzetti, M., Italian Air Force, Italy; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 211-231; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The Eurofighter 2000 Programme is developed by a four Nations Consortium involving Germany, Italy, Spain and UK. The Flight Test Departments of the Eurofighter partners companies (ALN, BAe, CASA, DASA) have evolved a test program consisting of seven instrumented prototypes tasked with different test objectives and aiming to provide a Release to Service for the production Aircraft by the year 2001. Within the EF2000 program, the Defence Ministries of the four Nations tasked their Official Test Centers to assess the status of the program development. This lecture highlights the steps undertaken by Alenia, upon agreement with the Officials, on the subject of the integration of the new engine (EJ200, developed by the Engine Consortium Manufactures, Eurojet) onto the Eurofighter 2000 Aircraft.
Author
Prototypes; Engine Control; Management Planning

19990046356 Defence Evaluation Research Agency, Structural Materials Center, Farnborough, UK
Development and Validation of Algorithms for Engine Usage Monitoring Systems
Henderson, M. B., Defence Evaluation Research Agency, UK; Harrison, G. F., Defence Evaluation Research Agency, UK; November 1998; 10p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The design techniques used to provide the required component life with the safety levels imposed by the regulatory authorities are discussed. The development and validation of materials algorithms to determine the rate at which this life is consumed under service usage for the usage recorders are described. For lifting highly stressed engine components two of the most important variables are the piece of material that an individual component is made from, and the way in which the engine is used. Engines contain a number of highly loaded parts which are only released for limited service usage. At the end of the design and development process each part is qualified to the extent that a service life is 'declared' by the design authority. When a component reaches this declared life it is withdrawn from use. Life limitation is based on assessment of the low cycle fatigue, thermal fatigue and/or creep service capability of the component under consideration and engine life consumption is based on the stresses, strains and temperatures experienced at critical areas depending on the mission profiles, engine intake conditions, individual pilot reactions and several other parameters.
Author
Algorithms; Engine Inlets; Monitors; Service Life

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.

19990044103 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Close Formation Flight Control
Proud, Andrew W.; May 1999; 147p; In English
Report No.(s): AD-A361704; AFIT/GE/ENG/99M-24; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In this research the close formation flight control problem is addressed. The formation consists of a lead and wing aircraft, where the wing flies in close formation with the lead, such that the lead's vortices produce aerodynamic coupling effects, and a reduction in the formation's drag is achieved. A controller, i.e., a formation-hold autopilot for the wing aircraft, is designed such that the formation's geometry is maintained in the face of lead aircraft maneuvers. In the formation flight control system, the wing and lead aircraft dynamics are coupled due to kinematic effects, and, in the case of close formations, additional aerodynamic coupling effects are introduced. In the research these additional aerodynamic coupling effects are properly modeled. The most significant aerodynamic coupling effect introduced by close formation flight entails the coupling of the lateral/directional channel into the altitude-hold autopilot channel. It is shown that formation hold autopilots designed ignoring the aerodynamic coupling effects, yield satisfactory performance in close formation flight.
DTIC
Aerodynamic Forces; Aerodynamic Characteristics; Flight Control

19990045727 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Multiple Model Adaptive Estimation Using Filter Spawning
Fisher, Kenneth A.; Mar. 1998; 229p; In English
Report No.(s): AD-A361774; AFIT/EN/ENG/99M-09; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Multiple Model Adaptive Estimation with Filter Spawning is used to detect and estimate partial actuator failures on the VISTA F-16. The truth model is a full six-degree-of-freedom simulation provided by Calspan and General Dynamics. The design models are chosen as 13-state linearized models, including first order actuator models. Actuator failures are incorporated into the truth model and design model assuming a "failure to free stream . Filter Spawning is used to include additional filters with partial actuator failure hypotheses into the Multiple Model Adaptive Estimation (MMAE) bank. The spawned filters are based on varying degrees of partial failures (in terms of effectiveness) associated with the complete-actuator-failure hypothesis with the highest conditional probability of correctness at the current time. Thus, a blended estimate of the failure effectiveness is found using the filters' estimates based upon a no-failure hypothesis (or, an effectiveness of 100%), a complete actuator failure hypothesis (or, an effectiveness of 0%), and the spawned filters' partial-failure hypotheses. This yields substantial precision in effectiveness

estimation, compared to what is possible without spawning additional filters, making partial failure adaptation a viable methodology in a manner heretofore unachieved.
DTIC
Kalman Filters; F-16 Aircraft; Adaptive Control

19990046108 Air Force Systems Command, Wright-Patterson AFB, OH USA
F-16 Stability and Control Certification Testing With Digital Flight Control System Improvements (or how we Learned to Manage Risk)
Taschner, Michael J., Air Force Systems Command, USA; Janzen, Doyle B., Air Force Flight Test Center, USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 290-306; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

Risk management lessons learned are presented from an Block 40/50 stability and control certification flight test program. Departure resistance enhancements significantly improved the maneuvering limits of the F-16 with large air-to-air missile lateral asymmetries. However post-departure characteristics following high-energy yaw departures proved problematic. Loadings with large lateral asymmetries and inlet pods demonstrated highly-dynamic upright spins. Deep stall recovery procedures were inadequate and on two occasions the spin chute was deployed to ensure aircraft recovery. Flight testing with inlet pods was suspended while test safety procedures were refined and an upright spin recovery procedure developed. The new procedures allowed successful completion of the program without further incident. Timeless risk management lessons were relearned in areas such as hazard identification risk assessment when performance is near ultimate achievable levels and developing viable risk control measures. Tough benefit-cost trade-offs were made to balance user requirements with flight test risk.
Author
F-16 Aircraft; Flight Control; Stability; Flight Tests; User Requirements; Certification

19990046110 Royal Air Force, London, UK
Meeting the UK's Future STOVL Recovery Requirements
Paines, Justin, Royal Air Force, UK; Stone, Paul, Royal Navy, UK; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 323-337; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

The UK's future STOVL recovery requirements are reviewed in the light of Harrier VSTOL operations and the impact of the Harrier's unique VSTOL capabilities. A description of the Vectored-thrust Aircraft Advanced Control programme and its background is followed by an account of the development and flight test of its major safety mechanism, the Independent Monitor (M). Various STOVL lessons learned are re-counted, with particular relevance to the renaissance in STOVL flight test which will accompany the development of the Joint Strike Fighter (JSF) STOVL variant. These lessons include the impact of performance limitations on jet-borne flight test and the unpredictability of the partially jet-borne STOVL transition regime. The choices to be faced in the design of advanced STOVL flight control are considered along with the balance between the benefits of highly automated digital flight control for STOVL and potential loss in pilot flexibility. Plans for future research are reviewed.
Author
Aircraft Control; Automatic Control; Digital Systems; Flight Control

19990046114 Flight Test Squadron (420th), Edwards AFB, CA USA
B-2A Residual Pitch Oscillation (RPO) Investigation
Moss, Christopher, Flight Test Squadron (420th), USA; Shifflett, Samuel, Flight Test Squadron (420th), USA; 1997 Report to the Aerospace Profession: Forty First Symposium Proceedings; Sep. 1997, pp. 393-410; In English; See also 19990046095; Copyright; Avail: Issuing Activity (Society of Experimental Test Pilots, Lancaster, CA), Hardcopy, Microfiche

In September of 1992, low altitude/high speed (LAHS) residual pitch oscillations (RPO) were first reported during a loads expansion test. During straight and level flight at 500 feet altitude with a forward center of gravity (cg), oscillations of 1.0 to 1.6 Hz frequency and + magnitude were observed, and a + 0.2g oscillation was observed during an airspace management turn. The magnitude of the oscillation seemed to be dependent on cg and Mach number. Increasing angle of attack (AOA) above trim also increased the magnitude of the oscillation. At the time, postnight analysis indicated the oscillations were most likely caused by aerodynamic and actuator characteristics that combined to reduce short period damping and stability margins. An actuator deadband had been responsible for similar oscillations at high and medium altitudes, and those oscillations were eliminated with hardware and software modifications. An interim limit restricted forward cg at high airspeed until the damping could be improved. The oscillation was not considered to be possible flutter, as flutter testing had already cleared this Mach/altitude condition for all configurations. Later, it would be known that this oscillation was not only dependent on cg, but also outboard fuel loading and

payload. Though the flutter clearance flights had thoroughly tested the LAHS regime, the aircraft configurations used, which flutter analysis had predicted to be the critical configurations, were not conducive to RPO. As a result, flutter testing only saw small oscillations that were attributed to the same actuator non-linearity.
Author
Oscillations; Research; B-2 Aircraft; Aerodynamic Characteristics; Angle of Attack; Center of Gravity; Flutter Analysis

19990046435 NASA Dryden Flight Research Center, Edwards, CA USA
Simulator Evaluation of Simplified Propulsion-Only Emergency Flight Control Systems on Transport Aircraft
Burcham, Frank W., Jr., NASA Dryden Flight Research Center, USA; Kaneshige, John, NASA Ames Research Center, USA; Bull, John, Caelum Research Corp., USA; Maine, Trindel A., NASA Dryden Flight Research Center, USA; June 1999; 49p; In English
Contract(s)/Grant(s): RTOP 522-35-14
Report No.(s): NASA/TM-1999-206578; NAS 1.15:206578; H-2331; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the advent of digital engine control systems, considering the use of engine thrust for emergency flight control has become feasible. Many incidents have occurred in which engine thrust supplemented or replaced normal aircraft flight controls. In most of these cases, a crash has resulted, and more than 1100 lives have been lost. The NASA Dryden Flight Research Center has developed a propulsion-controlled aircraft (PCA) system in which computer-controlled engine thrust provides emergency flight control capability. Using this PCA system, an F-15 and an MD-11 airplane have been landed without using any flight controls. In simulations, C-17, B-757, and B-747 PCA systems have also been evaluated successfully. These tests used full-authority digital electronic control systems on the engines. Developing simpler PCA systems that can operate without full-authority engine control, thus allowing PCA technology to be installed on less capable airplanes or at lower cost, is also a desire. Studies have examined simplified ?PCA Ultralite? concepts in which thrust control is provided using an autothrottle system supplemented by manual differential throttle control. Some of these concepts have worked well. The PCA Ultralite study results are presented for simulation tests of MD-11, B-757, C-17, and B-747 aircraft.
Author
Flight Control; Simulators; Transport Aircraft; Digital Systems; Engine Control; Thrust Control

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).

19990045708 NASA Marshall Space Flight Center, Huntsville, AL USA
Uncertainty Analysis of the NASA MSFC 14-inch Trisonic Wind Tunnel
Springer, Anthony M., NASA Marshall Space Flight Center, USA; Walker, Holly J., NASA Marshall Space Flight Center, USA; Frost, Alonzo, NASA Marshall Space Flight Center, USA; 1999; In English; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): X-33/242-22/EZ
Report No.(s): AIAA Paper 99-0684; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An uncertainty analysis was performed on the NASA MSFC 14-inch trisonic wind tunnel using the AIAA standard for the assessment of wind tunnel data uncertainty and the methodology presented in the AGARD report 'Quality Assessment for Wind Tunnel Testing.' This analysis shows what the major contributing factors to the overall data uncertainty of the resultant wind tunnel data are and how these contributing factors can be reduced. The basic analysis was performed for the facility operational parameters, flow conditions, and then the effects over the Mach range of 0.3 to 5.0 on the final aerodynamic data coefficients. The effects of changing accuracy, conditions, precision, and biases at the various Mach numbers were analyzed. The analysis was performed for two main systems the facility flow conditions mentioned above and the model instrumentation including the strain gauge balance, pressure system, and supporting instrumentation. A detailed analysis of the stain gauge balance is not presented. This analysis serves as a reference for the 14-inch wind tunnels customers, users and other facilities undertaking an analysis of their facilities.
Author
Accuracy; Aerodynamics; Measuring Instruments; Trisonic Wind Tunnels

19990045720 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Development of Site Characterization Simulator

Kassel, Neil W.; Mar. 1999; 124p; In English

Report No.(s): AD-A361724; AFIT/GEE/ENG/99M-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The purpose of this study was to develop a tool for Remedial Project Managers (RPMs) to learn and practice the site characterization process. One of the key difficulties encountered by RPMs during site characterization is the need to develop a model of the site based on limited data. These limited data are used to determine parameters that describe hydrogeologic and contaminant properties (aquifer hydraulic conductivity, contaminant concentration, etc.) and are obtained using sampling techniques that interrogate a very small volume, usually much smaller than node spacing of the computer model used to simulate site conditions. The value of the parameter being measured in the field and used in modeling the site is therefore a function of both the sampling location and the volume (of water, aquifer) interrogated. This research identified techniques to incorporate the impact of spatial variability and sampling method (particularly, sampling volume and method error) in a site characterization simulator.

DTIC

Computerized Simulation; Spatial Distribution; Models; Aquifers

19990045814 Naples Univ., Italy

The Study of Aircraft Trajectory on Airport Surfaces

Tocchetti, Andrea, Naples Univ., Italy; Bruno, Vincenzo, Naples Univ., Italy; deRisodiCarpinone, Vittorio, Naples Univ., Italy; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 1; 18p; In English; See also 19990045796; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A study the maneuvering of an aircraft through a curve in the runway is described. The problem of studying a geometry of exit paths was undertaken so that the aircraft trajectory while taxiing can be made more secure, and at the same time improve the traffic capacity of the runway.

CASI

Airports; Runways; Taxiing; Airfield Surface Movements; Runway Conditions; Trajectories

19990045904 NASA Johnson Space Center, Houston, TX USA

Ellington Field: A Short History, 1917-1962

Carlson, Erik, NASA Johnson Space Center, USA; Feb. 1999; 56p; In English

Report No.(s): NASA/CR-1999-208921; NAS 1.26:208921; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This document details the chronological history of an air field in Southeast Texas that currently serves as an adjunct to NASA Johnson Space Center as well as a civilian/military air field. The field was built early in the 20th century, soon after airplane flight became a recognized factor in American military applications, was central to a wide variety of military uses throughout this century, and remains viable for such purposes in addition to serving a vital role in NASA's training of astronauts.

Author

Airports; Military Aircraft; Aircraft Design; Pilots; Airport Planning

19990046017 National Aerospace Lab., Tokyo Japan

Starting Loads in Supersonic Engine Wind Tunnels

Sakuranaka, N.; Shimura, T.; Mitani, T.; Izumikawa, M.; Tomioka, S.; Oct. 1998; 30p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB99-141558; NAL-TR-1360; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Starting loads, which are especially severe in free-jet type engine wind tunnels, were investigated in order to carry out accurate and safe force measurement. Unsteady pressures and forces were measured and analyzed by fast Fourier transform (FFT). Expected maximum peak load of the Ramjet Engine Test Facility (FJTF) was predicted from power spectral density and probability distribution using the results of a pilot wind tunnel test. Visual observation was also conducted and combined with the results of unsteady pressure measurement to clarify the cause of the large starting loads. The cause was considered to be the flow structure in which nozzel flow is recompressed by a separation oblique-shock wave and impinges on the model installed on a force measuring system (FMS).

NTIS

Test Facilities; Supersonic Wind Tunnels; Fast Fourier Transformations; Loads (Forces)

19990046213 National Aerospace Lab., Tokyo Japan

Estimating Aerodynamic Characteristics of the ALFLEX Vehicle Using Flight Test Data and Comparison with Wind Tunnel Test Data

Yanagihara, M.; Shigemi, M.; Suito, T.; Jul. 1998; 40p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB99-141517; NAL-TR-1353; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

One of the purposes of the Automatic Landing Flight Experiment (ALFLEX) is to estimate the aerodynamic characteristics of a vehicle with a delta wing and tip fins. The tests for this purpose, such as alpha and beta sweep tests and control surface excitation test, were conducted during the hanging flights and automatic landing flights. by analyzing the flight test data obtained at the Woomera test site in Australia, the aerodynamic characteristics of the ALFLEX vehicle were estimated and the results were compared with one predicted by several wind tunnel tests. As a result, the differences between the estimated characteristics and the results of the basic wind tunnel test were within the variation. Some other wind tunnel tests, however, showed significantly different results from the flight tests. These differences seemed to be caused by errors of the wind tunnel tests due to, for example, the effect of the supporting device.

NTIS

Aerodynamic Characteristics; Wind Tunnel Tests; Flight Tests; Control Surfaces

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19990046232 Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine, France

Aerospace 2020, Volume 2 ***Aeronautique et espace a l'horizon 2020, Volume II***

December 1998; 224p; In French

Report No.(s): AGARD-AR-360-Vol-2(F); ISBN 92-836-2002-X; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche

Volume II, is the main document of the "Aerospace 2020" report by the NATO Advisory Group for Aerospace Research and Development (AGARD). This study examines the most advanced aerospace technologies currently under development or study. It centers on what are now considered to be the most promising technologies, as well as structural and tactical consequences they will have on the theater of operations and on systems over the next 25 years. Subjects covered include the impact of proliferation, man-machine interaction, synthetic environments, directed-energy armaments, information technology, unpiloted tactical aircraft, suborbital launchers, hypersonic missiles as well as a discussion of acceptable acquisition costs. The technologies are evaluated from two viewpoints: as assets and as threats. Remarks and recommendations are presented.

Transl. by Schreiber

Aerospace Engineering; North Atlantic Treaty Organization (NATO); Technology Assessment; Military Operations; Defense Program

19990046432 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Proceedings of the 1999 Space Control Conference (17th), held on 13-15 April 1999

Spence, L. B.; Apr. 1999; 200p; In English

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

Report No.(s): AD-A361857; STK-254; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The seventeenth Annual Space Control Conference sponsored by ESC and co-hosted by MIT Lincoln Laboratory and the AF Research Laboratory was held on 13, 14, and 15 April 1999. The purpose of this series of conferences is to provide a forum for the presentation and discussion of space control issues. This proceedings documents those presentations from this conference that were received in time for pre-conference publication. The papers contained were reproduced directly from copies supplied by their authors (with minor mechanical changes where necessary). It is hoped that this publication will enhance the utility of the conference.

DTIC

Control; Aerospace Engineering

13
ASTRODYNAMICS

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

19990046776 NASA Goddard Space Flight Center, Greenbelt, MD USA
Optimal Variable-Structure Control Tracking of Spacecraft Maneuvers
Crassidis, John L., Texas A&M Univ., USA; Vadali, Srinivas R., Texas A&M Univ., USA; Markley, F. Landis, NASA Goddard Space Flight Center, USA; 1999; In English; Flight Mechanics, 18-20 May 1999, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An optimal control approach using variable-structure (sliding-mode) tracking for large angle spacecraft maneuvers is presented. The approach expands upon a previously derived regulation result using a quaternion parameterization for the kinematic equations of motion. This parameterization is used since it is free of singularities. The main contribution of this paper is the utilization of a simple term in the control law that produces a maneuver to the reference attitude trajectory in the shortest distance. Also, a multiplicative error quaternion between the desired and actual attitude is used to derive the control law. Sliding-mode switching surfaces are derived using an optimal-control analysis. Control laws are given using either external torque commands or reaction wheel commands. Global asymptotic stability is shown for both cases using a Lyapunov analysis. Simulation results are shown which use the new control strategy to stabilize the motion of the Microwave Anisotropy Probe spacecraft.
Author
Control Theory; Optimal Control; Spacecraft Control; Spacecraft Maneuvers

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

19990045852 NASA Johnson Space Center, Houston, TX USA
STS-96 FD Highlights and Crew Activities Report: Flight Day 05
May 31, 1999; In English; Videotape: 24 min. 19 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999068295; BRF-1418E; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this fifth day of the STS-96 Discovery mission, the flight crew, Commander Kent V. Rominger, Pilot Rick D. Husband, and Mission Specialists Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette, and Valery Ivanovich Tokarev are seen performing logistics transfer activities within the Discovery/International Space Station orbiting complex. The crew transfers supplies, equipment, and water. Payette and Tokarev perform maintenance activities on the storage batteries in the Zarya module. Barry and Tokarev install acoustic insulation around some of the fans inside Zarya. Jernigan and Husband install shelving in 2 soft stowage racks. Husband and Barry troubleshoot and perform maintenance activities on the Early Communications System. At the end of the workday, Rominger, Jernigan, and Barry discussed the progress of the mission with NBC's "Today," CBS "This Morning," and CNN.
CASI
Discovery (Orbiter); Spacecrews; International Space Station; Zarya Control Module; Spacecrew Transfer

19990045853 NASA Johnson Space Center, Houston, TX USA
STS-96 FD Highlights and Crew Activities Report: Flight Day 04
May 30, 1999; In English; Videotape: 21 min. 11 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999068294; BRF-1418D; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this fourth day of the STS-96 Discovery mission, the flight crew, Commander Kent V. Rominger, Pilot Rick D. Husband, and Mission Specialists Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette, and Valery Ivanovich Tokarev are seen performing final preparations for their space walk. Views of the crew helping Barry and Jernigan suit up for their mission is also presented. Ochoa uses the robot arm to maneuver Jernigan up to the space station module. During the space walk Barry and Jerni-

gan move two cranes, and three bags containing handrails and tools to the outside of the Unity module. They also install a thermal cover on a Unity trunnion pin, inspect peeling paint on Zarya and one of the two Early Communications System antennas on Unity.
CASI
Discovery (Orbiter); Spacecrews; International Space Station

19990045854 NASA Johnson Space Center, Houston, TX USA
STS-96 FD Highlights and Crew Activities Report: Flight Day 03
May 29, 1999; In English; Videotape: 18 min. 53 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999068293; BRF-1418C; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this third day of the STS-96 Discovery mission, the flight crew, Commander Kent V. Rominger, Pilot Rick D. Husband, and Mission Specialists Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette, and Valery Ivanovich Tokarev are seen executing the very first docking with the International Space Station. Also shown are views of the docking taken from both the Unity and Discovery. Final preparation for the mission's space walk is also presented. Jernigan and Barry check the tools and the emergency rescue backpacks they will need for their space walk. Ochoa and Jernigan perform leak and pressurization checks and open the hatch to the Unity module. Ochoa and Takarev store docking targets and lights and check the hatch seals in the narrow passageway. Rominger and Husband remove and store four electronic boxes around the Unity module.
CASI
Discovery (Orbiter); Spacecrews; International Space Station; Spacecraft Docking; Manned Space Flight; Unity Connecting Module

19990045855 NASA Johnson Space Center, Houston, TX USA
STS-96 FD Highlights and Crew Activities Report: Flight Day 02
May 28, 1999; In English; Videotape: 17 min. 15 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999068292; BRF-1418B; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this second day of the STS-96 Discovery mission, the flight crew, Commander Kent V. Rominger, Pilot Rick D. Husband, and Mission Specialists Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette, and Valery Ivanovich Tokarev are seen preparing for the docking with the International Space Station (Unity and Zarya modules). Ochoa and Payette open the tunnel and hatches leading to the SPACEHAB module in the payload bay. Payette and Tokarev place equipment in the module to create space in Discovery's cabin. Jernigan, Barry, Payette and Husband test three spacesuits. Ochoa and Payette also test a 50-foot robot arm. And Jernigan and Ochoa extend the outer ring of Discovery's Orbiter Docking System.
CASI
Discovery (Orbiter); Spacecrews; International Space Station; Unity Connecting Module; Zarya Control Module; Spacecraft Docking

19990045856 NASA Johnson Space Center, Houston, TX USA
STS-96 FD Highlights and Crew Activities Report: Flight Day 01
May 27, 1999; In English; Videotape: 17 min. 58 sec. playing time, in color, with sound
Report No.(s): NONP-NASA-VT-1999068291; BRF-1418A; No Copyright; Avail: CASI; A02, Videotape-VHS; A22, Videotape-Beta

On this first day of the STS-96 Discovery mission, the flight crew, Commander Kent V. Rominger, Pilot Rick D. Husband, and Mission Specialists Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette, and Valery Ivanovich Tokarev are seen performing pre-launch activities such as eating the traditional breakfast, crew suit-up, and the ride out to the launch pad. Also, included are various panoramic views of the shuttle on the pad. The crew is readied in the 'white room' for their mission. After the closing of the hatch and arm retraction, launch activities are shown including countdown, engine ignition, launch, and the separation of the Solid Rocket Boosters.
CASI
Discovery (Orbiter); Manned Space Flight; Spacecrews

19990046321 NASA Marshall Space Flight Center, Huntsville, AL USA
Orbital Debris Removal Using Ground Based Lasers
Campbell, Jonathan W., NASA Marshall Space Flight Center, USA; 1998; In English; Optical Science, Engineering and Instrumentation, 19-24 Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; Copyright;

Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The purpose of this research was to assess the feasibility of eliminating 1-10 cm size orbital debris using an integrated, ground based systems comprised of radar and electrooptical sensors and lasers. The radar would be used for day/night, all weather acquisition and coarse tracking and then hand off to the laser system for fine tracking and debris particle engagement.

Derived from text

Space Debris; Electro-Optics; Elimination; Tracking Radar; YAG Lasers

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.

19990044024 GenCorp Aerojet, Azusa, CA USA

Integrated Advanced Microwave Sounding Unit-A(AMSU-A). Performance Verification Reports: Final Comprehensive Performance Test Report, P/N: 1356008-1-TST, S/N: 202/A1

Haigh, R., GenCorp Aerojet, USA; November 1998; 554p; In English

Contract(s)/Grant(s): NAS5-32314

Report No.(s): NASA/CR-1998-209225; NAS 1.26:209225; AEROJET-11337; CDRL-208; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche

This is the Performance Verification Report, Final Comprehensive Performance Test Report, P/N 1356008-1-TST, S/N 202/A1 for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).

Author

Advanced Microwave Sounding Unit; Performance Tests; Earth Observing System (EOS); Documentation

19990044112 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Whole Spacecraft Vibration Isolation

Karahalis, Gregory G.; Mar. 1999; 169p; In English

Report No.(s): AD-A361679; AFIT/GSO/ENY/99M-05; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The Department of Defense identified launch vibration isolation as a major research interest. Reducing the loads a satellite experiences during launch will greatly enhance the reliability, lifetime, and payload to structure ratio. DoD satellite programs stand to benefit significantly from advances in vibration isolation technology.

DTIC

Vibration Isolators; Launching; Loads (Forces)

19990044115 Schafer (W. J.) Associates, Inc., Albuquerque, NM USA

STW/AR

Feb. 1999; 97p; In English

Contract(s)/Grant(s): N00014-97-D-2014/001

Report No.(s): AD-A361670; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The Air Force Research Laboratory (AFRL) has identified a need for professional technology support to develop space vehicle sensor technologies that are critical to future military Space Control counterspace defensive missions and architectures. The objectives of this task are to provide systems engineering, analytical and technical analysis and assessments, and program development and management support in support of AFRL Space Electronics and Protection branch of the Space Vehicles Directorate. The scope of this effort is to provide AFRL with an in-depth analysis, requirements definition, program planning, and experiment support for the Satellite Threat Warning and Attack Reporting (STW/AR) program. These technology programs directly address needs highlighted in the Space Control mission area. This effort encompasses a full range of activities related to the STW/AR technology program from helping to define the system-level requirements for focusing development activities and planned experiments, developing Concept of Operations (CONOPs) and future architectures, and providing quantitative analyses to support design, as well as technology development activities. This task requires working with many organizations within AFRL, the Air Force Space Command (AFSPC), the United States Space Command (USSPACECOM), and its other service components,

and other military and national organizations such as Defense Advanced Research Projects Agency (DARPA), the National Reconnaissance Organization (NRO), and National Aeronautics and Space Administration (NASA).
DTIC
Warning Systems; Space Missions; NASA Programs; Project Management; Project Planning

19990045701 GenCorp Aerojet, Azusa, CA USA
EOS/AMSU: A Blackbody Spacecraft Test Targets Operation and Maintenance Manual
Nov. 10, 1998; 21p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-209221; NAS 1.26:209221; AEROJET-11181; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the spacecraft test targets and readout console as described in section 5.3.3 of the performance specification S-480-80. The spacecraft targets are to be used to provide a well-known radiometric reference for testing the functionality of the AMSU-A instruments at the spacecraft contractor's facility.
Author
Maintenance; Manuals; Functional Design Specifications; Targets; Acceptability

19990045997 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Structural Emergence and the Collaborative Behavior of Autonomous Nano-Satellites
Petrovich, Daniel J.; Mar. 08, 1999; 233p; In English
Report No.(s): AD-A361744; AFIT/GE/ENG/99M-22; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The collaborative behavior of nano-satellites in a zero-gravity environment is explored, and satellite characteristics are proposed that maximize constellation robustness and minimize manufacturing costs. Behavioral algorithms are proposed to facilitate both swarming and structural formation and are validated using the Structural Emergence Simulator (STEMS) Graphical User Interface (GUl). A payload of multiple satellites is placed in a zero-gravity environment and released to re-configure autonomously into a pre-designed structure. Data transmission between satellites is not permitted during the swarming phase of the structure formation mission. A binary behavior algorithm is invented that produces a direction and magnitude solution to the satellite control system. A second behavior algorithm, the four-post algorithm, is invented to facilitate structure formation behavior. This algorithm switches satellite transmitter channels, effectively altering the path 0 incident swarming satellites. The algorithm is subject to two constraints: rules must be evaluated and acted upon locally, and the structure architecture must be known. Structural emergence is realized: the binary and four-post algorithms facilitate endless transitions from a gaseous swarming state to a solid structural state. Two methods of conserving fuel are discovered Fuel saving of 38% are realized by setting thruster levels based upon environmental noise, and fuel savings of 45% are realized by seeding structural formation prior to swarm equilibrium. Finally, analysis indicates a proportional relationship between architecture complexity and structure formation half-life.
DTIC
Graphical User Interface; Artificial Satellites; Algorithms; Structural Properties (Geology); Gravitation

19990046399 GenCorp Aerojet, Azusa, CA USA
Integrated Advanced Microwave Sounding Unit-A (AMSU-A). Engineering Test Report: AMSU EOS A1 Thermal Balance Test Correlation
Nov. 01, 1998; 12p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1999-209219; NAS 1.26:209219; AEROJET-11340; CDRL-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the thermal test correlation for Earth Observing System / Advanced Microwave Sounding Unit-A (EOS/AMSU A-1) system.
Author
Advanced Microwave Sounding Unit; Thermal Analysis; Thermal Stability; Steady State

19990046607 NASA Goddard Space Flight Center, Greenbelt, MD USA
Feasibility of Decentralized Linear-Quadratic-Gaussian Control of Autonomous Distributed Spacecraft
Carpenter, J. Russell, NASA Goddard Space Flight Center, USA; 1999; In English; Flight Mechanics, 18-20 May 1999, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A distributed satellite formation, modeled as an arbitrary number of fully connected nodes in a network, could be controlled using a decentralized controller framework that distributes operations in parallel over the network. For such problems, a solution that minimizes data transmission requirements, in the context of linear-quadratic-Gaussian (LQG) control theory, was given by Speyer. This approach is advantageous because it is non-hierarchical, detected failures gracefully degrade system performance, fewer local computations are required than for a centralized controller, and it is optimal with respect to the standard LQG cost function. Disadvantages of the approach are the need for a fully connected communications network, the total operations performed over all the nodes are greater than for a centralized controller, and the approach is formulated for linear time-invariant systems. to investigate the feasibility of the decentralized approach to satellite formation flying, a simple centralized LQG design for a spacecraft orbit control problem is adapted to the decentralized framework. The simple design uses a fixed reference trajectory (an equatorial, Keplerian, circular orbit), and by appropriate choice of coordinates and measurements is formulated as a linear time-invariant system.
Author
Linear Quadratic Gaussian Control; Control Theory; Spacecraft Control; Autonomous Navigation; Automatic Flight Control

19990046644 NASA Goddard Space Flight Center, Greenbelt, MD USA
Design of a Formation of Earth-Orbiting Satellites: The Auroral Lites Mission
Hametz, Mark E., AI Solutions, Inc., USA; Conway, Darrel J., AI Solutions, Inc., USA; Richon, Karen, NASA Goddard Space Flight Center, USA; 1999; In English; Flight Mechanics, 18-20 May 1999, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) has proposed a set of spacecraft flying in close formation around the Earth in order to measure the behavior of the auroras. The mission, named Auroral Lites, consists of four spacecraft configured to start at the vertices of a tetrahedron, flying over three mission phases. During the first phase, the distance between any two spacecraft in the formation is targeted at 10 kilometers (km). The second mission phase is much tighter, requiring satellite interrange spacing targeted at 500 meters. During the final phase of the mission, the formation opens to a nominal 100-km interrange spacing. In this paper, we present the strategy employed to initialize and model such a close formation during each of these phases. The analysis performed to date provides the design and characteristics of the reference orbit, the evolution of the formation during Phases I and II, and an estimate of the total mission delta-V budget. AI Solutions' mission design tool, FreeFlyer, was used to generate each of these analysis elements. The tool contains full force models, including both impulsive and finite duration maneuvers. Orbital maintenance can be fully modeled in the system using a flexible, natural scripting language built into the system. In addition, AI Solutions is in the process of adding formation extensions to the system facilitating mission analysis for formations like Auroral Lites. We will discuss how FreeFlyer is used for these analyses.
Author
Auroras; Auroral Irradiation; Aeronautical Satellites; Satellite Networks; Position (Location)

19990046716 Stanford Univ., Space Systems Development Lab., Stanford, CA USA
Autonomous Satellite Command and Control through the World Wide Web: Phase 3, *1 Jan. 1997 - 30 Sep. 1998*
Cantwell, Brian, Stanford Univ., USA; Twiggs, Robert, Stanford Univ., USA; 1998; 75p; In English
Contract(s)/Grant(s): NCC2-5202; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

NASA's New Millenium Program (NMP) has identified a variety of revolutionary technologies that will support orders of magnitude improvements in the capabilities of spacecraft missions. This program's Autonomy team has focused on science and engineering automation technologies. In doing so, it has established a clear development roadmap specifying the experiments and demonstrations required to mature these technologies. The primary developmental thrusts of this roadmap are in the areas of remote agents, PI/operator interface, planning/scheduling fault management, and smart execution architectures. Phases 1 and 2 of the ASSET Project (previously known as the WebSat project) have focused on establishing World Wide Web-based commanding and telemetry services as an advanced means of interfacing a spacecraft system with the PI and operators. Current automated capabilities include Web-based command submission, limited contact scheduling, command list generation and transfer to the ground station, spacecraft support for demonstrations experiments, data transfer from the ground station back to the ASSET system, data archiving, and Web-based telemetry distribution. Phase 2 was finished in December 1996. During January-December 1997 work was commenced on Phase 3 of the ASSET Project. Phase 3 is the subject of this report. This phase permitted SSDL and its project partners to expand the ASSET system in a variety of ways. These added capabilities included the advancement of ground station capabilities, the adaptation of spacecraft on-board software, and the expansion of capabilities of the ASSET management algorithms. Specific goals of Phase 3 were: (1) Extend Web-based goal-level commanding for both the payload PI and the spacecraft engineer; (2) Support prioritized handling of multiple PIs as well as associated payload experimenters; (3) Expand the number and types of experiments supported by the ASSET system and its associated spacecraft; (4) Implement more advanced

resource management, modeling and fault management capabilities that integrate the space and ground segments of the space system hardware; (5) Implement a beacon monitoring test; (6) Implement an experimental blackboard controller for space system management; (7) Further define typical ground station developments required for Internet-based remote control and for full system automation of the PI-to-spacecraft link. Each of those goals is examined in the next section. Significant sections of this report were also published as a conference paper.
Author
Remote Control; Resources Management; Scheduling; World Wide Web; Client Server Systems; Automatic Control; Satellite Control; Satellite Ground Support; Satellite Guidance; Satellite Communication

19990046740 NASA Marshall Space Flight Center, Huntsville, AL USA
The Propulsive Small Expendable Deployer System Experiment
Johnson, Les, NASA Marshall Space Flight Center, USA; Estes, Robert D., Smithsonian Astrophysical Observatory, USA; Lorenzini, Enrico, Smithsonian Astrophysical Observatory, USA; Martinez-Sanchez, Manual, Massachusetts Inst. of Tech., USA; Sanmartin, Juan, Madrid Univ., Spain; Mar. 24, 1999; 6p; In English
Contract(s)/Grant(s): RTOP 242-35-30; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Relatively short electrodynamic tethers can extract orbital energy to 'push' against a planetary magnetic field to achieve propulsion without the expenditure of propellant. The Propulsive Small Expendable Deployer System experiment will use the flight-proven Small Expendable Deployer System (SEDS) to deploy a 5 km bare copper tether from a Delta II upper stage to achieve approximately 0.4 N drag thrust, thus lowering the altitude of the stage. The experiment will use a predominantly 'bare' tether for current collection in lieu of the endmass collector and insulated tether approach used on previous missions. The flight experiment is a precursor to a more ambitious electrodynamic tether upper stage demonstration mission which will be capable of orbit raising, lowering and inclination changes - all using electrodynamic thrust. The expected performance of the tether propulsion system during the experiment is described.
Author
Deployment; Planetary Magnetic Fields; Propulsion; Tethering

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SPACECRAFT PROPULSION AND POWER

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

19990046250 NASA Marshall Space Flight Center, Huntsville, AL USA
Vacuum Plasma Spray (VPS) Forming of Solar Thermal Propulsion Components Using Refractory Metals
Zimmerman, Frank R., NASA Marshall Space Flight Center, USA; Hissam, David A., NASA Marshall Space Flight Center, USA; Gerrish, Harold P., NASA Marshall Space Flight Center, USA; Davis, William M., Boeing North America, Inc., USA; 1999; 5p; In English; Advanced Energy, 11-15 Apr. 1999, Maui, HI, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 242-73-10; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Thermal Spray Laboratory at NASA's Marshall Space Flight Center has developed and demonstrated a fabrication technique using Vacuum Plasma Spray (VPS) to form structural components from a tungsten/rhenium alloy. The components were assembled into an absorber cavity for a fully-functioning, ground test unit of a solar then-nal propulsion engine. The VPS process deposits refractory metal onto a graphite mandrel of the desired shape. The mandrel acts as a male mold, forming the required contour and dimensions of the inside surface of the deposit. Tungsten and tungsten/25% rhenium were used in the development and production of several absorber cavity components. These materials were selected for their high temperature (greater than 25000 C [greater than 4530 F]) strength. Each absorber cavity comprises 3 coaxial shells with two, double-helical flow passages through which the propellant gas flows. This paper describes the processing techniques, design considerations, and process development associated with forming these engine components.
Author
Procedures; Design Analysis; Structural Design; Tungsten Alloys; Rhenium Alloys; Refractory Metals; Fabrication; Engine Parts

19990046494 NASA Glenn Research Center, Cleveland, OH USA

Preliminary Evaluation of a 10 kW Hall Thruster

Jankovsky, Robert S., NASA Glenn Research Center, USA; McLean, Chris, Space Power, Inc., USA; McVey, John, Space Power, Inc., USA; April 1999; 18p; In English; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 242-81-20

Report No.(s): NASA/TM-1999-209075; NAS 1.15:209075; AIAA Paper 99-0456; E-11636; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 10 kW Hall thruster was characterized over a range of discharge voltages from 300-500 V and a range of discharge currents from 15-23 A. This corresponds to power levels from a low of 4.6 kW to a high of 10.7 kW. Over this range of discharge powers, thrust varied from 278 mN to 524 mN, specific impulse ranged from 1644 to 2392 seconds, and efficiency peaked at approximately 59%. A continuous 40 hour test was also undertaken in an attempt to gain insight with regard to long term operation of the engine. For this portion of the testing the thruster was operated at a discharge voltage of 500 V and a discharge current of 20 A. Steady-state temperatures were achieved after 3-5 hrs and very little variation in performance was detected.

Author

Electric Propulsion; Rocket Engine Design; Hall Effect; Booster Rocket Engines; Rocket Propellants; Engine Tests; Rocket Thrust

19990046741 Alabama Univ., Huntsville, AL USA

Mixing of Supersonic Streams

Hawk, C. W., Alabama Univ., USA; Landrum, D. B., Alabama Univ., USA; Muller, S., Alabama Univ., USA; Turner, M., Alabama Univ., USA; Parkinson, D., Alabama Univ., USA; 1998; 7p; In English, 7-11 Dec, 1998, Tucson, AZ, USA; Sponsored by Department of the Army, USA

Contract(s)/Grant(s): NCC8-123; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Strutjet approach to Rocket Based Combined Cycle (RBCC) propulsion depends upon fuel-rich flows from the rocket nozzles and turbine exhaust products mixing with the ingested air for successful operation in the ramjet and scramjet modes. It is desirable to delay this mixing process in the air-augmented mode of operation present during low speed flight. A model of the Strutjet device has been built and is undergoing test to investigate the mixing of the streams as a function of distance from the Strutjet exit plane during simulated low speed flight conditions. Cold flow testing of a 1/6 scale Strutjet model is underway and nearing completion. Planar Laser Induced Fluorescence (PLIF) diagnostic methods are being employed to observe the mixing of the turbine exhaust gas with the gases from both the primary rockets and the ingested air simulating low speed, air augmented operation of the RBCC. The ratio of the pressure in the turbine exhaust duct to that in the rocket nozzle wall at the point of their intersection is the independent variable in these experiments. Tests were accomplished at values of 1.0, 1.5 and 2.0 for this parameter. Qualitative results illustrate the development of the mixing zone from the exit plane of the model to a distance of about 10 rocket nozzle exit diameters downstream. These data show the mixing to be confined in the vertical plane for all cases, The lateral expansion is more pronounced at a pressure ratio of 1.0 and suggests that mixing with the ingested flow would be likely beginning at a distance of 7 nozzle exit diameters downstream of the nozzle exit plane.

Author

Supersonic Flow; Combustion Products; Exhaust Emission; Exhaust Gases; Gas Streams

19990046767 Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA USA

Rocketdyne RBCC Engine Concept Development

Ratckin, G., Boeing Co., USA; Goldman, A., Boeing Co., USA; Ortwerth, P., Boeing Co., USA; Weisberg, S., Boeing Co., USA; 1999; In English; ISABE, Sep. 1999, Florence, Italy

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

Boeing Rocketdyne is pursuing the development of Rocket Based Combined Cycle (RBCC), propulsion systems as demonstrated by significant contract work in the hypersonic arena (ART, NASP, SCT, system studies) and over 12 years of steady company discretionary investment. The Rocketdyne concept is a fixed geometry integrated rocket, ramjet, scramjet which is hydrogen fueled and uses hydrogen regenerative cooling. The baseline engine structural configuration uses an integral structure that eliminates panel seals. seal purge gas, and closeout side attachments. Rocketdyne's experimental RBCC engine (Engine A5) was constructed under contract with the NASA Marshall Space Flight Center. Engine A5 models the complete flight engine flowpath consisting of an inlet, isolator, airbreathing combustor and nozzle. High performance rocket thrusters are integrated into the engine to enable both air-augmented rocket (AAR) and pure rocket operation. Engine A5 was tested in CASL's new FAST facility as an air-augmented rocket, a ramjet and a pure rocket. Measured performance demonstrated vision vehicle performance levels for

Mach 3 AAR operation and ramjet operation from Mach 3 to 4. Rocket mode performance was above predictions. For the first time. testing also demonstrated transition from AAR operation to ramjet operation. This baseline configuration has also been shown, in previous testing, to perform well in the scramjet mode.
Author
Aerospace Planes; Propulsion System Configurations; Propulsion System Performance; Engine Tests; Rocket Engine Design

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CHEMISTRY AND MATERIALS (GENERAL)

19990045730 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
High-Grade Paper Recycling: A Program Management Perspective
Carter, Roger L.; Mar. 1999; 147p; In English
Report No.(s): AD-A361781; AFIT/GEE/ENV/94S-36; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
Recycling of high-grade paper is one method of reducing the use of natural resources and the amount of waste being emitted into the environment, both in the process of manufacturing and in the disposal of unneeded documents. The Air Force Materiel Command (AFMC) is a significant user of high-grade paper, thus recycling represents a potential saving to society in the form of lessened negative impact on the environment as the result of AFMC operations. The possibility also exists for AFMC to reduce operating costs. The purpose of this study is to explore means of reducing high-grade paper disposal by AFMC, examine program management of high-grade paper recycling by AFMC, and apply effective program management processes to the AFMC high-grade paper recycling program.
DTIC
Recycling; Earth Resources; Cost Reduction

19990045985 Helsinki Univ. of Technology, Lab. of Inorganic and Analytical Chemistry, Espoo Finland
Helsinki University of Technology, Laboratory of Inorganic and Analytical Chemistry Annual Report, 1997
Niinistoe, L.; Tolonen-Kivimaeki, O.; 1998; 38p; In English
Report No.(s): PB99-135865; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
Contents include the following: Introduction; Personnel; Teaching Activities; Research Facilities and Projects; Theses; International Activities; Publications.
NTIS
Universities; Finland; Inorganic Chemistry

19990046081 NASA Lewis Research Center, Cleveland, OH USA
Substituted 1,1,1-Triaryl-2,2,2-Trifluoroethanes and Processes for their Synthesis
Alston, William B., Inventor, NASA Lewis Research Center, USA; Gratz, Roy F., Inventor, NASA Lewis Research Center, USA; Jan. 19, 1999; 14p; In English; Division of US-Patent-Appl-SN-982350, filed 27 Nov. 1992
Patent Info.: Filed 15 Arp. 1994; NASA-Case-LEW-14345-8; US-Patent-5,861,540; US-Patent-Appl-SN-228541; US-Patent-Appl-SN-982350; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche
Synthetic procedures to tetraalkyls. tetraacids and dianhydrides substituted 1,1,1-triaryl-2,2,2-trifluoroethanes which comprises: (1) 1.1-bis(dialkylaryl)-1-aryl-2,2,2 -trifluoroethane, (2) 1,1-bis(dicarboxyaryl)-1-aryl-2.2,2- trifluoroethane or (3) cyclic dianhydride or diamine of 1,1-bis(dialkylaryl)-1-aryl-2,2,2- trifluoroethanes. The synthesis of (1) is accomplished by the condensation reaction of an aryltrifluoromethyl ketone with a dialkylaryl compound. The synthesis of (2) is accomplished by oxidation of (1). The synthesis dianhydride of (3) is accomplished by the conversion of (2) to its corresponding cyclic dianhydride. The synthesis of the diamine is accomplished by the similar reaction of an aryltrifluoromethyl ketone with aniline or alkyl substituted or disubstituted anihnes. Also, other derivatives of the above are formed by nucleophilic displacement reactions.
Official Gazette of the U.S. Patent and Trademark Office
Alkyl Compounds; Diamines; Anhydrides; Aniline; Hydrocarbons; Nuclear Reactions

19990046221 National Inst. of Standards and Technology, Building and Fire Research Lab., Gaithersburg, MD USA
Fire Safety of Passenger Trains, Phase 1. Material Evaluation (Cone Calorimeter) ***Final Report***
Peacock, R. D.; Braun, E.; Mar. 1999; 208p; In English
Report No.(s): PB99-134801; NISTIR-6132; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This document presents the Phase I results of the program which focused on the evaluation of passenger rail care interior materials using Cone Calorimeter test data. A summary of U.S. transportation agency requirements for various types of vehicles is also provided. An update of U.S. and European passenger train fire performance requirements and related research is included.
NTIS
Fire Prevention; Transportation; Passengers; Fires

19990046340 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Development of a fullerene based hydrogen storage system
Brosha, E. L., Department of Energy, USA; Davey, J. R., Department of Energy, USA; Garzon, F. H., Department of Energy, USA; Gottesfeld, S., Department of Energy, USA; Dec. 31, 1998; 15p; In English
Report No.(s): DE99-000555; LA-UR-98-1871; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The project objective was to evaluate hydrogen uptake by fullerene substrates and to probe the potential of the hydrogen/fullerene system for hydrogen fuel storage. As part of this project, the authors have completed and tested a fully automated, computer controlled system for measuring hydrogen uptake that is capable of handling both a vacuum of 1 x 10(sup (minus)6) torr and pressures greater than 200 bars. The authors have first established conditions for significant uptake of hydrogen by fullerenes. Subsequently, hydrogenation and dehydrogenation of pure and catalyst-doped C60 was further studied to probe suitability for hydrogen storage applications. C60 (center-dot) H18.7 was prepared at 100 bar H2 and 400 C, corresponding to hydrogen uptake of 2.6 wt%. Dehydrogenation of C60 (center-dot) H18.7 was studied using thermogravimetric and powder x-ray diffraction analysis. The C60 (center-dot) H18.7 molecule was found to be stable up to 430 C in Ar, at which point the release of hydrogen took place simultaneously with the collapse of the fullerene structure. X-ray diffraction analysis performed on C60 (center-dot) H18.7 samples dehydrogenated at 454 C, 475 C, and 600 C showed an increasing volume fraction of amorphous material due to randomly oriented, single-layer graphine sheets. Evolved gas analysis using gas chromatography and mass spectroscopy confirmed the presence of both H(sub 2) and methane upon dehydrogenation, indicating decomposition of the fullerene. The remaining carbon could not be re-hydrogenated. These results provide the first complete evidence for the irreversible nature of fullerene hydrogenation and for limitations imposed on the hydrogenation/dehydrogenation cycle by the limited thermal stability of the molecular crystal of fullerene.
NTIS
Fullerenes; Hydrogen Fuels; Amorphous Materials; Dehydrogenation; Hydrogenation; Doped Crystals; Storage Tanks

19990046386 Florida Agricultural and Mechanical Univ., Tallahassee, FL USA
Recycled and Virgin Plastics in Fiber Reinforced Concrete ***Final Report, Oct. 1994 - Aug. 1997***
Tawfiq, K. S.; Aug. 30, 1998; 252p; In English
Report No.(s): PB99-134496; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The primary objectives of this study is to conduct a laboratory investigation to evaluate the intrinsic stress that can cause cracking of concrete mixed recommended by the Florida Department of Transportation with the addition of monofilament and fibrillated polypropylene and monofilament polyolefin fibers, subjected to highly cyclic loading. In addition, the flexural behavior of concrete reinforced with recycled post-consumer in-house made fibers will be study and Finite Element Methods (FEM) following laboratory work would be used to establish comparable numerical models for the flexural test and pavement overlays.
NTIS
Recycling; Plastics; Composite Materials; Concrete Structures

19990046420 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Experimental Investigation of Organic Synthesis in Hydrothermal Environments ***Final Report, 1 Nov. 1997 - 31 Oct. 1998***
Shock, Everett L., Washington Univ., USA; 1998; 4p; In English
Contract(s)/Grant(s): NCC2-5244; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The results of the investigation were presented at a Astrobiology Institute General Meeting. Seafloor hydrothermal systems may be the most likely locations on the early Earth for the emergence of life. Because of the disequilibrium inherent in such dynamic, mixing environments, abundant chemical energy would have been available for formation of the building blocks of life. In addition, theoretical studies suggest that organic compounds in these conditions would reach metastable states, due to kinetic barriers to the formation of stable equilibrium products (CO2 and methane). The speciation of organic carbon in metastable states is highly dependent on the oxidation state, pH, temperature, pressure and bulk composition of the system. The goal of our research is to investigate the effects of a number external variables on the formation, transformation, and stability of organic compounds at hydrothermal conditions. We have begun experimental work to attempt to control the oxidation state of simulated hydrothermal

systems by using buffers composed of mineral powders and gas mixtures. We are also beginning to test the stability of organic compounds under these conditions.
Author
Hydrothermal Systems; Metastable State; Ocean Bottom; Organic Compounds; Abiogenesis; Chemical Evolution; Protobiology

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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.

19990043984 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Durability-Based Design Criteria for an Automotive Structural Composite
Corum, J. M.; Battiste, R. L.; Brinkman, C. R.; Ren, W.; Ruggles, M. B.; Dec. 31, 1998; 11p; In English; Annual ESD advanced composite technology conference and exposition
Report No.(s): DE99-000225; ORNL/CP-99195; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Before composite structures can be widely used in automotive applications, their long-term durability must be assured. The Durability of Lightweight Composite Structures Project at Oak Ridge National Laboratory was established by the US Department of Energy to help provide that assurance. The project is closely coordinated with the Automotive Composites Consortium. The experimentally-based, durability-driven design criteria described in this paper are the result of the initial project thrust. The criteria address a single reference composite, which is an SRIM (Structural Reaction Injection Molded) polyurethane, reinforced with continuous strand, swirl-mat E-glass fibers. The durability issues addressed include the effects of cyclic and sustained loadings, temperature, automotive fluid environments, and low-energy impacts (e.g., tool drops and roadway kickups) on strength, stiffness, and deformation. The criteria provide design analysis guidance, a multiaxial strength criterion, time-independent and time-dependent allowable stresses, rules for cyclic loading, and damage tolerance design guidance. Environmental degradation factors and the degrading effects of prior loadings are included. Efforts are currently underway to validate the criteria by application to a second random-glass-fiber composite. Carbon-fiber composites are also being addressed.
NTIS
Composite Structures; Durability; Automobiles; Degradation

19990043988 Department of Energy, Washington, DC USA
Transient radiation effects in D.O.I. optical materials: KD(sup *)P
Simmons-Potter, K.; Jul. 31, 1998; 12p; In English
Report No.(s): DE99-000468; SAND-98-1576; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Department of Energy and Defense Programs systems are becoming increasingly reliant on the use of optical technologies that must perform under a range of ionizing radiation environments. In particular, the radiation response of materials under consideration for applications in direct optical initiation (D.O.I.) schemes must be well characterized. In this report, transient radiation effects observed in a KD*P crystal are characterized. Under gamma exposure with 2 MeV photons in a 20--30 nsec pulse, the authors observe induced absorption at 1.06 (micro)m that causes a peak decrease in overall sample transmittance of only 10%. This induced loss is seen to recover fully within the first 30 (micro)sec.
NTIS
Transmittance; Radiation Effects; Optical Properties

19990044089 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Mechanical Vibration Testing Results of Acoustic Test Panels *Final Report*
Ratcliffe, Colin P.; Crane, Roger M.; Dec. 1998; 17p; In English
Report No.(s): AD-A361932; NSWCCD-65-TR-1998/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the mechanical vibration testing of two graphite reinforced composite plates. The plates were tested in a free-free boundary condition up to a frequency of approximately 6 kHz. The plates were designed to assess two different damping treatments. They consisted of a 1.37 inch thick carbon epoxy structural section with a 0.13 in thick region on one side for each treatment. One plate used a conventional constrained layer design, while the other used a thin free layer of fiber reinforced ure-

thane. The results show that while the constrain layer damped plate has a higher energy dissipation potential, it also has a reduced stiffness. There is also some localized modal behavior, which suggests it may also be reduced in strength.
DTIC
Mechanical Properties; Vibration; Stiffness; Acoustic Properties; Boundary Conditions

19990045707 AS and M, Inc., Hampton, VA USA
Progressive Failure and Life Prediction of Ceramic and Textile Composites ***Final Report, February 1996 - March 1998***
Xue, David Y., AS and M, Inc., USA; Shi, Yucheng, AS and M, Inc., USA; Katikala, Madhu, AS and M, Inc., USA; Johnston, William M., Jr., AS and M, Inc., USA; Card, Michael F., AS and M, Inc., USA; March 1998; 152p; In English
Contract(s)/Grant(s): NAS8-40638; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

An engineering approach to predict the fatigue life and progressive failure of multilayered composite and textile laminates is presented. Analytical models which account for matrix cracking, statistical fiber failures and nonlinear stress-strain behavior have been developed for both composites and textiles. The analysis method is based on a combined micromechanics, fracture mechanics and failure statistics analysis. Experimentally derived empirical coefficients are used to account for the interface of fiber and matrix, fiber strength, and fiber-matrix stiffness reductions. Similar approaches were applied to textiles using Repeating Unit Cells. In composite fatigue analysis, Walker's equation is applied for matrix fatigue cracking and Heywood's formulation is used for fiber strength fatigue degradation. The analysis has been compared with experiment with good agreement. Comparisons were made with Graphite-Epoxy, C/SiC and Nicalon/CAS composite materials. For textile materials, comparisons were made with triaxial braided and plain weave materials under biaxial or uniaxial tension. Fatigue predictions were compared with test data obtained from plain weave C/SiC materials tested at AS&M. Computer codes were developed to perform the analysis. Composite Progressive Failure Analysis for Laminates is contained in the code CPFail. Micromechanics Analysis for Textile Composites is contained in the code MicroTex. Both codes were adapted to run as subroutines for the finite element code ABAQUS and CPFail-ABAQUS and MicroTex-ABAQUS. Graphic user interface (GUI) was developed to connect CPFail and MicroTex with ABAQUS.
Author
Ceramic Matrix Composites; Textiles; Fatigue Life; Failure Analysis; Laminates

19990045994 Los Alamos National Lab., NM USA
Mechanical properties of NiTi-TiC shape-memory composites
Dunand, D. C.; Fukami-Ushiro, K. L.; Mari, D.; Roberts, J. A.; Bourke, M. A.; Dec. 31, 1997; 14p; In English; 1997 fall meeting of the Materials Research Society
Report No.(s): DE98-006343; LA-UR-98-1200; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper reviews recent work on the mechanical behavior of martensitic NiTi composites reinforced with 10--20 vol.% TiC particulates. The behavior of the composites is compared to that of unreinforced NiTi, so as to elucidate the effect of mismatch due to matrix transformation, thermal expansion, twinning or slip, in the presence of purely elastic particles. The twinning and subsequent thermal recovery of deformed composites, measured both macroscopically (by compressive testing and by dilatometry) and microscopically (by neutron diffraction), are summarized.
NTIS
Mechanical Properties; Nickel Alloys; Titanium Alloys; Titanium Carbides; Composite Materials

19990046035 Rensselaer Polytechnic Inst., Troy, NY USA
Development and use of image scanning ellipsometer to study the dynamics of heated thin liquid films ***Final Report, Jul. 1, 1989--Jun. 30, 1998***
Wayner, P. C.; Plawsky, J. L.; Jul. 31, 1998; 9p; In English
Report No.(s): DE99-001432; DOE/ER/14045-14; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The general objective of this research was to study the characteristics of evaporative phase change in ultra-thin films. The immediate objective was to develop and use microscopic image processing systems (IPS) to measure film thickness profiles. The IPS has two possible configurations: an image analyzing interferometer (IAI) and/or an image scanning ellipsometer (ISE). Both pure liquid films and the formation of sol-gel (xerogels) coatings were studied. An IAI was developed and used to measure the thickness profiles of equilibrium and evaporating liquid films under various conditions. The design and construction of an ISE was also completed and the system was successfully tested by measuring the thickness profile and the refractive index of a non uniform solid film. The profiles of both wetting and partially wetting draining isothermal films were also measured using the ISE. The profiles of the wetting films were analyzed to obtain the dynamics of transport processes in completely wetting thin films. The analysis of the nonwetting profiles continues. TEOS based sol-gels were fabricated in bulk as well as deposited as films on

silicon wafers by spin-coating. The authors found that the properties of the final xerogel films are very sensitive to the processing conditions.
NTIS
Image Processing; Ellipsometers; Thin Films; Phase Change Materials

19990046083 NASA Lewis Research Center, Cleveland, OH USA
Self-Lubricating Composite Containing Chromium Oxide
Dellacorte, Christopher, Inventor, NASA Lewis Research Center, USA; Edmonds, Brian J., Inventor, NASA Lewis Research Center, USA; Feb. 02, 1999; 6p; In English
Patent Info.: Filed 16 Jan. 1997; NASA-Case-LEW-16183-1; US-Patent-5,866,518; US-Patent-Appl-SN-786360; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A self lubricating. friction and wear reducing composite material useful over a wide temperature range of from cryogenic temperature up to about 900 C. contains 60 80 wt. % of particulate Cr2O3, dispersed in a metal binder of a metal alloy containing Cr and at least 50 wt. % of Ni, Cr or a mature of Ni and Cr. It also contains 5-20 wt. % of a fluoride of at least one Group I, Group II or rare earth metal and. optionally, 5-20 wt. % of a low temperature lubricant metal, such as Ag. Au, Pt, Pd, Rh and Cu. This composite exhibits less oxidation instability and less abrasiveness than composites containing chromium carbide, is readily applied using plasma spray and can be ground and polished with a silicon carbide abrasive.
Official Gazette of the U.S. Patent and Trademark Office
Lubrication; Cryogenic Temperature; Chromium Oxides; Silicon Carbides; Plasmas (Physics); Composite Materials

19990046085 NASA Lewis Research Center, Cleveland, OH USA
Producing Fiber Reinforced Composites Having Dense Ceramic Matrices
Behrendt, Donald R., Inventor, NASA Lewis Research Center, USA; Singh, Mrityunjay, Inventor, NASA Lewis Research Center, USA; Feb. 02, 1999; 4p; In English; Continuation-in-part of abandoned US-Patent-Appl-SN-265902, filed 21 Jun. 1994
Patent Info.: Filed 20 Sep. 1996; NASA-Case-LEW-15449-2; US-Patent-5,865,922; US-Patent-Appl-SN-725205; US-Patent-Appl-SN-265902; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A fiber preform is partially infiltrated with a ceramic material. A porous solid polymer is formed by reaction forming the infiltrated preform which is then pyrolized. Microporous carbon in the composite matrix is converted into silicon carbide.
Official Gazette of the U.S. Patent and Trademark Office
Ceramic Matrix Composites; Silicon Carbides; Preforms; Fiber Composites; Ceramics

19990046385 Oak Ridge National Lab., TN USA
Third Order Optical Nonlinearity of Colloidal Metal Nanoclusters Formed by MeV Ion Implantation
Sarkisov, S. S., Alabama A & M Univ., USA; Williams, E., Alabama A & M Univ., USA; Curley, M., Alabama A & M Univ., USA; Ila, D., Alabama A & M Univ., USA; Venkateswarlu, P., Alabama A & M Univ., USA; Poker, D. B., Oak Ridge National Lab., USA; Hensley, D. K., Oak Ridge National Lab., USA; Oct. 31, 1997; 17p; In English; Radiation Effects in Insulators
Contract(s)/Grant(s): DE-AC05-96OR-22464; NAGw-4078
Report No.(s): DE98-000686; ORNL/CP-94849; CONF-9709116; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the results of characterization of nonlinear refractive index of the composite material produced by MeV Ag ion implantation of LiNbO(sub 3) crystal (z-cut). The material after implantation exhibited a linear optical absorption spectrum with the surface plasmon peak near 430 nm attributed to the colloidal silver nanoclusters. Heat treatment of the material at 500 deg C caused a shift of the absorption peak to 550 nm. The nonlinear refractive index of the sample after heat treatment was measured in the region of the absorption peak with the Z-scan technique using a tunable picosecond laser source (4.5 ps pulse width).The experimental data were compared against the reference sample made of MeV Cu implanted silica with the absorption peak in the same region. The nonlinear index of the Ag implanted LiNbO(sub 3) sample produced at five times less fluence is on average two times greater than that of the reference.
NTIS
Colloids; Composite Materials; Crystals; Ion Implantation; Refractivity; Heat Treatment; Silver; Ions

19990046398 Prins Maurits Lab. TNO, Rijswijk Netherlands
Evaluation of the Ballistic Resistance of Composite Materials Under FSP Impact: Experimental Results ***Final Report***
Deutekom, M. J.; Mar. 1999; 41p; In Dutch
Contract(s)/Grant(s): A96KL453

Report No.(s): AD-A362024; PML-1998-A106; TNO-TD98-0347; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Personal protection equipment of the soldier consists more and more of polymeric composite materials. to understand the ballistic resistance of these materials, a reliable analysis tool is necessary. However, there is still a need for reliable experimental data to calibrate and validate the simulation predictions. The University of British Columbia (UBC) in Vancouver is developing simulation models for ballistic impact on composite materials under assignment from the Defence Research Establishment Valcartier (DREV). A joint project with DREV was started to study the impact behaviour of fibre reinforced plastics (FRP). to validate the models, TNO Prins Maurits Laboratory (TNO-PML) performed instrumented ballistic impact experiments on two types of FRPs impacted by FSPs (Fragment Simulating Projectiles). A cineradiographic high-speed camera (IMAX) was used to measure the displacement of the backface and FSP during impact. A Velocity Interference System for Any Reflector (VISAR) was also used to measure the velocity changes at the backface of the target. The experiments with the aramide FRP panels were successful and gave very reliable data to verify computer simulation models. A trend for the penetration process could not be observed.
DTIC

Terminal Ballistics; Polymer Matrix Composites; Computerized Simulation; Fragments

19990046495 National Inst. of Standards and Technology, Structures Div., Gaithersburg, MD USA

NIST Workshop on Standards Development for the Use of Fiber Reinforced Polymers for the Rehabilitation of Concrete and Masonry Structures

Duthinh, Dat, Editor, National Inst. of Standards and Technology, USA; Feb. 1999; 170p; In English, 7-8 Jan. 1998, Tucson, AZ, USA

Report No.(s): PB99-122160; NISTIR-6288; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

One of the impediments to the expansion of the use of fiber-reinforced polymer (FRP) composites for the rehabilitation of structures is the lack of design standards, which is the subject of this workshop. by bringing together researchers from academia, practitioners from industry and regulators from government, it aims at providing a snapshot of the state of the practice and establishing research needs to develop national standards on the use of FRP composites for the rehabilitation of concrete and masonry structures. The workshop included a plenary session where nine speakers defined the issues and established a framework for the discussion. Next, participants broke out into three separate sessions, on columns, beams and slabs, and walls, respectively.
NTIS

Fiber Composites; Concrete Structures; Masonry; Earthquakes; Buildings

19990046616 NASA Langley Research Center, Hampton, VA USA

Delamination and Stitch Failure in Stitched Composite Joints

Glaessgen, E. H., NASA Langley Research Center, USA; Raju, I. S., NASA Langley Research Center, USA; Poe, C. C., Jr., NASA Langley Research Center, USA; 1999; In English; Structures, Structural Dynamics, and Materials, 12-15 Apr. 1999, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-1247; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The effect of stitches on the failure of a single lap joint configuration was determined in a combined experimental and finite element study. The experimental program was conducted to determine debond growth under static monotonic loading. The stitches were shown to delay the initiation of the debond and provide load transfer beyond the load necessary to completely debond the stitched lap joint. The experimentally determined debond length vs. applied load was used as an input parameter in the finite element analysis of both configurations. The strain energy release rates at the debond front were calculated using plate finite elements. Nonlinear fastener elements were used to model the stitches and multipoint constraints were used to model the contact problem. Models of the unstitched configuration showed significant values of modes I and II across the width of the joint and showed that mode III is zero at the centerline but increases near the free edge. Models of the stitched configuration showed that the stitches were effective in reducing mode I to zero, but had less of an effect on modes II and III.
Author

Composite Structures; Composite Materials; Failure; Lap Joints; Debonding (Materials)

19990046617 NASA Langley Research Center, Hampton, VA USA

Three-Dimensional Effects in the Plate Element Analysis of Stitched Textile Composites

Glaessgen, E. H., NASA Langley Research Center, USA; Raju, I. S., NASA Langley Research Center, USA; 1999; In English; Structures, Structural Dynamics, and Materials, 12-15 Apr. 1999, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-1416; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Three-dimensional effects related to the analysis of stitched textile composites are discussed. The method of calculation is based on the virtual crack closure technique (VCCT), and models that model the upper and lower surface of the delamination or debond with two-dimensional (2D) plate elements rather than three-dimensional (3D) solid elements. The major advantages of the plate element modeling technique are a smaller model size and simpler geometric modeling. Details of the modeling of the laminated plate and the stitching are discussed.
Author
Composite Materials; Laminates; Textiles; Plates (Structural Members); Crack Closure; Surface Cracks; Cracking (Fracturing); Fatigue (Materials); Fracture Mechanics

19990046773 NASA Lewis Research Center, Cleveland, OH USA
Elemental Metals or Oxides Distributed on a Carbon Substrate or Self-Supported and the Manufacturing Process Using Graphite Oxide as Template
Hung, Ching-Cheh, Inventor, NASA Lewis Research Center, USA; Mar. 02, 1999; In English
Patent Info.: Filed 4 Apr. 1997; NASA-Case-LEW-16342-1; US-Patent-5,876,687; US-Patent-Appl-SN-833107; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A process for providing elemental metals or metal oxides distributed on a carbon substrate or self-supported utilizing graphite oxide as a precursor. The graphite oxide is exposed to one or more metal chlorides to form an intermediary product comprising carbon, metal, chloride, and oxygen. This intermediary product can be further processed by direct exposure to carbonate-solutions to form a second intermediary product comprising carbon, metal carbonate, and oxygen. Either intermediary product may be further processed: a) in air to produce metal oxide; b) in an inert environment to produce metal oxide on carbon substrate; c) in a reducing environment to produce elemental metal distributed on carbon substrate. The product generally takes the shape of the carbon precursor.
Official Gazette of the U.S. Patent and Trademark Office
Graphite; Metal Oxides; Substrates; Carbonates; Metals

19990046777 NASA Langley Research Center, Hampton, VA USA
Carbon-Carbon Piston Architectures
Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Schwind, Francis A., Inventor, NASA Langley Research Center, USA; May 04, 1999; In English; Provisional Application of US-Patent-Appl-SN-012930, filed 6 Mar. 1996
Patent Info.: Filed 27 Feb. 1997; NASA-Case-LAR-15492-1; US-Patent-5,900,193; US-Patent-Appl-SN-805195; US-Patent-Appl-SN-012930; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An improved structure for carbon-carbon composite piston architectures consists of replacing the knitted fiber, three-dimensional piston preform architecture described in U.S. Pat. No. 4.909,133 (Taylor et al.) with a two-dimensional lay-up or molding of carbon fiber fabric or tape. Initially. the carbon fabric or tape layers are prepregged with carbonaceous organic resins and/or pitches and are laid up or molded about a mandrel. to form a carbon-fiber reinforced organic-matrix composite part shaped like a ”U” channel, a ”T”-bar. or a combination of the two. The molded carbon-fiber reinforced organic-matrix composite part is then pyrolized in an inert atmosphere, to convert the organic matrix materials to carbon. At this point, cylindrical piston blanks are cored from the ”U” channel, ”T”-bar, or combination part. These blanks are then densified by reimpregnation with resins or pitches which are subsequently carbonized. Densification is also be accomplished by direct infiltration with carbon by vapor deposition processes. Once the desired density has been achieved, the piston billets are machined to final piston dimensions; coated with oxidation sealants; and/or coated with a catalyst. When compared to conventional steel or aluminum-alloy pistons, the use of carbon-carbon composite pistons reduces the overall weight of the engine; allows for operation at higher temperatures without a loss of strength; allows for quieter operation; reduces the heat loss; and reduces the level of hydrocarbon emissions.
Official Gazette of the U.S. Patent and Trademark Office
Pistons; Carbon-Carbon Composites; Carbon Fibers; Casting; Aluminum Alloys; Resins

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.

19990044072 New York Univ., Dept. of Chemistry, New York, NY USA
Accurate polyatomic quantum dynamics studies of combustion reactions. Final progress report, July 1, 1994--June 30, 1998
Zhang, J. Z. H.; Dec. 31, 1998; 9p; In English
Report No.(s): DE99-001415; DOE/ER/14453-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This program is designed to develop accurate yet practical computational methods, primarily based on time-dependent quantum mechanics, for studying the dynamics of polyatomic reactions beyond the atom-diatom systems. Efficient computational methodologies are developed and the applications of these methods to practical chemical reactions relevant to combustion processes are carried out. The program emphasizes the practical aspects of accurate quantum dynamics calculations in order to understand, explain and predict the dynamical properties of important combustion reactions. The aim of this research is to help provide not only qualitative dynamics information but also quantitative prediction of reaction dynamics of combustion reactions at the microscopic level. Through accurate theoretical calculations, the authors wish to be able to quantitatively predict reaction cross sections and rate constants of relatively small gas-phase reactions from first principles that are of direct interest to combustion. The long-term goal of this research is to develop practical computational methods that are capable of quantitatively predicting dynamics of more complex polyatomic gas-phase reactions that are of interest to combustion.
NTIS
Quantum Mechanics; Polyatomic Gases; Combustion Physics; Reaction Kinetics

19990045784 National Inst. of Standards and Technology, Information Technology Lab., Gaithersburg, MD USA
Phase-Field Model of Solidification with Convection
Anderson, D. M., North Carolina Univ., USA; McFadden, G. B., National Inst. of Standards and Technology, USA; Wheeler, A. A., Southampton Univ., UK; Sep. 1998; 42p; In English
Report No.(s): PB98-169170; NISTIR-6237; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The authors develop a phase-field model for the solidification of a pure material that includes convection in the liquid phase. The model permits the interface to have an anisotropic surface energy, and allows a quasi-incompressible thermodynamic description in which the densities in the solid and liquid phases may each be uniform. The solid phase is modeled as an extremely viscous liquid, and the formalism of irreversible thermodynamics is employed to derive the governing equations. The authors investigate the behavior of their model in two important simple situations corresponding to the solidification of a planar interface at constant velocity: density change flow and a shear flow. In the former case the authors obtain a non-equilibrium form of the Clausius-Clapeyron equation and investigate its behavior by both a direct numerical integration of the governing equations, and an asymptotic analysis corresponding to a small density difference between the two phases. In the case of a parallel shear flow, the authors are able to obtain an exact solution which allows us to investigate its behavior in the sharp interface limit, and for large values of the viscosity ratio.
NTIS
Solidification; Convection; Liquid Phases

19990045868 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Natural Attenuation of Chlorinated Ethenes by Anaerobic Reductive Dechlorination Coupled with Aerobic Cometabolism
VEERKAMP, DEREK D.; Mar. 1999; 119p; In English
Report No.(s): AD-A361770; FIT/GEE/ENV/99M-16; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Chlorinated solvents and their daughter products are the most common contaminants of groundwater at industrial and military facilities in the United States. Limitations of conventional technologies have intensified efforts to find alternative methods to remediate contaminated sites to regulatory goals set by CERCLA. Natural attenuation of chlorinated solvents is a promising alternative to traditional pump and treat methods but has not been well understood or widely accepted. This modeling study investigated the ability of TCE to completely degrade under various aquifer conditions and rate order constants. It also examined a case study of a former landfill site at Moody AFB. We found unusually high flow of ground water by advection or dispersion inhibits the complete degradation of TCE. High concentrations of sulfate or nitrate inhibit the creation of methanogenic conditions and therefore inhibit reductive dechlorination of TCE. We also found an electron donor co-contaminant a critical factor for the com-

plete destruction of TCE because it creates anaerobic conditions. The model illustrated a possible explanation for the lack of down gradient contaminants at the landfill site may be the coupling of reductive dechlorination and cometabolism naturally attenuation the contaminants.
DTIC
Attenuation; Contamination; Chlorination; Reaction Kinetics

19990046195 Montpellier-2 Univ., Lab. des Materiaux et Procedes Membranaires, France
Photo-Induced Energy and Electron Transfer in Porphyrin Triad and Related Dyads: TMR Large-Scale Facilities Access Programme
Seta, P.; Janot, J. M.; Matousek, P.; Towrie, M.; Parker, T.; Feb. 26, 1999; ISSN 1358-6254; 14p; In English
Report No.(s): PB99-139396; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
This report describes the experiment entitled 'Photo-Induced Energy and Electron Transferin Porphyrin Triad and Related Dyads; carried out at the Central Laser Facility (CLF) from the 2nd Nov to the 15th Nov. 1997. The experiment, funded by the Framework IV Large-Scale Facilities Access Scheme, was proposed by Dr P Seta, Laboratoire des Materiaux et Procedes Membrainaires, Montpellier and carried out by visiting researchers from the Laboratory. They were supported by researchers from the Central Laser Facility, Rutherford Appleton Laboratory.
NTIS
Energy Transfer; Porphyrins; Photosynthesis; Electron Transfer; Dyadics; Energy Conversion

19990046205 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Photoinduced Absorption Studies of the Deactivation of Excited Electronic States in Highly Ordered Films of Oligothiophenes. TMR Large-Scale Facilities Access Programme
Oelkrug, D., Tuebingen Univ., Germany; Egelhaaf, H. J., Tuebingen Univ., Germany; Lehr, B., Tuebingen Univ., Germany; Gierschner, J., Tuebingen Univ., Germany; Lueer, L., Tuebingen Univ., Germany; Feb. 25, 1999; ISSN 1358-6254; 14p; In English
Report No.(s): PB99-141046; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The present studies have shown the potential of the pump-probe technique in the elucidation of ultrafast processes in organic thin films. Further work is needed to conclusively assign the observed decay traces to transient species. This will be greatly assisted by spectral detection, e.g. by an optical multichannel analyzing (OMA) system. In order to reduce thermal effects, measurements have to be performed at lower light levels (requiring enhanced signal to noise ratio) and smaller beam spot areas. In order to investigate the effects of oxygen and of temperature on the photophysics of organic films, especially on charge carrier formation and recombination, experiments under high vacuum and at cryogenic temperatures are necessary.
NTIS
Deactivation; Thin Films; Photoabsorption; Excitation

19990046307 Arizona State Univ., Tempe, AZ USA
Integration of Photocatalytic Oxidation with Air Stripping of Contaminated Aquifers
Changrani, R.; Raupp, G. B.; Turchi, C.; Dec. 1998; 46p; In English
Report No.(s): PB99-127920; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The global objective of this work was to evaluate the integration of gas-solid ultraviolet (UV) photocatalytic oxidation (PCO) downstream of an air stripper as a technology for cost-effectively treating water pumped from an aquifer contaminated with chlorinated volatile organic compounds (VOCs). Experimental work was performed at the bench-scale in the laboratory during the first phase of the project, and at the pilot-scale in a simulated field-test situation during the second phase.
NTIS
Aquifers; Oxidation; Chlorination; Organic Compounds; Field Tests

19990046442 Rutherford Appleton Lab., Central Laser Facility, Chilton, UK
Photophysics of Cyanine Dyes on Surfaces: Time Resolved Transient Absorption Spectra and Lifetime Measurements. TMR Large-Scale Facilities Access Programme
Worrall, D. R., Loughborough Univ. of Technology, UK; Wilkinson, F., Loughborough Univ. of Technology, UK; Matousek, P., Rutherford Appleton Lab., UK; Vieira Ferreira, L. F.; Oliveira, A. S.; Feb. 24, 1999; 16p; In English
Report No.(s): PB99-141020; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
In recently published work the authors describe the behavior of several cyanine dyes adsorbed onto a natural polymer, microcrystalline cellulose. In the range of concentrations under study (from 0.005 to 25.0 (micro)mol of dye per gram of cellulose) several cynides exhibit sandwich type and/or head to tail ground state aggregates. The aggregation is dependent on dye structure and

on the degree of hydration of the sample. Steady-state and laser induced fluorescence emission may provide different emission spectra. For several cyanines under study and for low loadings, only monometers (M(star)) emit and the two emission spectra are equal within experimental error, while for higher loadings a new emission (N(star)) was observed arising from a photoisomer generated by the absorption of an initial photon, and excited by the absorption of a second photon. Supralinear dependencies on laser fluence were detected in several cases.
NTIS
Dyes; Adsorption; Emission Spectra; Absorption Spectra; Time Functions

19990046576 Combustion Inst., Pittsburgh, PA USA
Twenty-Seventh Symposium (International) on Combustion, Volume 2
Terpackaro, Sue; Jan. 1998; 1586p; In English; Combustion, 2-7 Aug. 1998, Boulder, CO, USA
Contract(s)/Grant(s): DAAG55-98-1-0465
Report No.(s): AD-A361819; ARO-38898.3-EG-CF; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche
The Twenty-Seventh International Symposium on Combustion was held on the campus of the University of Colorado at Boulder from August 2 to 7 1998. There were 1180 technical participants which included 312 students and represented 34 countries.
DTIC
Combustion; Premixed Flames

19990046577 Combustion Inst., Pittsburgh, PA USA
Twenty-Seventh Symposium (International) on Combustion, Volume 1
Terpackaro, Sue; Jan. 1998; ISSN 0082-0784; 1578p; In English; Combustion, 2-7 Aug. 1998, Boulder, CO, USA; Presented at 27th International Symposium on Combustion at Colorado Univ at Boulder, Boulder, CO on 2-7 Aug 98. ADA361819
Contract(s)/Grant(s): DAAG55-98-1-0465
Report No.(s): AD-A361820; ARO-38898.2-EG-CF; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche
The Twenty-Seventh International Symposium on Combustion was held on the campus of the University of Colorado at Boulder from August 2 to 7 1998. There were 1180 technical participants which included 312 students and represented 34 countries.
DTIC
Combustion; Premixed Flames

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METALLIC MATERIALS

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

19990044059 Oak Ridge National Lab., TN USA
Role of Cr antiferromagnetism on interlayer magnetic coupling in Fe/Cr multilayered systems
Shi, Z. P.; Fishman, R. S.; Jun. 30, 1998; 11p; In English; International symposium on metallic multilayers
Report No.(s): DE99-001341; ORNL/CP-98579; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Many experiments have verified the presence of a spin-density wave (SDW) within the Cr spacer of Fe/Cr multilayers and wedges. The authors review the recently-proposed interlayer magnetic coupling mediated by a SDW. Unlike previously proposed mechanisms, this magnetic coupling is strongly temperature- dependent. Depending on the temperature and the number N of Cr monolayers (ML), the SDW may be either commensurate (C) or incommensurate (I) with the bcc Cr lattice.
NTIS
Chromium Alloys; Iron Alloys; Interlayers; Antiferromagnetism

19990044070 Sandia National Labs., Livermore, CA USA
Thermal-mechanical modeling and experimental validation of weld solidification cracking in 6061-T6 aluminum
Dike, J. J.; Brooks, J. A.; Bammann, D. J.; Li, M.; Dec. 31, 1997; 9p; In English; ASM international conference on welding and joining science and technology
Report No.(s): DE99-001420; SAND-97-8582C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Finite element simulation using an internal state variable constitutive model coupled with a void growth and damage model are used to study weld solidification cracking of 6061-T6 aluminum. Calculated results are compared with data from an experimental program determining the locations of failure as a function of weld process parameters and specimen geometry. Two types of weld solidification cracking specimen were studied. One specimen, in which cracking did not occur, was used to evaluate finite

element simulations of the thermal response and calculations of average strain across the weld. The other specimen type was used to determine the location of crack initiation as a function of weld process parameters. This information was used to evaluate the finite element simulations of weld solidification cracking. A solidification model which includes dendrite tip and eutectic undercooling was used in both thermal and mechanical finite element analyses. A strain rate and temperature history dependent constitutive model is coupled with a ductile void growth damage model in the mechanical analyses. Stresses near the weld pool are examined to explain results obtained in the finite element analyses and correlated with experimental observations. Good agreement is obtained between simulation and experiment for locations of crack initiation and extent of cracking. Some effects of uncertainties in material parameters are discussed.
NTIS
Aluminum Alloys; Crack Initiation; Cooling; Solidification; Finite Element Method; Computerized Simulation; Welded Joints; Fracturing; Liquid Metals

19990045627 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Vortex Glass Transition in Superconducting Aluminum Films
Tanaka, Shinichiro, Kyushu Univ., Japan; Kawae, Tatsuya, Kyushu Univ., Japan; Takeda, Kazuyoshi, Kyushu Univ., Japan; Fujiki, Hiroyuki, Kyushu Univ., Japan; Shinozaki, Fumishige, Kyushu Univ., Japan; Aomine, Takafumi, Kyushu Univ., Japan; Technology Reports of Kyushu University; Jul. 1998; Volume 71, No. 4, pp. 303-310; In Japanese; See also 19990045622; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

In order to study the vortex glass(VG) transition for conventional type-2 superconductors, we have investigated the transport property and complex ac susceptibility (chi = chi' + i(chi")) in the mixed state of aluminum films with different thickness at various external magnetic fields. The aluminium films have the characteristics with lower Tc and longer coherence length in contrast to high-Tc superconductors. The transport data for the thick film (approx. 1000 A) and thin film (approx. 200 A) can be well collapsed onto a single function theoretically expected for three- and two dimensional systems, respectively, with reasonable value of VG transition temperature and critical exponent. In ac susceptibility measurements, the frequency dependence of the peak temperature of chi" is shown to follow the equation proposed in the VG model. Values of the critical exponent are consistent with those determined from the transport data, whereas the VG transition temperatures are much lower titan those from the transport data.
Author
Vortices; Glass; Aluminum; Superconducting Films; Research; Transport Properties

19990045660 Department of Energy, Office of Energy Research, Washington, DC USA
Hydrogen retention in ion irradiated steels
Hunn, J. D.; Lewis, M. B.; Lee, E. H.; Dec. 31, 1998; 7p; In English
Report No.(s): DE99-000393; ORNL/CP-99115; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In the future 1--5 MW Spallation Neutron Source, target radiation damage will be accompanied by high levels of hydrogen and helium transmutation products. The authors have recently carried out investigations using simultaneous Fe/He, H multiple-ion implantations into 316 LN stainless steel between 50 and 350 C to simulate the type of radiation damage expected in spallation neutron sources. Hydrogen and helium were injected at appropriate energy and rate, while displacement damage was introduced by nuclear stopping of 3.5 MeV Fe(+), 1 micrometer below the surface. Nanoindentation measurements showed a cumulative increase in hardness as a result of hydrogen and helium injection over and above the hardness increase due to the displacement damage alone. TEM investigation indicated the presence of small bubbles of the injected gases in the irradiated area. In the current experiment, the retention of hydrogen in irradiated steel was studied in order to better understand its contribution to the observed hardening. to achieve this, the deuterium isotope (H-2) was injected in place of natural hydrogen (H-1) during the implantation. Trapped deuterium was then profiled, at room temperature, using the high cross-section nuclear resonance reaction with He-3. Results showed a surprisingly high concentration of deuterium to be retained in the irradiated steel at low temperature, especially in the presence of helium. There is indication that hydrogen retention at spallation neutron source relevant target temperatures may reach as high as 10%.
NTIS
Stainless Steels; Radiation Effects; Ion Implantation; Hydrogen Isotopes; Ion Irradiation

19990045768 Department of Energy, Washington, DC USA
Characterization of U-Nb(6%) ingots produced via the electron beam cold hearth refining process
McKoon, R. H.; Nov. 14, 1997; 19p; In English; Electron beam melting and refining state of the art 1997 conference
Report No.(s): DE98-057445; UCRL-JC-129311; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A study was undertaken at Lawrence Livermore National Laboratory to characterize uranium, 6% niobium ingots produced via electron beam melting, hearth refining and continuous casting and to compare this material with conventional VIM (Vacuum Induction Melting)/skull melt/VAR (Vacuum Arc Remelting) material. Samples of both the ingot and feed material were analyzed for niobium and trace metallic elements, carbon, oxygen and nitrogen. This material was also inspected metallographically and via microprobe analysis.
NTIS
Uranium Alloys; Niobium Alloys; Electron Beams; Vacuum Melting; Arc Melting; Refining

19990046059 Sandia National Labs., Livermore, CA USA
Novel process for fabricating Mg2Ni
Guthrie, S. E.; Thomas, G. J.; Dec. 31, 1998; 8p; In English
Report No.(s): DE98-052852; SAND-98-8512C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The alloy, Mg2Ni, has a number of desirable properties for use as a lightweight reversible hydride for hydrogen storage applications. It has relatively good storage capacity (3.6 wt.% H2 as Mg2NiH4) and a higher plateau pressure and lower operating temperature than MgH2. A novel low temperature (less than 300 C) process is reported that does not require melting of the alloy constituents to achieve a single phase alloy of Mg2Ni. The process results in smaller particle dimensions without sacrifice in product yield and eliminates the need for post processing to achieve homogenization and particle sizing. It can also be implemented in-situ in storage vessels to greatly simplify fabrication while providing more material predictability during the activation process. The process is described and the hydride properties of the product are reported and compared to conventionally formed alloys.
NTIS
Magnesium Alloys; Nickel Alloys; Synthesis (Chemistry); Intermetallics; Operating Temperature; Hydrogen; Propellant Storage

19990046065 NASA Langley Research Center, Hampton,VA USA
Fatigue Analyses Under Constant- and Variable-Amplitude Loading Using Small-Crack Theory
Newman, J. C., Jr., NASA Langley Research Center, USA; Phillips, E. P., NASA Langley Research Center, USA; Everett, R. A., Jr., Army Research Lab., USA; May 1999; 27p; In English
Contract(s)/Grant(s): RTOP 522-18-11-01
Report No.(s): NASA/TM-1999-209329; L-17862; ARL-TR-2001; NAS 1.15:209329; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Studies on the growth of small cracks have led to the observation that fatigue life of many engineering materials is primarily ”crack growth” from micro-structural features, such as inclusion particles, voids, slip-bands or from manufacturing defects. This paper reviews the capabilities of a plasticity-induced crack-closure model to predict fatigue lives of metallic materials using ”small-crack theory” under various loading conditions. Constraint factors, to account for three-dimensional effects, were selected to correlate large-crack growth rate data as a function of the effective stress-intensity factor range (delta-Keff) under constant-amplitude loading. Modifications to the delta-Keff-rate relations in the near-threshold regime were needed to fit measured small-crack growth rate behavior. The model was then used to calculate small-and large-crack growth rates, and to predict total fatigue lives, for notched and un-notched specimens under constant-amplitude and spectrum loading. Fatigue lives were predicted using crack-growth relations and micro-structural features like those that initiated cracks in the fatigue specimens for most of the materials analyzed. Results from the tests and analyses agreed well.
Author
Crack Propagation; Fatigue Life; Microcracks; Stress Intensity Factors; Dynamic Loads; Fracture Mechanics; Variable Amplitude Loading

19990046067 NASA Lewis Research Center, Cleveland, OH USA
Method for Surface Texturing Titanium Products
Banks, Bruce A., Inventor, NASA Lewis Research Center, USA; Dec. 29, 1998; 12p; In English
Patent Info.: Filed 23 Jun. 1997; NASA-Case-LEW-16392-1; US-Patent-5,853,561; US-Patent-Appl-SN-999562; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

The present invention teaches a method of producing a textured surface upon an arbitrarily configured titanium or titanium alloy object for the purpose of improving bonding between the object and other materials such as polymer matrix composites and/or human bone for the direct in-growth of orthopaedic implants. The titanium or titanium alloy object is placed in an electrolytic cell having an ultrasonically agitated solution of sodium chloride therein whereby a pattern of uniform ”pock mark” like pores or cavities are produced upon the object’s surface. The process is very cost effective compared to other methods of producing rough surfaces on titanium and titanium alloy components. The surface textures produced by the present invention are etched

directly into the parent metal at discrete sites separated by areas unaffected by the etching process. Bonding materials to such surface textures on titanium or titanium alloy can thus support a shear load even if adhesion of the bonding material is poor.
Official Gazette of the U.S. Patent and Trademark Office
Titanium; Sodium Chlorides; Polymer Matrix Composites; Adhesive Bonding; Electrolytic Cells; Titanium Alloys

19990046503 Helsinki Univ. of Technology, Lab. of Metallurgy, Espoo, Finland
Modelling of Heat Transfer, Phase Transformations and Microstructure in Continuous Casting Strand
Miettinen, Jyrki, Helsinki Univ. of Technology, Finland; Kytoenen, Heli, Helsinki Univ. of Technology, Finland; 1998; ISSN 1455-2329; 48p; In English
Report No.(s): PB99-141145; TKK-MK-52; ISBN 951-22-4244-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Three earlier developed models of heat transfer, solidification and phase transformations for steels were coupled and applied to continuous casting strands of Imatra Steel. The new model was validated by comparing calculated results of microstructure, phase fraction and hardness with experimentally measured data.
NTIS
Phase Transformations; Heat Transfer; Microstructure; Casting; Strands

19990046702 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
Fracture Studies on High Hardness BISALLOY 500(R) Steel
Khan, M. Z. Shah, Defence Science and Technology Organisation, Australia; Alkemade, S. J., Defence Science and Technology Organisation, Australia; Weston, G. M., Defence Science and Technology Organisation, Australia; 1997; In English
Report No.(s): DSTO-RR-0130; DODA-AR-010-523; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche
Mechanical properties of a high hardness alloy steel containing microstructural banding were determined in both transverse (T-L) and longitudinal (L-T) orientations with respect to the rolling direction. Tests undertaken included tensile, Charpy impact, fracture toughness, stress corrosion and constant amplitude fatigue. The specimen orientation was found to have little influence on the tensile properties however, Charpy V-notch specimens tested in the L-T orientation showed impact energy values four times higher than those in the T-L orientation. When fatigue tested, microstructural banding in the steel caused secondary cracking normal to the primary crack direction which in turn was found to influence crack propagation and fracture resistance. Discontinuous bands normal to the direction of the primary fracture plane (L-T orientation) were beneficial in resisting crack extension whereas, when the bands were continuous (T-L orientation), they were detrimental to the overall fracture process. The morphology of secondary cracking in the L-T orientation was different to the secondary cracking observed in the T-L orientation.'Secondary cracking in the L-T orientation promoted crack arrest and resulted in higher mechanical properties when compared with specimens tested in T-L orientation.
Author
Fracture Strength; Hardness; Steels; Alloys; Charpy Impact Test

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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.

19990044060 Oak Ridge National Lab., Metals and Ceramics Div., TN USA
Effect of neutron radiation on the dielectric, mechanical, and thermal properties of ceramics for RF transmission windows
Hazelton, C.; Rice, J.; Snead, L. L.; Zinkle, S. J.; Dec. 31, 1998; 30p; In English
Report No.(s): DE99-001340; ORNL/CP-98583; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The behavior of electrically insulating ceramics was investigated before and after exposure to neutron radiation. Mechanical, thermal, and dielectric specimens were studied after exposure to a fast neutron dose of 0.1 displacements per atom (dpa) at Oak Ridge National Laboratory (ORNL). Four materials were compared to alumina: polycrystalline spinel, aluminum nitride, sialon and silicon nitride. Mechanical bend tests were performed before and after irradiation. Thermal diffusivity was measured using a room temperature laser flash technique. Dielectric loss factor was measured at 105 MHz with a special high resolution resonance cavity. The materials exhibited a significant degradation of thermal diffusivity and an increase in dielectric loss tangent. The flexural strength and physical dimensions were not significantly affected by the 0.1 dpa level of neutron radiation. The aluminum nitride

and S silicon nitride showed superior RF window performance over the sialon and the alumina. The results are compared to radiation studies on similar materials.
NTIS
Ceramics; Radiation Effects; Fast Neutrons; Dielectric Properties; Mechanical Properties; Irradiation; Polycrystals; Thermodynamic Properties; Windows (Apertures)

19990044069 Washington Univ., Dept. of Physics, Seattle, WA USA
X-ray and Gamma-ray spectroscopy of solids under pressure ***Progress Report, Nov. 1996--Dec. 1998***
Ingalls, R. L.; Dec. 31, 1998; 17p; In English
Report No.(s): DE99-001427; DOE/ER/45622-3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This report describes the recent synchrotron x-ray absorption fine structure (XAFS) measurements on a number of systems that undergo pressure induced changes in local structure at high pressure. The reader should also refer to the accompanying renewal proposal for a more in-depth discussion of the general scope of this program, and its relevance to condensed matter science. The author merely states that the methods here are aimed at using XAFS to probe the various phenomena that are caused by high pressure, especially including various structural, and/or electronic, changes or transitions. The general technique is based upon a pressure cell which utilizes sintered boron carbide anvils, since diamond anvils generally produce Bragg glitches which spoil the high quality XAFS necessary for precision structural measurements. Sample pressure is determined at the beam-line by measuring and analyzing, via XAFS, the compression of some cubic material contained within the sample chamber. Recently, the author has extended this work to 77 K using helium gas for the applied force, rather than hydraulic oil.
NTIS
X Ray Absorption; Absorption Spectroscopy; Condensed Matter Physics; Fine Structure

19990044100 Dayton Univ., OH USA
Fracture and Fatigue Crack Growth Behavior of Advanced Ceramic Matrix Composites. ***Final Report, 15 Sep. 1995 - 14 Dec. 1998***
Buchanan, Dennis J.; Mar. 1999; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0500
Report No.(s): AD-A361714; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
Ultrasonic C-scans have successfully been used to investigate damage from notches and holes in Nexte1610 /Aluminosilicate (N610/AS) during tensile and fatigue loading conditions. Sectioned fatigue specimens verified that the region of distributed matrix damage and longitudinal fiber breakage correlated well with the C-scan damage zone at 23C. At 950C the C-scan data showed that the damage zone was confined to the notch plane where damage was primarily due to self similar crack growth. Sectioned samples verified that longitudinal fiber breaks were predominant in the vicinity of the matrix crack. The results from these tests are being employed to develop damage and failure criteria for N610/AS and other woven CMC.
DTIC
Crack Propagation; Ceramic Matrix Composites; Fatigue (Materials); Composite Structures

19990045659 Department of Energy, Office of Energy Research, Washington, DC USA
Physical principles of ion-beam processing of polymeric materials and applications
Lee, E. H.; Dec. 31, 1998; 11p; In English; Brazilian Vacuum Society conference
Report No.(s): DE99-000394; ORNL/CP-99116; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Irradiation of polymeric materials with energetic ions in the range of several hundreds of keV to several MeV causes drastic changes in physical, chemical, and mechanical properties. Studies indicate that irradiation produces many active radicals which then react with each other, transforming spaghetti-like tangled polymer chains into a highly cross-linked network structure. Analysis of experimental data shows that the most important parameter for cross- linking is the deposited energy density along the ion track, often expressed in terms of linear energy transfer (LET) in units of eV/nm. High LET produces a high number of free radicals over many neighboring molecular chains and thereby facilitates cross-linking. On the other hand, under low LET conditions, radicals are produced so sparsely that cross-linking efficiency decreases. Moreover, the deposited energy in the chain often leads to chain scission when there are no radicals in the neighboring chains for crosslinking. This paper reviews the current understanding of cross-linking mechanisms in terms of nuclear and electronic stopping and their impact on materials' properties.
NTIS
Ion Beams; Mechanical Properties; Crosslinking

19990045761 Department of Energy, Washington, DC USA
Transient radiation effects in D.O.I. optical materials: Schott filter glass
Simmons-Potter, K.; Jul. 31, 1998; 14p; In English
Report No.(s): DE99-000467; SAND-98-1575; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Department of Energy and Defense Programs systems are becoming increasingly reliant on the use of optical technologies that must perform under a range of ionizing radiation environments. In particular, the radiation response of materials under consideration for applications in direct optical initiation (D.O.I.) schemes must be well characterized. In this report, transient radiation effects observed in Schott filter glass S-7010 are characterized. Under gamma exposure with 2 MeV photons in a 20-30 nsec pulse, the authors observe strong initial induced fluorescence in the red region of the spectrum followed by significant induced absorption over the same spectral region. Peak induced absorption coefficients of 0.113 cm(exp -1) and 0.088 cm(exp -1) were calculated at 800 nm and 660 nm respectively.
NTIS
Radiation Effects; Optical Filters; Glass

19990045863 National Inst. of Standards and Technology, Gaithersburg, MD USA
Ceramics: 1998 Programs and Accomplishments
Jan. 1999; 152p; In English
Report No.(s): PB99-131856; NISTIR-6247; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The activities of the NIST Ceramics Division are organized in the form of Programs, emphasizing a desire to foster collaborations within the Division as well as throughout the Materials Science and Engineering Laboratory, and to conduct focused activities on a scale that can lead to greater benefits for the US ceramics community. The Programs are made up of projects whose primary goal is the development of measurement techniques and standards. Activities such as the development of Standard Reference Materials and databases are integrated within the relevant Programs. At the same time, we continue to maintain a Division management structure in the form of Groups.
NTIS
Ceramics; Data Bases

19990045869 Ceracon, Inc., Sacramento, CA USA
A Novel Manufacturing Processing Route for Forming High-Density Ceramic Armor Materials: Phase I - SBIR *Final Report, 25 Apr. 1991 - 11Dec. 1991*
Raman, Ramas V.; Apr. 1999; 48p; In English
Contract(s)/Grant(s): DAA15-01-C-0087
Report No.(s): AD-A361805; ARL-CR-437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the Phase I small business innovative research (SBIR) project was to demonstrate the feasibility of applying the Combustion Synthesis (CS)/Ceracon Consolidation Process for forming 10-cm-diameter, 2.5-cm-thick high-density titanium carbide (TiC) and titanium diboride (TiB2) pieces. The Phase I project demonstrated for the first time the feasibility of CS initiation to form TiC and TiB2 by using Ceracon's hot, granular media and their in-situ consolidation. The effects of applied pressure and pressure-transmitting media (PTM) temperature in controlling density, as well as thermal management issues to prevent cracking in applying the CS/Ceracon process to form TiC and TiB2, have been identified. In-situ CS/Ceracon consolidation to densities exceeding 98% was demonstrated for fabricating 10-cm-diameter, 2.5-cm-thick TiC pieces. The CS/Ceracon-processed, high-density TiC specimen has a fine grain size, microhardness values exceeding 2,500 kg/mm2, and compressive strength of 1.3 GPa. Due to the use of inexpensive conventional forging equipment and a low-cost grain for both initiating self-propagating high-temperature synthesis (SHS) and consolidation, this novel approach has the potential to be significantly more cost effective than currently used conventional hot pressing (HP) or hot isostatic pressing (HiPing) of TiC and TiB2 powders. A set of recommendations for the technical approach to be followed in process upscaling in Phase II to fabricate larger size tiles of TiC material is provided.
DTIC
Ceramics; Titanium Compounds; Hot Isostatic Pressing; Titanium Carbides; Compressive Strength; Combustion Synthesis

19990045884 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
The Resistance to Thermal and Moisture Transmission and Durability of Candidate Rainwear Fabrics
Egglestone, G. T., Defence Science and Technology Organisation, Australia; October 1998; 16p; In English
Report No.(s): DSTO-TR-0733; DODA-AR-010-656; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The current in-service raincoat used by the Army is considered unsuitable for operations in northern Australia due to its lack of 'breathability'. Breathability in a raincoat is directly related to the ability of the fabric to transport heat and moisture vapour at a rate that will keep the body in a state of thermal equilibrium under operational conditions. Five candidate fabrics were tested for their durability and resistance to the transport of heat and moisture vapour. The waterproof component of two of the fabrics was a coating while the other three were waterproofed using semi-permeable membranes. From a comfort viewpoint the worst fabric was that currently used in the in-service raincoat. The study recomends that a sandwich laminate be trialed using a 30 microns Microvapour Porous (MVP) membrane as the moisture barrier. The final fabric will consist of a lightweight nylon printed in the Australian camouflage pattern, which will be laminated to one side of the membrane and either a lightweight knitted polyester or nylon fabric laminated to the other. Support Command Army has accepted the recommendations and will arrange manufacture of the fabric and limited in-service trailing of the raincoat to gauge user acceptance.
Author
Thermal Resistance; Waterproofing; Porosity; Moisture; Heat Transfer; Fabrics

19990045968 National Inst. for Fusion Science, Toki, Japan
Molecular Dynamics of Strongly-Coupled Multichain Coulomb Polymers in Pure and Salt Aqueous Solutions
Tanaka, Motohiko, National Inst. for Fusion Science, Japan; Grosberg, A. Yu, Massachusetts Inst. of Tech., USA; Tanaka, Toyoichi, Massachusetts Inst. of Tech., USA; November 1998; ISSN 0915-633X; 32p; In English
Report No.(s): NIFS-579; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The multichain effect and also the effect of added salt on randomly co-polymerized charged polymers (polyampholytes) in a Langevin fluid are studied with the use of molecular dynamics simulations. The monomers of opposite signs tend to form loose complexes, which makes the Coulomb force attractive on average. With multichain polyampholytes, the typical state at high temperature is a container-bound one-phase state of separated chains with a substantial void among them. The association and dissociation processes occur repeatedly, with the former process a few times faster than the latter. A glass transition occurs when temperature is lowered. A compact and glassy globule in a segregated phase, which resembles that of a single-chain polyampholyte, is a typical state at low temperature due to the Coulomb force. The probability of losing that state is as low as P(sub dis) approx. exp(-N(sup 3/2), with N the number of monomers. The critical temperature defined by overlapping of the chains increases with molecular weight and stiffness of the chains, and is less sensitive to the number of the chains. An alternate charge sequence makes a difference only when its block size is quite small. The addition of salt suppresses the formation of a dense globule by shielding the electric field; however, this is not effective when the salt ions are not allowed to penetrate well into the globule.
Author
Molecular Dynamics; Couples; Polymerization; Aqueous Solutions; Monomers

19990045980 Los Alamos National Lab., NM USA
Effects of dynamic Jahn-Teller distortions by Raman spectroscopy in the layered CMR manganite La(2-2x)SR(1+2x)Mn(2)O(7), x = 0.36
Bordallo, H. N.; Argyriou, D. N.; Mitchell, J. F.; Strouse, G. F.; Dec. 31, 1998; 5p; In English; National conference on condensed matter (ENFMc)
Report No.(s): DE99-000646; LA-UR-98-1941; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The close interplay among charge, spin, and lattice degrees of freedom in the colossal magnetoresistive (CMR) manganite oxides is believed to play an important role in the transport mechanism in these itinerant ferromagnets. While the work on CMR materials has concentrated on the 3D perovskite manganites, the discovery of the layered compounds La(2-2x)SR(1+2x)Mn(2)O(7) as another class of CMR oxides provides a rich opportunity to explore the relationship between structure and transport properties on varying length and time scales in reduced dimensions. The crystal structure of the layered CMR compounds La(2-2x)SR(1+2x)Mn(2)O(7) is comprised of perovskite bilayers of corner-linked MnO(6) octahedra forming infinite sheets. Doping of divalent cations such as SR(sup 2+) gives rise to a mixed valent system were Jahn-Teller (JT) active Mn(sup 3+) and JT-inactive Mn(sup 4+) co-exist on the lattice. Among the current theoretical models of transport in the three-dimensional perovskite materials is the role of JT. This transport mechanism plays a fundamental role above the Curie temperature (T(sub c)). Indeed, localized lattice distortions have been observed experimentally above T(sub c) in the (La,Ca)MnO(3) perovskite system. In this communication, the authors report resonant Raman spectroscopic measurements on a micro-crystalline sample of La(sub 1.28)SR(sub 1.72)Mn(2)O(7)(x = 0.36). The measurements suggest discrete phonon modes for the Mn(sup 3+) and Mn(sup 4+) lattice sites, which may arise from either dynamic or static localization and the presence of Mn(sup 2+) defects in the lattice.
NTIS
Jahn-Teller Effect; Raman Spectroscopy; Distortion; Manganese Oxides; Lanthanum Compounds; Strontium Compounds; Magnetoresistivity

19990046031 General Electric Co., Schenectady, NY USA

Optical and mechanical properties of thermally evaporated fluoride thin films

Zhang, K.; Fahey, R.; Jasinski, D.; Scarpino, C.; Dziendziel, R.; Jun. 08, 1998; 4p; In English; Optical interference coatings topical meeting

Report No.(s): DE99-001452; KAPL-P-000070; K-98040; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As a result of health and safety issues surrounding the use of radioactive materials on coated optical components, there has been renewed interest in coating materials whose optical and mechanical properties approach those offered by their radioactive counterparts. Due to the radioactive nature of ThF(4) and its widespread use in optical coatings, the coating industry is examining other low index and non-radioactive fluorides as possible alternatives. In this paper, the authors present the results of an experimental study on the optical and mechanical properties of thermally evaporated ThF(4), DyF(3), CeF(3), LiF, HfF(4), IRX, and IRB thin films, where the materials were deposited at different substrate temperatures. The objective is to examine this series of fluorides under comparable deposition conditions and with respect to such material properties as: n and k, film stress, and environmental stability. The optical constants of these fluorides were evaluated over the wavelength region from 1.0 (micro)m to 12.5 (micro)m.

NTIS

Optical Properties; Mechanical Properties; Evaporation; Thin Films

19990046033 General Electric Co., Schenectady, NY USA

Hermetic SiC-SiC composite tubes

Kowbel, W.; Liu, Y.; Bruce, C.; Withers, J. C.; Kolaya, L. E.; Dec. 31, 1998; 29p; In English; Annual meeting of the American Ceramic Society

Report No.(s): DE99-001450; KAPL-P-000072; K-98046; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

SiC-SiC composites have good potential for structural applications but are limited by expensive forming techniques. A high purity (beta)-SiC fiber produced by MER, and a polymer derived SiC matrix were used to fabricate small diameter hermetic SiC-SiC tubes. The process was optimized to prevent the formation of a brittle structure while rapidly forming a dense matrix. This tube was made hermetic by first coating the surface of the tube with a silicon carbide particle filled polymer slurry, followed by a Chemical Vapor Infiltration/Deposition (CVI/CVD) SiC deposition which was performed to close any residual porosity on the composite tube surface. X-ray diffraction and Transmission Electron Microscopy (TEM) examination was performed to determine the fiber and matrix structures. These tubes were found to be impermeable to helium with leak rates below 10(exp -9) cc/sec as determined by testing similar to MIL-STD-883D, method 1014.10. This high level of impermeability was sustained following thermal cycling between room temperature and 1,520 C.

NTIS

Hermetic Seals; Composite Structures; Structural Design; Tubes; Silicon Carbides

19990046082 NASA Langley Research Center, Hampton, VA USA

Copolyimides Prepared from 3,4'-Oxydianiline and 1,3-Bis(3-Aminophenoxy) Benzene with 3,3', 4,4'-Biphenylcarboxylic Dianhydride

Jensen, Brian J., Inventor, NASA Langley Research Center, USA; Feb. 02, 1999; 8p; In English

Patent Info.: Filed 14 Feb. 1995; NASA-Case-LAR-15332-1; US-Patent-5,866,676; US-Patent-Appl-SN-388651; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Polyimide copolymers were prepared by reacting different ratios of 3,4'-oxydianiline (ODA) and 1,3-bis(3- aminophenoxy)benzene (APB) with 3,3',4,4'- biphenylcarboxylic dianhydride (BPDA) and endcappfng with an effective amount of a non-reactive endcapper. Within a narrow ratio of diamines, from -50% ODA/50% APB to -95% ODA/5% APB, the copolyimides prepared with BPDA have a unique combination of properties that make them very attractive for various applications. This unique combination of properties includes low pressure processing (200 psi and below), long term melt stability (several hours at 390 C.), improved toughness, improved solvent resistance, improved adhesive properties, and improved composite mechanical properties.

Official Gazette of the U.S. Patent and Trademark Office

Copolymers; Diamines; Polyimides; Anhydrides; Benzene

19990046086 NASA Lewis Research Center, Cleveland, OH USA

Controlled Thermal Expansion Coat for Thermal Barrier Coatings

Brindley, William J., Inventor, NASA Lewis Research Center, USA; Miller, Robert A., Inventor, NASA Lewis Research Center, USA; Aikin, Beverly J. M., Inventor, NASA Lewis Research Center, USA; Jan. 26, 1999; 12p; In English

Patent Info.: Filed 29 Oct. 1997; NASA-Case-LEW-16390-1; US-Patent-5,863,668; US-Patent-Appl-SN-960309; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A improved thermal barrier coating and method for producing and applying such is disclosed herein. The thermal barrier coating includes a high temperature substrate, a first bond coat layer applied to the substrate of MCrAlX, and a second bond coat layer of MCrAlX with particles of a particulate dispersed throughout the MCrAlX and the preferred particulate is Al2O3. The particles of the particulate dispersed throughout the second bond coat layer preferably have a diameter of less then the height of the peaks of the second bond coat layer, or a diameter of less than 5 microns. The method of producing the second bond coat layer may either include the steps of mechanical alloying of particles throughout the second bond coat layer, attrition milling the particles of the particulate throughout the second bond coat layer, or using electrophoresis to disperse the particles throughout the second bond coat layer. In the preferred embodiment of the invention, the first bond coat layer is applied to the substrate, and then the second bond coat layer is thermally sprayed onto the first bond coat layer. Further, in a preferred embodiment of die invention, a ceramic insulating layer covers the second bond coat layer.

Official Gazette of the U.S. Patent and Trademark Office

Thermal Control Coatings; Ceramics; Thermal Expansion; Aluminum Oxides; Alloying

19990046295 National Inst. of Standards and Technology, Materials Science and Engineering Lab., Gaithersburg, MD USA

Poylmers: 1998 Programs and Accomplishments

Fanconi, B. M.; Hunston, D. L.; Jan. 1999; 196p

Report No.(s): PB99-118036; NISTIR-6249; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Technical activities of the Polymers Division, 854, for the 1988 fiscal year are described. The report is organized by programs: Electronic Packaging, Interconnection and Assembly; Polymer Blends and Processing; Polymer Composites; Polymer Characterization; and Dental and Medical Materials. The objectives, technical description, accomplishments, and outputs of each project included in the programs are given.

NTIS

Polymers; Characterization; Polymer Blends

19990046336 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA

Emissivity enhancement coatings for thermophotovoltaic (TPV) radiator applications

Yue, J. J., Department of Energy, USA; Cockeram, B. V., Department of Energy, USA; Dec. 31, 1998; 12p; In English

Report No.(s): DE99-000517; WAPD-T-3235; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Ten emissivity enhancing coatings (ZrO2 + 18% TiO2 + 10% Y2O3, Cr2O3, ZrC, Fe2TiO5, ZrTiO4, ZrO2 + 8% Y2O3 + 2% HfO2, TiC, TiC + 5% Al2O3 + 5% TiO2, ZrB2, and ZrB2 + 10% MoSi2) deposited on Mo, Nb, and Haynes 230 substrates were evaluated for potential use in thermophotovoltaic (TPV) radiator applications. Emissivity testing of as-coated and annealed coupons indicate that 5 of the 10 Vacuum Plasma Spray (VPS) coating candidates have promise (ZrO2 + 18% TiO2 + 10% Y2O3, ZrC, Fe2TiO5, ZrTiO4, ZrO2 + 8% Y2O3 + 2% HfO2). Four of the ten coatings have emissivity values that are too low to be of further interest (TiC, TiC + 5% Al2O3 + 5% TiO2, ZrB2, and ZrB2 + 10% MoSi2). The final coating was mostly Cr2O3, and exhibited excessive evaporation during vacuum annealing with a significant decrease in emissivity. Base metal powder, which was added to the bond layer of all coatings to improve coating adhesion, was detected in the top layer of the coatings. Differences in reactive interaction between the base metal powder and coating during vacuum annealing produced varying changes in emissivity. A small decrease in emissivity was observed for the ZrC coating deposited on niobium, which agrees with the limited interaction between the niobium base metal particles and the ZrC coating detected in SEM/EDS examinations. A large decrease in emissivity was observed for the ZrC coating deposited on Haynes 230, and significant interaction between the base metal particles and ZrC coating was observed.

NTIS

Sprayed Coatings; Emissivity; Metal Powder; Substrates; Molybdenum Compounds; Niobium; Photovoltaic Conversion

19990046337 Department of Energy, Office of Energy Research, Washington, DC USA

Magnetic excitations in the S = (1/2) quasi-one-dimensional magnet SR(14-x)Ca(x)Cu24O41

Matsuda, M., Department of Energy, USA; Katsumata, K., Department of Energy, USA; Shapiro, S. M., Department of Energy, USA; Shirane, G., Department of Energy, USA; Aug. 20, 1998; 13p; In English; 42nd; Magnetism and Magnetic Materials, USA

Report No.(s): DE99-000549; BNL-65843; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Neutron scattering experiments have been performed on SR(14-x)Ca(x)Cu24O41 (x = 3 and 6), which consists of CuO2 chains and CuO2O3 ladders, in order to study the effect of Ca substitution on the dimerized state in the chains. The Ca substitution broadens the excitation peak although the excitation energy is almost unchanged. The effects of Ca and Y substitution on the dimerized state are compared.

NTIS

Magnetic Properties; Excitation; Neutron Scattering; Single Crystals

19990046345 Tokyo Denki Univ., Faculty of Engineering, Japan

Synthesis of Glycol-Uron Polymer with Biodegradable Function

Kisanuki, S., Tokyo Denki Univ., Japan; Horie, T., Tokyo Denki Univ., Japan; Shiba, R., Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1997, No. 45, pp. 53-64; In Japanese; See also 19990046342; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

We synthesized glycol-uron polymer and studied its structure, physical and chemical characteristics and biodegradability of the membrane, aiming at the development of biodegradable high polymer for agricultural raising seedling pot. The composition ratio of the polymer was glycol/uron=1/1, (not dependent upon the kind of glycol), and the alternative straight chain structure was confirmed. The ability of the polymer to create a membrane was greatly improved, compared with that of polyglycol. The membrane obtained showed high hygroscopicity, 20-50%. From these facts, it seemed that the introduction of the uron-ring into the polymer contributed to the retention of the strength of membrane and ether oxygen in the polymer contributed to hygroscopicity. In the burial test of the membrane in the general soil, the disintegration and the biodegradability of the membrane were found. The disintegration or the biodegradation of membrane is influenced by polymerization condition or the kind of glycol used, but generally, considerable disintegration was found after burial for 1-2 months and biodegradation was found after burial for 4-5 months. Furthermore, as a result of this study, biodegradation was found also in forced degradation test of membrane in activated sludge. It was made clear that the degree of biodegradation depended on the molecular weight of the polymer.

Author

Biodegradability; Biodegradation; Ethers; Glycols; High Polymers; Membranes

19990046480 Ceracon, Inc., Sacramento, CA USA

A Novel Manufacturing Processing Route for Forming High-Density Ceramic Armor Materials: Phase II- SBIR ***Final Report, 9 Sep. 9 - 9 SAep 1994***

Raman, Rams V.; Apr. 1999; 104p; In English

Report No.(s): AD-A361810; TR-RS20112-F-1; ARL-CR-438; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The feasibility of a combustion synthesis/Ceracon forging (CS/CF) fabrication process for low-cost high-quality ceramic armor is demonstrated. CS of titanium (Ti) and carbon (C) forming titanium carbide (TiC) was followed by a quasi-isostatic pressurization and densification to produce tiles with 95% + densities with sizes of up to 15 cm x 15 cm x 2.5 Cm. Several tiles were fabricated and delivered to the U.S. Army Research Laboratory (ARL) for evaluation and testing. A cost model, which showed that approximately 60% in cost savmgs can be realized with the CS/CF method, was developed. Temperature measurements and one-dimensional (1-D) computations were used to develop thermal management practices to make crack-free tiles. X-ray diffraction (XRD) verified full conversion of reactants to products. A considerable variation in TiC grain size and microhardness was found between the surface (-10 pm, high hardness) and the interior (up to 100 pm, low hardness) that depended on conditions during processing. Fractography showed transgranular fracture in the interior and intergranular fracture at the surface. Quasi-static compressive strength was found to be 1.79 GPa, while the flexural strength, determined from four-point bending tests, was 0.17 GPa.

DTIC

Manufacturing; Density; Combustion; Ceramics

19990046779 NASA Langley Research Center, Hampton, VA USA

Thermally Stable, Piezoelectric and Pyroelectric Polymeric Substrates

Simpson, Joycely O., Inventor, NASA Langley Research Center, USA; St.Clair, Terry L., Inventor, NASA Langley Research Center, USA; Apr. 06, 1999; In English

Patent Info.: Filed 7 Sep. 1995; NASA-Case-LAR-15279-1; US-Patent-5,891,581; US-Patent-Appl-SN-524855; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A thermally stable, piezoelectric and pyroelectric polymeric substrate was prepared. This thermally stable, piezoelectric and pyroelectric polymeric substrate may be used to prepare electromechanical transducers, thermomechanical transducers, accel-

erometers. acoustic sensors, infrared sensors, pressure sensors, vibration sensors, impact sensors, in-situ temperature sensors, in-situ stress/strain sensors, micro actuators, switches, adjustable fresnel lenses, speakers, tactile sensors. weather sensors, micro positioners, ultrasonic devices, power generators, tunable reflectors, microphones, and hydrophones. The process for preparing these polymeric substrates includes: providing a polymeric substrate having a softening temperature greater than 1000 C; depositing a metal electrode material onto the polymer film; attaching a plurality of electrical leads to the metal electrode coated polymeric substrate; heating the metal electrode coated polymeric substrate in a low dielectric medium; applying a voltage to the heated metal electrode coated polymeric substrate to induce polarization; and cooling the polarized metal electrode coated polymeric electrode while maintaining a constant voltage.
Official Gazette of the U.S. Patent and Trademark Office
Piezoelectricity; Pyroelectricity; Substrates; Thermal Stability; Thermodynamics; Electromechanics; Transducers; Infrared Detectors; Electric Conductors

19990046780 NASA Langley Research Center, Hampton, VA USA
Dimensionally Stable Ether-Containing Polyimide Copolymers
Fay, Catharine C., Inventor, NASA Langley Research Center, USA; St.Clair, Anne K., Inventor, NASA Langley Research Center, USA; Mar. 30, 1999; In English
Patent Info.: Filed 28 Feb. 1997; NASA-Case-LAR-15572-1; US-Patent-5,889,139; US-Patent-Appl-SN-816946; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Novel polyimide copolymers containing ether linkages were prepared by the reaction of an equimolar amount of dianhydride and a combination of diamines. The polyimide copolymers described herein possess the unique features of low moisture uptake, dimensional stability, good mechanical properties, and moderate glass transition temperatures. These materials have potential application as encapsulants and interlayer dielectrics.
Official Gazette of the U.S. Patent and Trademark Office
Copolymers; Diamines; Dimensional Stability; Polyimides; Ethers

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.

19990045844 New York State Energy Planning Board, Albany, NY USA
Report on Issues Regarding the Existing New York Liquefied Natural Gas Moratorium
Nov. 1998; 104p; In English
Report No.(s): PB99-136251; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The New York Energy Planning Board has prepared this study to provide the Govenor and the Legislature with information necessary to determine the need for further extension or modification of the existing State moratorium on the siting of new liquefied natural gas (LNG) facilities and intrastate transportation routes as required by Chapter 385 of the laws of 1997. The report examines existing laws and regulations that would affect new LNG facilities in New York and government initiatives in other states. It reviews existing use of LNG in New York, including safety issues and potential public concerns that may arise with lifting the moratorium. It also discusses the economic and environmental effects of increased LNG usage for New York State. The study concludes that there are economic and environmental advantages for allowing the construction of new LNG facilities as well as the intrastate transportation of LNG over new routes. Additionally, it concludes that safety concerns associated with these facilities are adequately addressed by existing Federal, State and local statutes and regulations.
NTIS
Environment Effects; Law (Jurisprudence); Liquefied Natural Gas; Regulations

19990046422 BES Technologies, Inc., Watertown, NY USA
Converting Cellulose Wastes into Value-Added Products *Final Report*
Oct. 1998; 114p; In English
Report No.(s): PB99-133134; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The New York State Energy Research and Development Authority, Oswego County, and private companies funded a research/feasibility study to determine if 300 to 500 tons per day of waste cellulose is available in the region for a process (Pencor/Biofine) that converts cellulose into value-added chemicals. Other key aspects of the project were to investigate existing multi-fuel

boilers in Oswego County that would provide steam and permit the recovery of energy from the burning of a high-BTU by-product generated by the Biofine process; and evaluate the regulatory requirements. The results of the study verify that over 300 dry tons per day of cellulose in various forms is available for the Pencor/Biofine process within a two-hour (100-mile) radius of Oswego County. The primary site selected for the process (Miller Brewery) is not available for sale but may be leased from the future owners. The regulatory requirements for siting the process and the boiler required to provide process steam and recover energy from the char are site specific but no major obstacles exist toward implementing the project in Oswego County.
NTIS
Wood; Borders; Cellulose; Feasibility Analysis; Waste Utilization

19990046445 NASA Johnson Space Center, Houston, TX USA
Automated Propellant Blending
Hohmann, Carl W., Inventor, NASA Johnson Space Center, USA; Harrington, Douglas W., Inventor, NASA Johnson Space Center, USA; Dutton, Maureen L., Inventor, NASA Johnson Space Center, USA; Tipton, Billy Charles, Jr., Inventor, NASA Johnson Space Center, USA; Bacak, James W., Inventor, NASA Johnson Space Center, USA; Salazar, Frank, Inventor, NASA Johnson Space Center, USA; Mar. 09, 1999; 28p; In English
Patent Info.: Filed 20 Aug. 1997; NASA-Case-MSC-22757-1; US-Patent-5,879,079; US-Patent-Appl-SN-917581; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An automated propellant blending apparatus and method uses closely metered addition of countersolvent to a binder solution with propellant particles dispersed therein to precisely control binder precipitation and particle aggregation. A profile of binder precipitation versus countersolvent-solvent ratio is established empirically and used in a computer algorithm to establish countersolvent addition parameters near the cloud point for controlling the transition of properties of the binder during agglomeration and finishing of the propellant composition particles. The system is remotely operated by computer for safety, reliability and improved product properties, and also increases product output.
Official Gazette of the U.S. Patent and Trademark Office
Solvents; Propellants; Binders (Materials)

31
ENGINEERING (GENERAL)

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

19990045622 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Technology Reports of Kyushu University, Volume 71
Jul. 1998; ISSN 0023-2718; 244p; In Japanese; See also 19990045623 through 19990045628; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Contents include the following: Numerical simulation on interacting flows of supersonic jets impinging on the wall. Introduction of group iteration and its application to design of UAVs. On analysis of wave-structure interactions by Green's identity formula for oblique incident waves. Electrohydrodynamics of liquid crystal in dielectric regime - variety of chevron patterns. Vortex glass transition in superconducting aluminum films. Synchrotron radiation: why does new radiation open new fields?
CASI
Synchrotron Radiation; Supersonic Jet Flow; Liquid Crystals; Electrohydrodynamics; Dielectrics; Periodicals

19990045699 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Turbomachinery blade optimization using the Navier-Stokes equations
Chand, K. K.; Lee, K. D.; Dec. 01, 1997; 14p; In English; American Institute of Aeronautics and Astronautics (AIAA) sciences meeting
Report No.(s): DE98-054342; UCRL-JC-129284; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A method is presented to perform aerodynamic design optimization of turbomachinery blades. The method couples a Navier-Stokes flow solver with a grid generator and numerical optimization algorithm to seek improved designs for transonic turbine blades. A fast and efficient multigrid, finite-volume flow solver provides accurate performance evaluations of potential designs. Design variables consist of smooth perturbations to the blade surface. A unique elliptic-hyperbolic grid generation method is used to regenerate a Navier-Stokes grid after perturbations have been added to the geometry. Designs are sought which improve a design

objective while remaining within specified constraints. The method is demonstrated with two transonic turbine blades with different types and numbers of design variables.
NTIS
Aerodynamics; Optimization; Supersonic Turbines; Turbine Blades; Navier-Stokes Equation

19990045901 Engineering Sciences, Inc., Huntsville, AL USA
Injector Design Tool Improvements: User's manual for FDNS V.4.5 ***Final Report***
Chen, Yen-Sen, Engineering Sciences, Inc., USA; Shang, Huan-Min, Engineering Sciences, Inc., USA; Wei, Hong, Engineering Sciences, Inc., USA; Liu, Jiwen, Engineering Sciences, Inc., USA; Apr. 04, 1998; 95p; In English; Original contains color illustrations
Contract(s)/Grant(s): NASA Order H-28612-D; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The major emphasis of the current effort is in the development and validation of an efficient parallel machine computational model, based on the FDNS code, to analyze the fluid dynamics of a wide variety of liquid jet configurations for general liquid rocket engine injection system applications. This model includes physical models for droplet atomization, breakup/coalescence, evaporation, turbulence mixing and gas-phase combustion. Benchmark validation cases for liquid rocket engine chamber combustion conditions will be performed for model validation purpose. Test cases may include shear coaxial, swirl coaxial and impinging injection systems with combinations LOXIH2 or LOXISP-1 propellant injector elements used in rocket engine designs. As a final goal of this project, a well tested parallel CFD performance methodology together with a user's operation description in a final technical report will be reported at the end of the proposed research effort.
Author
Liquid Propellant Rocket Engines; Manuals; User Manuals (Computer Programs); Parallel Processing (Computers); Computational Fluid Dynamics

19990046342 Tokyo Denki Univ., Faculty of Engineering, Japan
Research Reports of The Faculty of Engineering, Tokyo Denki University, No. 45
Dec. 1997; ISSN 0389-617X; 118p; In English; In Japanese; See also 19990046343 through 19990046346; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This reports the Research of The Faculty of Engineering, of Tokyo Denki University. Topics include: (1) Bit error rate and transmission limit of optical soliton communication systems; (2) modelling of coaxial wire-pipe negative glow corona discharges with and without external magnetic fields; (3) Experimental study on shear behaviour of steel-reinforced concrete columns under high compressive axial force; and (4) synthesis of glycol-uron polymer with biodegradable function. A complete list of research papers from the faculty for the year starting in November 1996 through October 1997 is also included.
CASI
Biodegradability; Glow Discharges; Magnetic Fields; Optical Communication; Composite Materials; Loads (Forces)

19990046446 NASA Langley Research Center, Hampton, VA USA
Ferroelectric Stirling-Cycle Refrigerator
Jalink, Antony, Jr., Inventor, NASA Langley Research Center, USA; Hellbaum, Richard F., Inventor, NASA Langley Research Center, USA; Rohrbach, Wayne W., Inventor, NASA Langley Research Center, USA; Feb. 09, 1999; In English
Patent Info.: Filed 3 Apr. 1997; NASA-Case-LAR-15664-1; US-Patent-5,867,991; US-Patent-Appl-SN-840111; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A Stirling-cycle refrigerator has a three-pump configuration and pumping sequence, in which one pump serves as a compressor. one pump serves as an expander, and one pump serves as a displacer. The pumps are ferroelectrically actuated diaphragm pumps which are coordinated by synchronizing the ferroelectric-actuator voltages in such a way that the net effect of the displacer is to reduce the deleterious effect of dead space; that is, to circulate a greater fraction of the working fluid through the heat exchangers than would be possible by use of the compressor and expander alone. In addition. the displacer can be controlled separately to make the flow of working fluid in the heat exchangers turbulent (to increase the rate of transfer of heat at the cost of greater resistance to flow) or laminar (to decrease the resistance to flow at the cost of a lower heat-transfer rate).
Official Gazette of the U.S. Patent and Trademark Office
Compressors; Ferroelectricity; Heat Exchangers; Heat Transfer; Refrigerators; Stirling Cycle; Cryogenic Cooling; Cryogenic Equipment; Cryogenics; Low Temperature; Pumps

19990046701 NASA Kennedy Space Center, Cocoa Beach, FL USA

Industrial Engineering Lifts Off at Kennedy Space Center

Barth, Tim, NASA Kennedy Space Center, USA; Industrial Engineering Solutions Journal; February 1998, pp. 27-32; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

When the National Aeronautics and Space Administration (NASA) began the Space Shuttle Program, it did not have an established industrial engineering (IE) capability for several probable reasons. For example, it was easy for some managers to dismiss IE principles as being inapplicable at NASA's John F. Kennedy Space Center (KSC). When NASA was formed by the National Aeronautics and Space Act of 1958, most industrial engineers worked in more traditional factory environments. The primary emphasis early in the shuttle program, and during previous human space flight programs such as Mercury and Apollo, was on technical accomplishments. Industrial engineering is sometimes difficult to explain in NASA's highly technical culture. IE is different in many ways from other engineering disciplines because it is devoted to process management and improvement, rather than product design. Images of clipboards and stopwatches still come to the minds of many people when the term industrial engineering is mentioned. The discipline of IE has only recently begun to gain acceptance and understanding in NASA. From an IE perspective today, the facilities used for flight hardware processing at KSC are NASA's premier factories. The products of these factories are among the most spectacular in the world: safe and successful launches of shuttles and expendable vehicles that carry tremendous payloads into space.

Author

Engineers; Payloads; Reliability Engineering; NASA Programs; Management Methods; Efficiency

19990046784 NASA Langley Research Center, Hampton, VA USA

Combination Space Station Handrail Clamp and Pointing Device

Hughes, Stephen J., Inventor, NASA Langley Research Center, USA; Apr. 13, 1999; In English; Provisional application of US-Patent-Appl-SN-019992, filed 18 Jun. 1996

Patent Info.: Filed 18 Sep. 1996; NASA-Case-LAR-15511-1; US-Patent-5,893,533; US-Patent-Appl-SN-019992; US-Patent-Appl-SN-717203; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A device for attaching an experiment carrier to a space station handrail is provided. The device has two major components, a clamping mechanism for attachment to a space station handrail, and a pointing carrier on which an experiment package can be mounted and oriented. The handrail clamp uses an overcenter mechanism and the carrier mechanism uses an adjustable preload ball and socket for carrier positioning. The handrail clamp uses a stack of disk springs to provide a spring loaded button. This configuration provides consistent clamping force over a range of possible handrail thicknesses. Three load points are incorporated in the clamping mechanism thereby spreading the clamping load onto three separate points on the handrail. A four bar linkage is used to provide for a single actuation lever for all three load points. For additional safety, a secondary lock consisting of a capture plate and push lock keeps the clamp attached to the handrail in the event of main clamp failure. For the carrier positioning mechanism, a ball in a spring loaded socket uses friction to provide locking torque; however. the ball and socket are torque limited so that the ball ran slip under kick loads (125 pounds or greater). A lead screw attached to disk spring stacks is used to provide an adjustable spring force on the socket. A locking knob is attached to the lead screw to allow for hand manipulation of the lead screw.

Official Gazette of the U.S. Patent and Trademark Office

Clamps; Joints (Junctions); Loads (Forces); Torque

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COMMUNICATIONS AND RADAR

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

19990044093 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Radar Cross Section Enhancement of Simple Targets

Crothers, Brian J.; Mar. 1999; 60p; In English

Report No.(s): AD-A361788; AFIT/GE/ENG/99M-06; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis explores the use of periodic open slots as passive antenna scatterers to enhance the radar cross section of a simple target. Two slot geometries are considered, thin rectangular slots and circular slots. Targets are modified with slot arrays of various element size, spacings, numbers, and geometries. These geometries were later backed by a cavity in an attempt to further enhance RCS. Measurements were taken and the results were compared to target baselines, which are nothing more than the unslotted ver-

sion of the same target. Moment method solutions were also computed for comparisons with measured results. Additionally, an analytical expression for antenna scattering was tested as a means of achieving a fast first order accurate solution for target RCS.
DTIC
Radar Cross Sections; Scattering; Antennas; Passivity

19990044097 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Non Co-Operative Detection of LPI/LPD Signals Via Cyclic Spectral Analysis
Gillman, Andrew M.; Mar. 1999; 122p; In English
Report No.(s): AD-A361720; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This research proposes and evaluates a novel technique for detecting LPI/LPD communication signals using a digital receiver primarily designed to detect radar signals, such as a Radar Warning Receiver (RWR) or an Electronic Support Measures (ESM) receiver. The proposed Cyclic Spectrum Analysis (CSA) receiver is a robust detector that takes advantage of the spectral correlation properties of second-order cyclostationary signals. A computationally efficient algorithm is used to estimate the Spectral Correlation Function (SCF). Using state-of-the-art FFT processing, it is expected that the proposed CSA receiver architecture could estimate the entire cyclic spectrum m approximately 0.6 ms. The estimate is then reduced to an energy related test statistic that is valid for all cycle frequencies within the receiver bandwidth. by producing an estimate of the cyclic spectrum, the CSA receiver also benefits post-detection tasks such as signal classification and exploitation. As modeled, the ideal CSA receiver detection performance is within 1.0 dB of the radiometer in benign signal environments and consistently outperforms the radiometer in adverse signal environments. The effect on detection performance when the CSA receiver is implemented with channelized and quadrature digital receiver architectures is also examined.
DTIC
Signal Processing; Spectrum Analysis; Detection; Fast Fourier Transformations

19990044101 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Optimal Wavelet Denoising for High Range Resolution Radar Classification
Huether, Brian M.; Mar. 1999; 137p; In English
Report No.(s): AD-A361713; AFIT/GE/ENG/99M-14; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Noncooperative identification (NCTI) of airborne targets is a top priority for the Air Force and this thesis makes a significant contribution to that area. High range resolution radar (HRR) provides an attractive means to perform NCTI. When measured HRR data is used, classification performance is excellent. However, it is often not feasible to acquire measured HRR signatures for a wide set of targets, thus necessitating the use of synthetically generated HRR data. Classification performance suffers severe degradation when using synthetic data. This thesis suggests that a large portion of HRR signature content is non-discriminatory and that this content is a cause of classifier degradation for the case of synthetic data. A unique wavelet-based denoising methodology is developed which is optimized with respect to classification accuracy. In the case of synthetic data, the denoising method leads to remarkable classification improvements. Classification accuracies are obtained which are comparable to those when training on measured data. This is an unprecedented result. It is also shown that the denoising approach of this thesis leads to superior classification results compared to those obtained with traditional wavelet-based methods.
DTIC
Radar; High Resolution; Classifications; Targets

19990045639 Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA
Improving Acoustic Models by Watching Television
Witbrock, Michael J., Carnegie-Mellon Univ., USA; Hauptmann, Alexander G., Carnegie-Mellon Univ., USA; Mar. 19, 1998; 6p; In English, Mar. 1997, Palo Alto, CA, USA; Sponsored by American Association for Artificial Intelligence, USA
Contract(s)/Grant(s): NSF IRI-94-11299
Report No.(s): AD-A350494; CMU-CS-98-110; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Obtaining sufficient labelled training data is a persistent difficulty for speech recognition research. Although well transcribed data is expensive to produce, there is a constant stream of challenging speech data and poor transcription broadcast as closed-captioned television. We describe a reliable unsupervised method for identifying accurately transcribed sections of these broadcasts, and show how these segments can be used to train a recognition system. Starting from acoustic models trained on the Wall Street Journal database, a single iteration of our training method reduced the word error rate on an independent broadcast television news test set from 62.2% to 59.5%.
DTIC
Acoustic Properties; Television Systems; Broadcasting; Machine Learning

19990045689 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Low Grazing Angle Tarrain Backscattering Coefficient Generator

O'Connor, William N.; Mar. 1999; 87p; In English

Report No.(s): AD-A361807; AFIT/GE/ENG/99M-21; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A near-horizon probabilistic terrain backscatter coefficient generator is introduced, combining modified sea-state curves with Weibull-type probability density functions. A total of nine terrain type classifications (soils & rocks, trees, grasses, shrubs, short vegetation, roads, urban areas, dry snow, and wet snow) are supported, for seven radar bands (L, S, C, X, Ku, Ka, and W), and both linear (HH, VV) and cross (HV, VH) polarizations. The Weibull functions are based on measured sigma and match the published data. The functions also provide a probabilistic nature to the generator. Modified sea state curves are used in place of the Weibull functions for near-horizon incidence angles due to the dearth of measured data at this range. The sea state approach is based on the theory that for sigma, similar surface roughness of two different terrain types results in similar sigma curve shapes. Generator testing and validation used available measured sigma for three terrain types. The testing did not reject the modified sea curve usage and allowed system implementation for the remaining terrain types.

DTIC

Backscattering; Radar Signatures; Scattering Coefficients

19990045690 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

An Empirical Prediction Model of the Performance Impacts of Material Tolerances in Frequency Selective Surfaces Using the Monte Carlo Method

Craig, Matthew D.; Mar. 1999; 96p; In English

Report No.(s): AD-A361809; AFIT/GE/ENG/99M-05; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Standard computational tools predicting frequency selective surface (FSS) performance model periodic structures as an infinite-by-infinite array of perfectly placed elements with perfect, identical dimensions, and with dielectric layers of uniform thickness and material composition. These models do not address perturbations caused by manufacturing tolerances of elements and dielectric layers, nor do they address edge effects caused by finite-by-finite dimensional arrays. The Monte Carlo Method was used to determine the effects of random variations in element dimension, placement, dielectric thickness, and dielectric material on FSS performance. A full-factorial experimental design was applied, and eight hundred twenty-five unique finite arrays of elements were generated with dimensions that varied randomly within tolerances. Each array was analyzed using the AIM code (Adaptive Integral Method), and a sensitivity analysis was performed to determine the influence of design parameter tolerances on FSS performance. Dipole length was shown to have the most significant impact on FSS performance. Dielectric material constant, and the combination of dipole length and dipole placement in the "length" direction also had statistically significant impact on FSS performance. In addition, low tolerances for two design parameter combinations--dielectric thickness alone, and the combination of all five design parameters--produced significant rapid variation in output performance data.

DTIC

Antenna Arrays; Performance Prediction; Software Development Tools; Design Analysis; Factorial Design

19990045718 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

TE Scattering From Bubbles In RAM

Cochran, John G.; Mar. 1999; 147p; In English

Report No.(s): AD-A361666; AFIT/GE/ENG/99M-04; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This research looks at various bubble sizes in one particular magnetic RAM (MAURAM) type, from grazing incidence (00) to 450 and at a frequency range from 2-18 GHz, TE polarization. The results from the absolute RCS measurement of the various sized RAM bubbles are discussed in terms of a frequency dependent increase in RCS. In the frequency band of interest, 2-18GHz, a RAM bubble increases the RCS at all angles, from grazing incidence (00) to 450 From 10-18GHz the RAM bubble does not cause an increase in RCS. In general the highest RCS is at 2GHz and tapers down as frequency increases. At near grazing angles the RCS increase due to the bubbles is 10-15dB. At the higher angles, the RCS increase due to the bubbles is 10-20dB. The RCS increase is relative to the noise plus clutter measurement of the range. The range of absolute RCS values for the various bubble sizes can range from -55 dBsm to -25 dBsm. The results of these experiments are captured in a statistical model which provides an estimate of the bubble's dependence on frequency, angle, and size.

DTIC

Scattering; Frequency Ranges; Magnetic Fields; Bubbles

19990045722 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Trade-Off Analysis of Communications Capabilities of Inter-Satellite Links

Feltman, Andrew J.; Mar. 1999; 122p; In English

Report No.(s): AD-A361727; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis designs, develops, and uses software Graphical User Interfaces (GUIs) to analyze the communications capabilities of Radio Frequency (RF) Inter-Satellite Links (ISLs). The GUIs are geared towards analyzing the proposed ISLs of the Discoverer II program, but are general enough to permit analysis of any free-space RF ISLs. Discoverer II is a demonstration program of low-earth orbiting satellites and is primarily focused on satellite-based sensor technology. This thesis shows RF ISLs can meet the program requirement to broadcast the sensor data back to CONUS in near-real-time. The GUIs operate in real-time and explore trade-offs in the communications capability by varying the requirements, parameters, and components of the system design. Three GUIs are developed. The first GUl uses parameters from an assumed satellite constellation geometry to calculate the operating range of the ISLs. The second GUl solves for an unknown parameter of the communications system when all other parameters are given. The third GUl extends the analysis capability by plotting the trade-off between two parameters over a specified range of data. The analysis of the Discoverer II ISLs indicates that antenna radius is a very significant factor in the trade-off analysis, as well as being an important satellite design parameter.

DTIC

Graphical User Interface; Communication Satellites

19990045782 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Target Pose Estimation from Radar Data Using Adaptive Networks

Learn, Andrew W.; Mar. 1999; 116p; In English

Report No.(s): AD-A361658; AFIT/GCS/ENG/99M-10; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This research investigates and extends recent work by J.C. Principe at the University of Florida in target pose estimation using adaptive networks. First, Principe's technique is successfully extended to estimate both azimuth and elevation using SAR images. A network trained and tested using MSTAR data yields mean errors of less than six degrees in azimuth and five degrees in elevation. Second, the technique is applied to high-range resolution radar (HRR) signatures. Ground target (azimuth only) testing yields mean errors of less than 11 degrees for most classes. Air target testing for networks trained and tested on the same aircraft class yields mean errors under five degrees in azimuth and six degrees in elevation. However, cross-class estimation yields poor results. HRR signatures are analyzed to identify error sources and recommend ways to improve accuracy. Finally, Principe's novel mutual information training method is compared against traditional mean-squared-error training. Results show both methods are generally equivalent, but mutual information experiences convergence problems for some complex training sets. In general, adaptive network techniques demonstrate significant potential for improving the state of the art in target pose estimation. Both the estimation of elevation in SAR and the application to HRR are new and noteworthy successes.

DTIC

Synthetic Aperture Radar; Radar Signatures; Radar Imagery; Radar Data

19990045866 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

A Performance Analysis of Dynamic Routing Algorithms in an IRIDIUM-Like Low Earth Orbit Satellite System

Pratt, Stephen R.; Mar. 1999; 134p; In English

Report No.(s): AD-A361763; AFIT/GCE/ENG/99M-04; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This research presents a first of its kind comparative analysis of the Extended Bellman-Ford and Darting algorithms, using the Iridium low earth orbit (LEO) satellite system configuration for the simulation environment. The algorithms are compared to one another via discrete-event computer simulation and evaluated based on their ability to route real-time voice communications under low, medium, and high network loading conditions. The algorithms' ability to meet real-time voice constraints is evaluated with a full and degraded satellite constellation using an algorithmic satellite removal method. The investigation results indicate that both algorithms are suitable for use in a LEO environment and are capable of meeting the real-time voice communications requirements as long as a load-balancing mechanism is in place to route traffic around heavily loaded satellites. The results also indicate that the Iridium system is robust, capable of meeting the real-time voice constraints even when the constellation is degraded.

DTIC

Communication Satellites; Routes; Voice Communication; Earth Orbital Environments; Low Earth Orbits

19990045887 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
An Analysis of Transmission and Storage Gains from Sliding Checksum Methods
Taylor, Richard, Defence Science and Technology Organisation, Australia; Jana, Rittwik, Defence Science and Technology Organisation, Australia; November 1998; 8p; In English
Report No.(s): DSTO-TR-0743; DODA-AR-010-672; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury South Austrialia), Hardcopy, Microfiche

In a previous report we described, modelled and analysed a protocol ”rsync” for synchronizing related files at different ends of a communications channel with a minimum of transmitted data. This report identifies the extent of the gains that this method may provide by performing experiments on large repositories of data. The outcome is a new method of compressing large directories of data that together with conventional methods provides major gains in compression factors. As is explained in the report these gains in compression are also indicative of the data transmission gains available when mirroring a collection of files at a remote site using rsync.
Author
Data Transmission; Protocol (Computers); Computer Programs

19990046015 Emergency Management Inst., Emmitsburg, MD USA
Technology and Emergency Management. Emergency Management Institute. Instructor Guide
Pine, J. C.; Feb. 1999; 252p; In English
Report No.(s): PB99-131906; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This course explores the application of technology applications. Some of these are portrayed in illustrations that accompany explanations of critical issues that are a part of technology application. In addition, special issues and problems associated with the use of technology in emergency management are examined and strategies to overcome these issues and problems are outlined. Some of the subjects treated are use of the Internet, spatial analysis applications in vulnerability analysis, networks and telecommunications systems, decision support systems, and emerging technologies. This manual has been developed and designed to be a strong starting point in the delivery of a course on Technology and Emergency Management. This course was developed within the context of the Higher Education Project of the Federal Emergency Management Agency (FEMA), the purpose of which is to encourage and support the spread of emergency management-related degree programs and education in colleges and universities across the USA.
NTIS
Technology Utilization; Emergencies; Education

19990046078 Prairie View Agricultural and Mechanical Coll., TX USA
Microwave Imaging on Metal Objects *Final Report, 1995-1998*
Tolliver, C. L., Prairie View Agricultural and Mechanical Coll., USA; Apr. 22, 1998; 38p; In English
Contract(s)/Grant(s): NCC9-40
Report No.(s): NASA/CR-1998-207795; NAS 1.26:207795; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This final report for the project discusses the attempts to model, using different methods, microwave image reconstruction. Maximum Entropy Method was not successful. Attempts to use Singular Value Decomposition (SVD) got some good results after initial failure. SVD is based upon a theory of linear algebra, to the effect that any M X N Matrix A whose number of rows M is greater than or equal to its number of columns, N can be written as the product of an M X N column-orthogonal matrix U, an N X N diagonal Matrix, W, with m positive or zero elements (the singular values) and the transposition of an N X N orthogonal matrix V. In microwave imaging, the scattered fields can be expressed by the induced current distribution. The SVD method required more contiguous computer memory than was available. Work was also done on the Conjugate Gradient Method (CGM), which didn’t work well when tried earlier. It was found that separation of the imaginary part and the real part during calculation may work. This work was considered incomplete as of the end of the grant period.
CASI
Conjugate Gradient Method; Current Distribution; Image Reconstruction; Matrices (Mathematics); Maximum Entropy Method; Microwave Imagery; Computerized Simulation

19990046343 Tokyo Denki Univ., Faculty of Engineering, Japan
Bit Error Rate and Transmission Limit of Optical Soliton Communication Systems
Abe, Mayumi, Tokyo Denki Univ., Japan; Saito, Tomohiro, Tokyo Denki Univ., Japan; Yoshino, Takayuki, Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1997, No. 45, pp. 1-9; In Japanese; See also 19990046342; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

The aim of this paper is to theoretically investigate the bit error rate (BER) for soliton communication systems employing optical amplifiers along a fiber-optic transmission line. Some important parameters in system design, such as the amplifier spacing, the transmission distance and the passband profile of optical filters, are discussed for the systems equipped with a preamplifier and cascaded amplifiers. We obtain the transmission limit by expanding the results into the system employing a distributed amplifier. The bit error rates calculated from the probability density function based on the orthogonal expansion of the light amplitude make it possible to exactly find system performances; the influences of the soliton pulse profile, its width and the optical filter passband profile are properly taken into account.
Author
Bit Error Rate; Fiber Optics; Light Amplifiers; Optical Communication; Telecommunication

19990046377 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Computation of Scattering from Bodies of Revolution Using an Entire-Domain Basis Implementation of the Moment Method
Ford, Arthur P., IV; Mar. 1999; 106p; In English
Report No.(s): AD-A361811; AFIT/GE/ENG/99M-10; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Research into improved calibration targets for measurement of radar cross-section has created a need for the ability to accurately compute the scattering from perfectly conducting bodies of revolution. Common computational techniques use Moment Method codes that employ subdomain basis functions to expand the unknown current density. This approach has its shortcomings. Large numbers of basis functions are required, and increasing the number of basis functions to improve accuracy after an initial computation requires re-computation of previous results and lost processing time. This research involves using basis functions that have as their domain the entire length of the surface. Entire-domain basis functions are better able to model the current density on a smooth surface. Fewer modes are required resulting in smaller matrix sizes. In addition, accuracy can be increased incrementally by adding entire-domain modes while retaining previously computed result saving significant computation time. Electric-field integral equations are developed and solved by an entire-domain implementation of the Moment Method for a perfectly conducting sphere. Comparison is made to the exact Mie series. Convergence in fewer modes is demonstrated over an equivalent application of subdomain pulses. Matrix fill time saves as much as hours over subdomain discretization.
DTIC
Radar Cross Sections; Method of Moments; Bodies of Revolution; Calibrating

19990046428 Air Force Research Lab., Sensors Directorate, Rome, NY USA
Operating the Cross Spectral Metric Algorithm with Limited Secondary Data Support, *Jan. - Jun. 1998*
Hale, Todd B.; Mar. 1999; 30p; In English
Contract(s)/Grant(s): Proj-4506
Report No.(s): AD-A361837; AFRL-SN-RS-TR-1998-215; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
One of the primary problems with the application of Space-Time Adaptive Processing (STAP) techniques is secondary data support for the covariance matrix estimate. Reed has shown the required secondary data support to achieve performance within 3 db of optimal SINR is approximately twice the Degrees Of Freedom (DOF) used. Reed proved this rule for Sample Matrix Inversion (SMI) techniques. A newer class of reduced dimension STAP algorithms uses a decomposition of the sample covariance matrix, thereby deviating from the SMI algorithm class. This report focuses on the performance of the Cross Spectral Metric (CSM) Algorithm with varying secondary data support sizes. The algorithm is shown to be highly susceptible to poor estimation of eigenvalues in the noise subspace. This susceptibility is manifested through large drops in output SINR with secondary data set sizes near the space-time product. to determine the cause of these performance drops, the CSM algorithm is recast in the structure of the eigenbeam model for SMI techniques presented by Gabriel. This new form of the CSM weight vector illustrates that eigenvalue spread in the noise subspace, a result of insufficient sample support, has a direct negative impact on the overall weight vector. Furthermore, eigenvalue spread is mitigated through the use of a diagonally loaded sample covariance matrix. Reducing the eigenvalue spread reduces the impact of cross spectral eigenbeams lying in the noise subspace. Monte Carlo simulations show the SINR performance drop mentioned previously is alleviated through the use of an appropriate diagonal load factor.
DTIC
Signal Processing; Algorithms; Eigenvalues; Command Service Modules; Covariance

19990046429 Nevada Univ., Dept. of Electrical Engineering, Reno, NV USA
Adaptive Nulling with a Cylindrical Array *Final Report, Mar. - Aug. 1998*
Haupt, Randy L.; Mar. 1999; 31p; In English
Contract(s)/Grant(s): F30602-98-C-0033; AF Proj. 4600

Report No.(s): AD-A361840; AFRL-SN-RS-TR-1999-36; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A genetic algorithm is used to adaptively place a sidelobe null using a cylindrical array antenna. Results show that a null can be placed down to the noise floor of the measurement system within 20 to 50 power measurements. This approach to adaptive nulling is a viable means of quickly placing a null in the sidelobes of a phased array antenna.

DTIC

Antenna Arrays; Genetic Algorithms; Adaptive Control

19990046481 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

The Effect of Registration Errors on Tracking in a Networked Radar System ***Final Report***

Mortenson, Bradley J.; Mar. 1999; 91p; In English

Report No.(s): AD-A361801; AFIT/GE/ENG/99M-19; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

To successfully combine information from distributed radar sensors, it is essential that each sensor be correctly referenced in a global coordinate system. If there are biases in the reported position of these sensors, the reported target position will also be biased and the ensuing global estimate of the target position will be degraded. Furthermore, any biases in range or azimuth measurements of these sensors will likewise be reflected in the degradation of global estimate of target position. Registration is the process of ensuring that these errors do not result in the creation of an additional redundant target when only a single target exists. The objective of this thesis is to create a model for analyzing the impact of these biases quantitatively. The model consists of modules which perform the required coordinate conversion, tracking, and data correlation. The target tracks are provided by a standard Kalman filter assuming a constant velocity model. The measurements, state estimates, and covariance matrices obtained from the Kalman filter are combined to form a Chi-squared correlation gate. With this model, the bounds on position, range, and azimuth biases are determined individually and cumulatively. The simulated results compare favorably with the theoretically determined bounds. An additional benefit of this model is that the spatial dependence of the biases may be obtained.

DTIC

Errors; Tracking Radar; Data Correlation; Radar Tracking; Networks

19990046582 Air Force Research Lab., Sensors Directorate, Hanscom AFB, MA USA

Time-Domain Deconvolution Removes the Effects of Near-Field Scatterers

Roberts, Thomas M.; May 1998; 22p; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A361850; AFRL-SN-RS-TR-1998-113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper studies a deconvolution problem that models the removal of interference caused by objects in the near field of antennas. Such interference affects antennas on complicated objects, such as ships and aircraft. Infinitely many time-domain deconvolution algorithms are considered here, of which the best one -- being stable and O(h2) accurate, and O(h4) accurate after Richardson extrapolation -- may compete with : Fourier and Laplace methods. Special care is taken to find an algorithm that accommodates discontinuity-related numerical noise in finite-difference-time-domain data.

DTIC

Finite Difference Time Domain Method; Electromagnetic Interference; Antenna Radiation Patterns

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.

19990044120 Lawrence Livermore National Lab., Livermore, CA USA

Field-emission cathode micro-electro-mechanical system technology for sensors, diagnostics, and microelectronics

Morse, J. D.; Koo, J. C.; Graff, R. T.; Jankowski, A. F.; Hayes, J. P.; Mar. 30, 1998; 7p; In English

Report No.(s): DE98-057440; UCRL-ID-130491; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We have investigated field-emission devices for applications in sensors, diagnostics, and micro-electronics. Field-emission devices micromachined from silicon and molybdenum have been fabricated and tested. Experimental results have shown that the presence of nitrogen gas molecules for pressures up to 1 mtorr has only a moderate impact on device emission performance, and has no long term effect on device operation. These results demonstrate that field-emission cathodes can potentially be used in

sensors applications where gas ionization by election impact is desirable, or other applications in which the field-emission device is exposed to less than ideal vacuum conditions.
NTIS
Field Emission; Cathodes; Microelectronics; Electromechanical Devices; Gas Ionization

19990045729 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Antenna Gain Enhancement Using a Photonic Band Gap Reflector
Schloer, Karl C.; Mar. 1999; 119p; In English
Report No.(s): AD-A361779; AFIT/GE/ENG/99M-26; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Scientists have long known that periodic structures can filter electromagnetic (EM) waves. In the last decade, extension of one- and two-dimensionally periodic structures into a third periodic dimension has produced photonic band gap (PBG) structures. A PBG structure is characterized by its omnidirectional stop band at a set of frequencies determined by the structure's periodicity and permittivity. In the present research, we investigate such a structure as an antenna reflector. We aim to develop a modeling approach that provides accurate computations of PBG behavior without relying on massively parallel processing. We also construct and measure the bulk reflection and transmission properties of a PBG structure, then use it as a planar reflector for a two-arm spiral antenna. We measure the same antenna's radiation properties when mounted above an absorber loaded cavity and a conducting ground plane to determine whether the PBG reflector provides gain enhancement. This comparison of a PBG reflector's performance against standard mounts for a practically useful broadband antenna is unique in PBG research.
DTIC
Antenna Radiation Patterns; Spiral Antennas; Photonics; Electromagnetic Radiation

19990045754 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Ultra-sensitive sensors for weak electromagnetic fields using high-(Tc) SQUIDS for biomagnetism, NDE, and corrosion currents
Kraus, R. H.; Flynn, E. R.; Espy, M.; Jia, Q. X.; Wu, X. D.; Dec. 31, 1998; 19p; In English
Report No.(s): DE99-000808; LA-UR-98-2181; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The research has directly contributed to a new DOE supported project, three patents (one granted and two submitted), and several potential opportunities for new program funding at the Laboratory. The authors report significant developments extending from basic understanding of and fabrication techniques for high critical-temperature (high-(Tc)) SQUID devices to the development of high-level applications such as the SQUID Microscope. The development of ramp edge geometry and silver-doped YBa2Cu3O(7-x) (YBCO) electrodes has tremendously improved the performance of high-(Tc) SQUIDS. Recent experiments have proven and quantified the LANL-patented superconducting imaging plane gradiometry concept. A SQUID microscope, developed largely under this project, has recently acquired data that demonstrated exceptional sensitivity and resolution. New techniques for background noise suppression, needed to use the extraordinarily sensitive SQUID sensors in unshielded environments, have also been developed. Finally, initial investigations to use SQUIDs in a basic physics experiment to measure the electric dipole moment of the neutron were very successful.
NTIS
Electromagnetic Fields; Critical Temperature; Biomagnetism; Corrosion; Squid (Detectors)

19990045995 Sandia National Labs., Albuquerque, NM USA
Hydrogen diffusion and chemistry during the annealing-induced generation of mobile protons in the oxide layer of Si/SiO(2)/Si capacitors
Vanhuesden, K.; Devine, R. A. B.; Fleetwood, D. M.; Warren, W. L.; Dec. 31, 1998; 2p; In English; IEEE semiconductor interface specialists conference
Report No.(s): DE98-006290; SAND-98-1977C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
In a number of recent studies the generation of mobile protons in the buried oxide of SiO materials and in thermal oxide buried underneath a poly-Si layer has been discussed. The protons are found to be stable and can be easily rearranged by applying an electric field. The details of the hydrogen reactions leading to the generation of the mobile H(sup +) are still under investigation. In a recent work a dynamic equilibrium model was presented. The forward reaction dominates above (approximately) 500 C and the resulting H(sup +) is mobile and entrapped inside the SiO(2). The electron is donated to the Si. The H(sup 0) is likely to be formed through H(2) + K (Leftrightarrow) HK + H(sup 0), where K is a cracking site. In the same work it was shown that the reactive hydrogen species enter the oxide from the device edges. Hence, the amount of the reactive species reaching the oxide by diffusion through the Si overlayer is negligible. These results seem to contradict earlier studies where it is shown that hydrogen

can easily diffuse through the top Si layer under the given experimental conditions. The authors present here new details on hydrogen diffusion and chemistry during the protonation anneal that may offer an explanation for the hydrogen diffusion paradox. The new findings suggest that reactions at the ambient/SiO(2) interface play a key role.
NTIS
Annealing; Protons; Silicon Oxides; Capacitors; Dynamic Models; Chemical Reactions; Gaseous Diffusion; Hydrogen Isotopes

19990045999 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Modulation of Electrostatic Microelectromechanical Mirrors Using a CMOS Controller
Rounsavall, Paul C.; Mar. 08, 1999; 104p; In English
Report No.(s): AD-A361750; AFIT/GE/ENG/99M-25; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Microelectromechanical Systems (MEMS) is a rapidly growing technology that lends itself particularly well to optical applications. An example of an optical MEMS device is the piston-action mirror that modulates the phase of reflected light. The phase of reflected light can be varied using thermal or electrostatic actuation to control the position of the mirror. In previous research, a modulation method to control thermally actuated mirrors was developed. This thesis presents the development, implementation, fabrication, and testing of a complimentary metal oxide semiconductor (CMOS) controller capable of directly interfacing between a digital system, such as a computer, and an electrostatically actuated MEMS mirror device. The controller pulse width modulates a supply voltage to vary the power applied to the MEMS mirror device. The MEMS mirror device responds with negligible position ripple to the applied average power of the pulse width modulation signal. by varying the duty cycle of the pulse width modulation signal, the position of the mirror is varied. This controller can be adapted to control other electrostatically actuated devices using the design and methodology described in this thesis. The implementation of this controller is a step toward the monolithic integration of a MEMS deformable mirror array with CMOS control electronics.
DTIC
Microelectromechanical Systems; Metal Oxide Semiconductors; Controllers; CMOS

19990046027 Premier Engineer Products Corp., Snyderville, UT USA
Capacitive charging system for high power battery charging
Dec. 31, 1998; 4p; In English
Report No.(s): DE99-001461; DOE/EE/15658-T8; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document describes a project to design, build, demonstrate, and document a Level 3 capacitive charging system, and it will be based on the existing PEZIC prototype capacitive coupler. The capacitive coupler will be designed to transfer power at a maximum of 600 kW, and it will transfer power by electric fields. The power electronics will transfer power at 100 kW. The coupler will be designed to function with future increases in the power electronics output power and increases in the amp/hours capacity of sealed batteries. Battery charging algorithms will be programmed into the control electronics. The finished product will be a programmable battery charging system capable of transferring 100 kW via a capacitive coupler. The coupler will have a low power loss of less than 25 watts when transferring 240 kW (400 amps). This system will increase the energy efficiency of high power battery charging, and it will enhance mobility by reducing coupler failures. The system will be completely documented. An important deliverable of this project is information. The information will be distributed to the Army's TACOM-TARDEC's Advanced Concept Group, and it will be distributed to commercial organizations by the Society of Automotive Engineers. The information will be valuable for product research, development, and specification. The capacitive charging system produced in this project will be of commercial value for future electric vehicles. The coupler will be designed to rapid charge batteries that have a capacity of several thousand amp/hours at hundreds of volts. The charging system built here will rapid charge batteries with several hundred amp/hours capacity, depending on the charging voltage.
NTIS
Electric Batteries; Energy Conservation; Battery Chargers; Design Analysis; Capacitance

19990046064 NASA Langley Research Center, Hampton,VA USA
Design and Development of Lateral Flight Director
Kudlinski, Kim E., NASA Langley Research Center, USA; Ragsdale, William A., Unisys Corp., USA; May 1999; 78p; In English
Contract(s)/Grant(s): RTOP 992-30-11
Report No.(s): NASA/TM-1999-208957; L-17781; NAS 1.15:208957; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The current control law used for the flight director in the Boeing 737 simulator is inadequate with large localizer deviations near the middle marker. Eight different control laws are investigated. A heuristic method is used to design control laws that meet specific performance criteria. The design of each is described in detail. Several tests were performed and compared with the cur-

rent control law for the flight director. The goal was to design a control law for the flight director that can be used with large localizer deviations near the middle marker, which could be caused by winds or wake turbulence, without increasing its level of complexity.
Author
Instrument Landing Systems; Boeing 737 Aircraft; Control Systems Design; Flight Control; Flight Simulators; Control Theory

19990046249 NASA Marshall Space Flight Center, Huntsville, AL USA
On the Mechanism for a Gravity Effect Using Type 2 Superconductors
Robertson, Glen A., NASA Marshall Space Flight Center, USA; 1999; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper, we formulate a percent mass change equation based on Woodward's transient mass shift and the Cavendish balance equations applied to superconductor Josephson junctions, A correction to the transient mass shift equation is presented due to the emission of the mass energy from the superconductor. The percentage of mass change predicted by the equation was estimated against the maximum percent mass change reported by Podkletnov in his gravity shielding experiments. An experiment is then discussed, which could shed light on the transient mass shift near superconductor and verify the corrected gravitational potential.
Author
Gravitation; Balance; Mass Ratios; Computation

19990046310 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Boulder, CO USA
Dipole Moments of Weak, Electrically Small Emitters from TEM-Cell Measurements
Hill, D. A.; Cavcey, K. H.; Dec. 1998; 40p; In English
Report No.(s): PB99-118200; NISTIR-5079; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The report presents a new method for determining the equivalent electric and magnetic dipole moments of an electrically small emitter from TEM-cell measurements. The electric dipole moments are determined from open-circuit measurements, and the magnetic dipole moments are determined from short-circuit measurements. The method has the advantages of simplicity in separating the electric and magnetic dipole emissions and increased sensitivity resulting from the in-phase reflection from the open- or short-circuited port. These results have practical application to the problem of detection of electronic bomb detonators.
NTIS
Electric Dipoles; Magnetic Dipoles; Emitters; Capacitance; Inductance

19990046339 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Development of high magnetic fields for energy research
Thompson, J. D., Department of Energy, USA; Campbell, L. J., Department of Energy, USA; Modler, R., Department of Energy, USA; Movshovich, R., Department of Energy, USA; Lawrence, J. M., Department of Energy, USA; Dec. 31, 1998; 8p; In English
Report No.(s): DE99-000552; LA-UR-98-1874; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). The primary purpose of work has been to develop the scientific basis for DOE support of a program that would build a novel, nondestructive 100-tesla magnet that would be available as a user facility for cutting-edge, energy-related research and technology at very high magnetic fields.
NTIS
Magnetic Fields; Test Facilities; Energy Technology; Nondestructive Tests

19990046344 Tokyo Denki Univ., Faculty of Engineering, Japan
Modelling of Coaxial Wire-Pipe Negative Glow Corona Discharges With and Without External Magnetic Fields
Chang, J. S., McMaster Univ., Canada; Pontiga, F., McMaster Univ., Canada; Kwan, A. L. C., McMaster Univ., Canada; Kaneda, T., Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1997; No. 45, pp. 11-22; In English; See also 19990046342; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

A model of a negative glow corona discharge in coaxial wire-pipe geometries with and without external magnetic fields are analytically and numerically investigated. The physical model is based on the one-dimensional modified Thomson-Rice's model with experimental current-voltage characteristics as calculation inputs, where the mobility of electrons is considered as a function of local electric fields. Then the external magnetic field is introduced and the local electron density, electron temperature, and

electric field profiles are obtained. Numerical results are presented for applied voltages from 9 to 20 kV, and gas flow rates from 1 to 51/min.
Author
Gas Flow; Magnetic Fields; Wire; Electric Potential; Glow Discharges; Electric Corona; Mathematical Models; Coaxial Cables

19990046769 NASA Lewis Research Center, Cleveland, OH USA
Method and Apparatus for Testing Microwave Devices and Circuits in a Controlled Environment
Miranda, Felix A., Inventor, NASA Lewis Research Center, USA; Toncich, Stanley S., Inventor, NASA Lewis Research Center, USA; Dec. 29, 1998; In English
Patent Info.: Filed 20 Nov. 1996; NASA-Case-LEW-20000-1; US-Patent-5,854,559; US-Patent-Appl-SN-780093; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A test system is disclosed that enables the testing of microwave components in a controlled environment without disturbing that environment. The system includes a test fixture which holds the calibration standards and the component being tested, and environmental control chamber, and a microwave switching system. The system provides a coaxial connection to microwave testing equipment, such as an automatic network analyzer (ANA) and facilitates both calibration and testing while maintaining environmental integrity.
Official Gazette of the U.S. Patent and Trademark Office
Microwave Equipment; Performance Tests; Calibrating; Environmental Tests

19990046778 NASA Johnson Space Center, Houston, TX USA
Ground Isolation Circuit for Isolating a Transmission Line from Ground Interference
Davidson, Craig A., Inventor, NASA Johnson Space Center, USA; Nov. 24, 1998; In English
Patent Info.: Filed 1 Feb. 1996; NASA-Case-MSC-22521-1; US-Patent-5,841,467; US-Patent-Appl-SN-595312; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An isolation circuit is disclosed for isolating ground interference from a wideband transmission signal. The ground isolation circuit of the present invention is constructed using a pair of matched mixer circuits. each of which receives a carrier signal from the same oscillator circuit. The first mixer circuit also receives the baseband signal input after appropriate conditioning, and modulates the baseband signal onto the carrier signal. In the preferred embodiment, the carrier signal has a predetermined frequency which is at least two times the frequency of the baseband signal. The modulated signal (which preferably comprises an rf signal) is transmitted via an rf transmission line to the second mixer, which demodulates the rf signal to recover the baseband signal. Each port of the mixer circuits connects to an isolation transformer to insure isolation from ground interference.
Official Gazette of the U.S. Patent and Trademark Office
Transmission Lines; Radio Frequencies; Mixing Circuits; Transformers

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.

19990043946 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
On Errors of Pulsating Flow Measurement by a Yawmeter with Spherical Head and a Numerical Flow Analysis
Takahara, Hisasada, Kyushu Univ., Japan; Furukawa, Akinori, Kyushu Univ., Japan; Technology Reports of Kyushu University; Mar. 1998; Volume 71, No. 2, pp. 119-126; In Japanese; See also 19990043944; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A multi-hole yawmeter is only one instrument to make simultaneous measurement of flow velocity and total pressure in a time dependent flow possible. A yawmeter coupled with small sized and high response pressure pickups has been available to unsteady flow measurements. As we made clear experimentally in the previous report, however the measurements should be accompanied with fluid-dynamic errors. Based on a guarantee of accuracy about this numerical method for a viscous flow around sphere in uniform steady flow, a fluid-dynamic error in measurement of periodically pulsating flow by 3-holes spherical yawmeter is investigated numerically. Measurement errors and mechanisms of their outbreak are studied in 3-kinds of pulsating flow by comparing with the experimental results, and some keys for reduction of the error are presented.
Author
Errors; Flow Measurement; Flow Velocity; Numerical Analysis; Steady Flow

19990044092 Louisiana Tech Univ., Ruston, LA USA

Parallel implicit Multigrid Method for Direct Numerical Simulation of Time-Dependent Compressible Turbulent Flow Around Flight Vehicles*, 1 Mar. 97 30 Sep. 98*

Liu, Chaoqun; Hua, Shan; Li, Jiang; Mar. 29, 1999; 44p; In English

Report No.(s): AD-A361789; AFRL-SR-BL-TR-99-0108; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An oblique transition process of a flat-plate boundary layer at a free-stream Mach number of M (infinity) =4.5 and a Reynolds number of 10000 based on free-stream velocity and inflow displacement thickness is simulated as the validation of the code. Four transitional stages are observed: the linear and weakly nonlinear growth, the appearance of staggered A-vortex patterns, the evolution of A-vortex into hairpin vortex, the breakdown of hairpin vortical structures. The evolution of averaged quantities, such as the skin-friction coefficient, the mean velocity profile, the boundary layer thickness are all computed and found agreed very well with theoretic and experimental results. For complex geometry, 2D and 3D numerical grid generation method are used to generate high-quality meshes. Subsonic flow around 2D NACA 0012 airfoil and 3D Delta wing with a large angle of attack are investigated with large eddy simulation. Flow separations and large eddy structures are observed, the interactions between vortical structures will be studied.

DTIC

Turbulent Flow; Numerical Analysis; Compressible Flow; Boundary Layer Separation; Direct Numerical Simulation; Separated Flow

19990044114 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Results from the Porting of the Computational Fluid Dynamics Code F3D to the Convex Exemplar (SPP-1000 and SPP-1600) ***Final Report, Jan. - Dec. 1996***

Pressel, Daniel M.; Mar. 1999; 64p; In English

Report No.(s): AD-A361672; ARL-TR-1923; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report discusses the continuing efforts to port the F3D computational fluid dynamics code to RISC-based SMPs. Originally, this program was optimized for Cray vector supercomputers such as the Cray C90. Previous attempts to run this code on 561 Power Challenges, and Convex Exemplars, as well as systems from SUN and Digital Equipment, demonstrated a level of performance that was so low as to be utterly useless (in many cases, it became necessary to kill the job before the first time step had completed). After making a concerted effort to port the program to an 561 Power Challenge (R8000 processor), acceptable levels of performance were finally achieved (Pressel 1997). Using this version of the code as the starting point, an effort was made to produce a program that ran efficiently on both systems from 561 and Convex. Unfortunately, a number of limitations with the Convex Exemplar were discovered that limited the success of this effort.

DTIC

Computational Fluid Dynamics; Supercomputers; Cray Computers

19990045623 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Numerical Simulations on Interacting Flows of Supersonic Jets Impinging on the Wall

Oshiro, Satoshi, Kyushu Univ., Japan; Aso, Shigeru, Kyushu Univ., Japan; Sakata, Nobuhiro, Kyushu Univ., Japan; Shida, Hiroya, Kyushu Univ., Japan; Technology Reports of Kyushu University; Jul. 1998; Volume 71, No. 4, pp. 245-249; In Japanese; See also 19990045622; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

High temperature jet impinging on the wall sometimes causes quite serious problems in launching the rocket from the ground. The interacting flow fields of supersonic jet impinging on the wall are simulated numerically. The distance from the nozzle exit to the wall is varied and the effects of the distance on the interacting flow fields are investigated numerically. The calculated flow patterns and pressure distributions show good agreements with experiments.

Author

Numerical Analysis; Supersonic Jet Flow; Simulation; Walls; Jet Impingement

19990045625 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

On Analysis of Wave-Structure Interactions by Green's Identity Formula for Oblique Incident Waves

Yoshida, Akinori, Kyushu Univ., Japan; Yamashiro, Masaru, Kyushu Univ., Japan; Irie, Isao, Kyushu Univ., Japan; Technology Reports of Kyushu University; Jul. 1998; Volume 71, No. 4, pp. 281-287; In Japanese; See also 19990045622; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A numerical method solving interactions between coastal structures and oblique incident waves is presented. The method is a so-called boundary integral method in which Green's Identity Formula for oblique incident waves is used for the expression of the velocity potential of wave motion. The derivation of the Green's Identity Formula and a way of it's numerical computation

on boundary elements are shown. Then, the method is applied to the reflection problem of oblique waves incident on a perfectly reflective vertical wall. The accuracy of the present method is checked by comparing the numerical results with the theoretical ones for values of the velocity potentials on water surface.
Author
Boundary Integral Method; Wave Interaction; Numerical Analysis

19990045867 Rutgers - The State Univ., Dept. of Mechanical and Aerospace Engineering, Piscataway, NJ USA
Large Eddy Simulation of Three-Dimensional High Speed Aerodynamic Flows ***Final Report, 1 Aug. 1996 - 30 Nov. 1998***
Knight, Doyle D.; Mar. 01, 1999; 24p; In English
Contract(s)/Grant(s): F49620-96-1-0389
Report No.(s): AD-A361765; RU-TR-MAE-203-F; AFRL-SR-BL-TR-99-0101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An unstructured grid Large Eddy Simulation (LES) methodology has been developed for compressible high speed flows. The filtered compressible Navier-Stokes equations are solved on an unstructured grid of tetrahera. The inviscid fluxes are obtained from an exact locally one-dimensional Riemann solver using Godunov's method. The viscous fluxes are obtained using a discrete analog of Gauss' Theorem. The reconstruction is performed using a Least Squares technique. The temporal integration is a Runge-Kutta method. The algorithm is overall second order accurate in space and time. Four flowfields have been computed: decay of isotropic turbulence, channel flow, supersonic flat plate boundary layer and supersonic compression corner. The first and second cases are effectively incompressible, while the third and fourth cases are supersonic (Mach 3). The computed results show close agreement with experiment and Direct Numerical Simulation and validate the unstructured grid LES methodology.
DTIC
Turbulence; Computational Fluid Dynamics; Supersonic Boundary Layers; Direct Numerical Simulation; Channel Flow

19990045886 NASA Marshall Space Flight Center, Huntsville, AL USA
Simulations of the Unsteady Flow through the Fastrac Supersonic Turbine
Griffin, Lisa W., NASA Marshall Space Flight Center, USA; Dorney, Daniel J., Virginia Commonwealth Univ., USA; 1999; 10p; In English; IGTI Turbo, Jun. 1999, Indianapolis, IN, USA; Sponsored by American Society of Mechanical Engineers, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 242-34-ZT; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Analysis of the unsteady aerodynamic environment in the Fastrac supersonic turbine is presented. Modal analysis of the turbine blades indicated possible resonance in crucial operating ranges of the turbopump. Unsteady computational fluid dynamics (CFD) analysis was conducted to support the aerodynamic and structural dynamic assessments of the turbine. Before beginning the analysis, two major problems with current unsteady analytical capabilities had to be addressed: modeling a straight centerline nozzle with the turbine blades and exit guide vanes (EGVs), and reducing run times significantly while maintaining physical accuracy. Modifications were made to the CFD code used in this study to allow the coupled nozzle/blade/EGV analysis and to incorporate Message Passing Interface (MPI) software. Because unsteadiness is a key issue for the Fastrac turbine [and future rocket engine turbines such as for the Reusable Launch Vehicle (RI.V)], calculations were performed for two nozzle-to-blade axial gaps. Calculations were also performed for the nozzle alone, and the results were imposed as an inlet boundary condition for a blade/EGV calculation for the large gap case. These results are compared to the nozzle/blade/EGV results.
Author
Guide Vanes; Supersonic Turbines; Turbine Blades; Unsteady Flow; Supersonic Nozzles; Computational Fluid Dynamics; Navier-Stokes Equation; Baldwin-Lomax Turbulence Model; Viscous Flow; Boundary Conditions

19990045983 Los Alamos National Lab., NM USA
Fully nonlinear internal waves in a system of two fluids. 1: Shallow water configuration; 2: Deep water configuration
Choi, W.; Camassa, R.; Dec. 31, 1998; 9p; In English; ASCE engineering mechanics conference
Report No.(s): DE99-000637; LA-UR-98-1231; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors derive model equations that govern the evolution of internal gravity waves at the interface of two immiscible fluids. These models follow from the original Euler equations under the sole assumption that the waves are long compared to the undisturbed thickness of one of the fluid layers. No smallness assumption on the wave amplitude is made. Here the shallow water configuration is first considered, whereby the waves are taken to be long with respect to the total undisturbed thickness of the fluids. In part 2, the authors derive models for the configuration in which one of the two fluids has a thickness much larger than the wavelength. The fully nonlinear models contain the Korteweg-de Vries (KdV) equation and the intermediate-long-wave (ILW) equation, for shallow and deep water configurations respectively, as special cases in the limit of weak nonlinearity and uni-

directional wave propagation. In particular, for a solitary wave of given amplitude, the characteristic wavelength is larger and the wave speed smaller than their counterparts for solitary wave solutions of the weakly nonlinear equations. These features are compared and found in overall good agreement with available experimental data for solitary waves of large amplitude in two-fluid systems.
NTIS
Internal Waves; Nonlinear Equations; Gravity Waves

19990046028 General Electric Co., Schenectady, NY USA
Annular flow of R-134a through a high aspect ratio duct: Local void fraction, droplet velocity and droplet size measurements
Trabold, T. A.; Kumar, R.; Vassallo, P. F.; Nov. 30, 1998; 39p; In English; 1998 international mechanical engineering congress and exposition
Report No.(s): DE99-001457; KAPL-P-000071; K-98042; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Local measurements were made in annular flow of R-134a through a vertical duct. Using a gamma densitometer, hot-film anemometer and laser Doppler velocimeter, profiles of void fraction, liquid droplet frequency and droplet velocity were acquired across the narrow test section dimension. Based upon these results, data for liquid droplet size were obtained and compared to previous experimental results from the literature. These data are useful for developing an improved understanding of practical two-phase refrigerant flows, and for assessment of advanced two-fluid computer codes.
NTIS
Annular Flow; High Aspect Ratio; Voids; Velocity Measurement; Drops (Liquids); Drop Size

19990046030 General Electric Co., Schenectady, NY USA
Predicting multidimensional annular flows with a locally based two-fluid model
Antal, S. P.; Strayer, T. D.; Jun. 30, 1998; 10p; In English; International conference on multi-phase flow
Report No.(s): DE99-001454; KAPL-P-000064; K-98030; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Annular flows are a well utilized flow regime in many industrial applications, such as, heat exchangers, chemical reactors and industrial process equipment. These flows are characterized by a droplet laden vapor core with a thin, wavy liquid film wetting the walls. The prediction of annular flows has been largely confined to one-dimensional modeling which typically correlates the film thickness, droplet loading, and phase velocities by considering the average flow conditions and global mass and momentum balances to infer the flow topology. In this paper, a methodology to predict annular flows using a locally based two-fluid model of multiphase flow is presented. The purpose of this paper is to demonstrate a modeling approach for annular flows using a multi-field, multidimensional two-fluid model and discuss the need for further work in this area.
NTIS
Annular Flow; Two Fluid Models; Multiphase Flow

19990046373 Iowa Univ., Inst. of Hydraulic Research, Iowa City, IA USA
Leonardian Fluid Mechanics: The Codices Madrid and the ”Libro dell’ Acqua”
Macagno, Enzo, Iowa Univ., USA; Dec. 1998; 160p; In English
Report No.(s): PB99-138398; IIHR-MONO-118; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Numerous notes in his various notebooks show that, late in his active life, Leonardo da Vinci was constantly thinking about the ’Libro dell’ Acqua’, but he left to posterity the task of finding a more complete form of describing his vision of the book. of course, we can do this only by the use of our concepts and language, especially in areas for which he did not provide precise notions and a complete terminology. So we must use terms such as kinematics, hydrostatics, dynamics, energy, pressure, thermodynamics, entropy or dissipation, which neither Leonardo nor high contemporaries knew, but that are necessary to describe his, sometimes implicit, notions. Leonardo wonders not only what water is (as in a note in the Ms C) but also how it moves, what forces it can exert, that is, what its mechanics is and how it can pass from one state to another, that is, its thermodynamics. For Leonardo, some physical properties of water, such as color, smell and taste, are important while nowadays they are not normally included in treatises and books on hydraulics and fluid mechanics. Optics is also inclued: for example water is considered as a mirror, notably less trivial cases than quiescent water, such as the wavy surface of the sea reflecting multiple images of the sun. The above mentioned passage in Ms C 26V deserves full quotation, Leonardo tried to compose a page describing his view of the element to which

he devoted so much of his studies. As in many other cases, he fell short of giving a complete, well rounded picture of what we know was in his mind.
NTIS
Water; Hydrodynamics

19990046378 Naval Postgraduate School, Monterey, CA USA
Observed Kinematics of Waves in the Surf Zone
Constantian, Richard K., Jr; Mar. 1999; 53p; In English
Report No.(s): AD-A361813; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The observed kinematics of waves in the surf zone is examined with extensive measurements from the DUCK94 experiment. Field data used in the study were obtained from vertical stacks of bi-directional current meters and a pressure sensor mounted on a rigid frame at 3 locations along a cross-shore transect in depths of 2,4, and 8m. Observed pressure and velocity spectra are compared to transfer functions based on linear finite depth theory and a simple nonlinear model that accounts for harmonic generation in shallow water. At high frequencies, the observed vertical attenuation of horizontal velocity spectra in 8 and 4m depth is much weaker than predicted by linear theory and generally in good agreement with the nonlinear model predictions. In 2m depth, differences between the linear and nonlinear transfer function are small and both predictions are in reasonable agreement with the observed weak vertical decay. At infragravity frequencies in shallow water depths, observed velocity spectra often show significant vertical decay that is not predicted by either model. Velocity and pressure spectra measured in 4m depth are in good agreement with the nonlinear transfer function. Pressure spectra levels at high frequencies are shown to be significantly reduced by the nonlinear Bernoulli term in the second order pressure field. Analysis of the slopes of the high-frequency tails of the observed velocity spectra shows considerable scatter with a general tendency for spectra to flatten as waves rotate through the surf zone.
DTIC
Waves; Kinematics; Tail Assemblies

19990046438 National Inst. of Standards and Technology, Thermal Machinery Group, Gaithersburg, MD USA
Multiphase Flow of Refrigerant 410a through Short Tube Orifices
Payne, W. Vance, National Inst. of Standards and Technology, USA; O'Neal, Dennis L., Texas A&M Univ., USA; 1999; 28p; In English, 23-27 Jan. 1999, Chicago, IL, USA
Report No.(s): PB99-139040; EPA/600/A-99/016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper gives results of tests of the (near) azeotropic refrigerant R-410a in critical flow through short tube orifices--12.7 mm (0.5 in.), 19.05 mm (0.75 in.), and 25.4 mm (1.0 in.) long--with diameters ranging from 1.09 to 1.94 mm (0.0432 to 0.0763 in.). (NOTE: R-410a is a mixture of 50% R-32 and 50% R-125 by mass.) Simulated condensing temperatures ranged from 26.7 to 51.7 C (80 to 125 F) with evaporating conditions of -1.11 to 10.0 C (30 to 50 F). Upstream pressures corresponding to the various condensing temperatures ranged from 3176 to 2136 kPa (461 to 310 psia). Downstream pressure, upstream pressure, upstream subcooling/quality, short tube diameter, and short tube length were studied to determine their effects on refrigerant mass flowrate. Comparisons were made with R-22 for comparable evaporating and condensing conditions.
NTIS
Multiphase Flow; Refrigerants; Orifices; Critical Flow

19990046629 NASA Lewis Research Center, Cleveland, OH USA
Magnetic Damping of g-Jitter Driven Flows: 3-D Calculations
Shang, D. Y., Washington State Univ., USA; Li, B. Q., Washington State Univ., USA; deGroh, H. C., NASA Lewis Research Center, USA; [1997]; In English
Contract(s)/Grant(s): NAG8-1477; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A 3-D numerical model is developed to represent the oscillating natural convection induced in a cylindrical cavity filled with Ga-doped germanium with and without the presence of an external magnetic field. The model is developed based on the penalty-finite element solution of the equations describing the transport of momentum, heat and solutal element as well as the electromagnetic field distribution in the melt pool. Automatic time step control is applied to help speed up the calculations. Numerical simulations are conducted to study the convection and magnetic damping effects as a function of frequency, directions and amplitudes of g-jitter and also the direction and magnitudes of the applied magnetic fields. The results show that the g-jitter driven flow is time dependent and exhibits a complex recirculating convection pattern in three dimensions and that an applied magnetic field

can be employed to suppress this deleterious convective flow and both magnitude and orientation of the applied field are important in magnetic damping of the g-jitter induced convective flows.
Author
Free Convection; Semiconductors (Materials); Melts (Crystal Growth); Magnetic Fields; Electromagnetic Fields; Convective Flow; Damping

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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.

19990044107 Schafer (W. J.) Associates, Inc., Albuquerque, NM USA
Support for Maui Space Surveillance Site and Maui High Performance Computing Center
Feb. 1999; 22p; In English
Contract(s)/Grant(s): N00014-97-D-2014; F49620-97-1-0148
Report No.(s): AD-A361692; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Integration and test of the GEMINI instrument package. Most of the work performed under this task supported development of the GEneralized Multi-wavelength INfrared Imager (GEMINI) for the Maui Space Surveillance Site. GEMINI, not to be confused with the National Science Foundation's Gemini Telescopes Project, is a one-of-a-kind sensor package built for USAF Space Command operational use in conjunction with its space object identification (SOI mission. GEMINI hosts a variety of sensors for use with several algorithms for reconstructing high-resolution satellite and astronomical images from data degraded by atmospheric turbulence. The first GEMINI operating mode made available to Space Command delivers high resolution images using a speckle imaging technique. Schafer contributed to the project by implementing and developing parallel speckle imaging recovery and calibration algorithms and by designing computer simulations to model real-world detector effects and predict available resolution. Schafer also conducted an observational evaluation of the speckle imaging algorithm. A distinctive feature of the GEMINI data acquisition/reduction system is the provision for near real-time (NRT) video feedback of reconstructed imagery to the GEMINI operator. NRT feedback allows the operator to select camera exposure times and optical filters based on the visual quality of reconstructed data. These operating parameters can thus be optimized while data is being acquired, potentially eliminating the need for subsequent observations of the same object. For example. raw image data of a bright satellite can yield a poor reconstruction if most of the light is concentrated in a strong, localized glint. Selection of a different filter may reduce the glint effect in the reconstruction, which would be apparent to the operator using an NRT imaging system.
DTIC
Space Surveillance; Imaging Techniques; Infrared Radiation

19990044111 Naval Research Lab., Sensors Section, Washington, DC USA
Dark HORSE 2 Quick-Look Report: Real-time Detection of Military Ground Targets Using an Infrared Hyperspectral Imaging Sensor
Stellman, Christopher M.; Bucholtz, Frank; Michalowicz, Joseph V.; Apr. 15, 1999; 29p; In English
Report No.(s): AD-A361680; NRL/MR/5621--99-8364; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Researchers at the Naval Research Laboratory (NRL) have successfully demonstrated autonomous, real time detection of military ground targets using a long-wave infrared hyperspectral imaging sensor. The work was performed under NRL's Dark HORSE effort, the culmination of a four-year Multispectral Overhead IR/EO Surveillance (MOVIES) program to develop real-time hyperspectral detection, cueing, target location, and target designation capabilities. The following provides an overview of Dark HORSE 2 (DH2), the recently completed second phase of the Dark HORSE effort. The DH2 hyperspectral sensor system is described in detail along with a recent field experiment in which it was employed. The system hardware components, software interface and processing methods are described in detail. In closing, a description of the test flight profiles is given and a preliminary analysis of the collected data is presented.
DTIC
Infrared Detectors; Computer Programs; Targets; Surveillance; Infrared Imagery

19990045640 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

Design of a Spectrometer Adapted to Weak Flows and High Rates of Measurement ***Conception d'un Spectrometre Adapte aux Faibles Flux et aux Hautes Cadences de Mesure***

Voge, Philippe, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 144p; In French

Report No.(s): ONERA-P-1998-4; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Predictive models calculate the signatures IR of aircraft with accuracy; it is then advisable to take measurements in order to validate them. It is in this objective that ONERA develops spectrometric means increasingly more powerful. It is within this framework that I've been asked to design an infrared spectrometer having the following properties: an low resolution about a great spectral interval, a great sensitivity, a dynamics and a high rate of measurement. This spectrometer being dedicated to series of embarked measurements, it was to also have qualities of compactness and robustness. A first part thus consisted in defining the instrument which answered the necessary performances. The choice of the interferometer of modified Mach-Zehnder brings the luminosity and the possibility of recording the totality of the spectrum in a measurement, without moving parts. The significant rate of measurement is ensured by a matrix of detectors whose second direction very largely increases the dynamics of measurement compared to the use of a bar. The essential originality of this work lies in the oversampling of the interferogram carried out thanks to the second direction of the matrix of detectors inclined compared to the axis of the fringes. This oversampling draws aside any problems of foldings up of spectrum by largely increasing the free spectral range of the spectrometer, and increases the number of useful points in the spectrum. An experimental part enabled us to validate the instrumental concept in the visible one and in laboratory. We developed a protocol of adjustment effective thanks to the development of a mathematical formalism quantifying the effect on the spectrum of an error of orientation of the matrix. The comparison between the spectra resulting from measurements of interferograms oversampled and not oversampled then shows well the interest of the method for measurement of broad spectra. All the experiments carried out confirmed the adequacy of this instrument with the necessary performances.
Author

Design Analysis; Robustness (Mathematics); Quality; Interferometry; Infrared Spectrometers

19990045669 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Performance of CdZnTe detectors passivated with energetic oxygen atoms

Prettyman, T. H.; Hoffbauer, M. A.; Rennie, J.; Dec. 31, 1998; 14p; In English; Symposium on radiation measurements and applications

Report No.(s): DE99-000760; LA-UR-98-2008; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Noise caused by surface-leakage current can degrade the performance of CdZnTe spectrometers, particularly devices with closely spaced contacts such as coplanar grid detectors. In order to reduce surface leakage, the authors are treating CdZnTe detector surfaces with energetic, neutral oxygen atoms. Energetic oxygen atoms react with the surface to form a resistive oxide layer. Because the reaction is effective at room temperature, deleterious heating of the substrate is avoided. In most cases, leakage current and noise are shown to decrease significantly after treatment. The effect of the treatment on the performance of coplanar grid detectors is presented.
NTIS

Oxygen Atoms; Zinc Tellurides; Cadmium Compounds; Neutral Gases; Detectors

19990045759 Department of Energy, Office of Energy Research, Washington, DC USA

Small inorganic scintillators as neutron detectors

Bartle, C. M.; Haight, R. C.; Dec. 31, 1998; 9p; In English; Symposium on radiation measurements and applications

Report No.(s): DE99-000611; LA-UR-98-1806; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Small organic scintillators that exhibit pulse shape differences (PSD) in response to charged particles have been investigated as possible neutron detectors in the energy range from 1 to 200 MeV. Neutrons in this energy range can induce reactions such as (n,p) and (n,alpha) in these scintillators, and the cross sections for these reactions vary with energy. Pulse-height and PSD distributions were measured as a function of neutron energy for small crystals of NaI(Tl) and CsI(Tl) at the LANSCE-WNR pulsed spallation neutron source. PSD information indicating the relative numbers of protons and alphas produced can give information about the neutron spectrum in fast-neutron radiation fields such as those encountered in space exploration.
NTIS

Neutrons; Scintillation Counters; Neutron Counters

19990045864 National Inst. of Standards and Technology, Optical Technology Div., Gaithersburg, MD USA

Spectroradiometric Detector Measurements, Part 3, Infrared Detectors

Migdall, A. L.; Eppeldauer, G. P.; Dec. 1998; 68p; In English

Report No.(s): PB99-134371; NIST/SP-250-42; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The National Institute of Standards and Technology (NIST) supplies calibrations of IR photodetector's spectral radiant power response from 1.8 micrometers to 20 micrometers. The spectral responsivity of a detector under test is determined by comparison to an absolute detector standard. That absolute detector standard is a cryogenic composite Si bolometer. The spectral radiant power response of the bolometer is based on detector measurements traceable to the NIST High Accuracy Cryogenic Radiometer (HACR) and on material transmittance and reflectance measurements. Silicon and Germanium photodetectors and pyroelectric detectors are used to transfer radiant power responsivity from HACR to the bolometer over a range of wavelengths. Reflectance and transmittance measurements of the bolometer absorber and window are used to determine the continuous relative spectral responsivity of the bolometer. This relative responsivity determination combined with the absolute responsivity measurements allows a continuous absolute spectral responsivity of the bolometer to be realized. The comparison between the detector under test and the bolometer is performed using a monochromator-based facility. A description is given of the procedures, equipment, and techniques used to perform these calibrations. Detailed estimates and procedures for determining uncertainties of the reported values are also presented.

NTIS

Spectroradiometers; Infrared Detectors

19990046066 NASA Johnson Space Center, Houston, TX USA

Method of Making an Electrically Conductive Strain Gauge Material

Li, Larry C. H., Inventor, NASA Johnson Space Center, USA; Dawn, Frederic S., Inventor, NASA Johnson Space Center, USA; Pesek, Todd A., Inventor, NASA Johnson Space Center, USA; Jan. 12, 1999; 8p; In English

Patent Info.: Filed 4 Mar. 1997; NASA-Case-MSC-22513-1; US-Patent-5,858,291; US-Patent-Appl-SN-810582; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An improved elastomeric electrically conductive strain gauge for use in virtual reality systems is disclosed which involves the flash heating of a doped ethylene vinyl acetate elastomer.

Official Gazette of the U.S. Patent and Trademark Office

Strain Gages; Elastomers; Electrical Resistivity; Virtual Reality

19990046087 NASA Kennedy Space Center, Cocoa Beach, FL USA

Two-Phase Quality/Flow Meter

Moerk, J. Steven, Inventor, NASA Kennedy Space Center, USA; Youngquist, Robert C., Inventor, NASA Kennedy Space Center, USA; Werlink, Rudy J., Inventor, NASA Kennedy Space Center, USA; Jan. 19, 1999; 10p; In English

Patent Info.: Filed 6 Nov. 1995; NASA-Case-KSC-11770; US-Patent-5,861,755; US-Patent-Appl-SN-552456; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A quality and/or flow meter employs a capacitance probe assembly for measuring the dielectric constant of flow stream, particularly a two-phase flow stream including liquid and gas components.ne dielectric constant of the flow stream varies depending upon the volume ratios of its liquid and gas components, and capacitance measurements can therefore be employed to calculate the quality of the flow, which is defined as the volume ratio of liquid in the flow to the total volume ratio of gas and liquid in the flow. by using two spaced capacitance sensors, and cross-correlating the time varying capacitance values of each, the velocity of the flow stream can also be determined. A microcontroller-based processing circuit is employed to measure the capacitance of the probe sensors.The circuit employs high speed timer and counter circuits to provide a high resolution measurement of the time interval required to charge each capacitor in the probe assembly. In this manner, a high resolution, noise resistant, digital representation of each of capacitance value is obtained without the need for a high resolution A/D converter, or a high frequency oscillator circuit. One embodiment of the probe assembly employs a capacitor with two ground plates which provide symmetry to insure that accurate measurements are made thereby.

Official Gazette of the U.S. Patent and Trademark Office

Flowmeters; Cross Correlation; Two Phase Flow; Flow Velocity

19990046088 NASA Langley Research Center, Hampton, VA USA

Thickness Gauging of Single-Layer Conductive Materials with Two-Point Non Linear Calibration Algorithm

Fulton, James P., Inventor, NASA Langley Research Center, USA; Namkung, Min, Inventor, NASA Langley Research Center, USA; Simpson, John W., Inventor, NASA Langley Research Center, USA; Wincheski, Russell A., Inventor, NASA Langley Research Center, USA; Nath, Shridhar C., Inventor, NASA Langley Research Center, USA; Dec. 08, 1998; 10p; In English; Prodi-visional US-Patent-Appl-SN-018182, filed 8 May 1996

Patent Info.: Filed 8 May 1997; NASA-Case-LAR-15381-1; US-Patent-5,847,562; US-Patent-Appl-SN-852990; US-Patent-

Appl-SN-018182; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A thickness gauging instrument uses a flux focusing eddy current probe and two-point nonlinear calibration algorithm. The instrument is small and portable due to the simple interpretation and operational characteristics of the probe. A nonlinear interpolation scheme incorporated into the instrument enables a user to make highly accurate thickness measurements over a fairly wide calibration range from a single side of nonferromagnetic conductive metals. The instrument is very easy to use and can be calibrated quickly.

Official Gazette of the U.S. Patent and Trademark Office

Thickness; Algorithms; Nonlinearity; Eddy Currents

19990046247 NASA Marshall Space Flight Center, Huntsville, AL USA

Coherent Doppler Wind Lidar Technology for Space Based Wind Measurements Including SPARCLE

Kavaya, Michael J., NASA Marshall Space Flight Center, USA; Singh, Upendra N., NASA Marshall Space Flight Center, USA; 1999; 6p; In English; Lasers and Electro-Optics, 23-28 May 19991, Baltimore, MD, Baltimore, MD, USA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

It has been over 30 years since coherent lidar systems first measured wind velocity, and over 20 years since the ”ultimate application” of measuring Earth’s winds from space was conceived. Coherent or heterodyne optical detection involves the combination (or mixing) of the returned optical field with a local oscillator (LO) laser’s optical field on the optical detector. This detection technique yields the benefits of dramatically improved signal-to-noise ratios; insensitivity to detector noise, background light and multiply scattered light; reduction of the returned signal’s dynamic range; and preservation of the optical signal spectrum for electronic and computer processing. (Note that lidar systems are also referred to as optical radar, laser radar, and LADAR systems.) Many individuals, agencies, and countries have pursued the goal of space-based wind measurements through technology development, experiments, field campaigns and studies.

Author

Doppler Radar; Coherent Radar; Technology Assessment; Wind Measurement; Optical Radar; Optical Measurement

19990046364 British Aerospace Public Ltd. Co., Sowerby Research Centre, Filton, UK

Official Fibre Sensing Techniques for Health and Usage Monitoring

Foote, P. D., British Aerospace Public Ltd. Co., UK; Ball, A., British Aerospace Public Ltd. Co., UK; November 1998; 12p; In English; See also 19990046347

Contract(s)/Grant(s): EPSRC-YAG/8/2/1054; CEC-BE-95-1524; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The rationale for structural health monitoring is presented with an emphasis on the requirements of structural monitoring sensors. The advantages of optical fibre based sensing techniques are discussed and examples given of systems employing Bragg fibre gratings as strain sensors for load monitoring. The key issues surrounding the integration of optical fibres into structures, especially those fabricated from composite materials, are discussed. The problems of damage detection in composite material are discussed with reference to techniques for impact detection using Bragg grating sensors.

Author

Optical Fibers; Fabrication; Detection; Damage; Procedures; Monitors

19990046366 Northrop Grumman Corp., Military Aircraft Systems Div., El Segundo, CA USA

Structural Health Monitoring of Fullscale Components Using Acoustic Emission and Fiber Optic Sensors

VanWay, Craig B., Northrop Grumman Corp., USA; Kudva, Jayanth N., Northrop Grumman Corp., USA; May, V. Scott, Air Force Research Lab., USA; Zeigler, Michael L., Air Force Research Lab., USA; November 1998; 8p; In English; See also 19990046347

Contract(s)/Grant(s): F33615-92-C-3203; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The principles governing aircraft life cycle monitoring in the United States can be invariably traced back to the Air Force’s Aircraft Structural Integrity Program (ASIP). ASIP, since its implementation in the late fifties, has had unparalleled success at increasing fleet readiness and reducing aircraft down time through the prediction, identification and containment of structural degradation. The ASIP ideal is to field a structure which never develops unanticipated flaws. The reality, of course, is there will always be unexpected problems during the life of a structure. For such eventualities, ASIP has included in its charter a task to provide monitoring of an airframe from its introduction into the fleet until its retirement. and all of this success has been accomplished with, in some cases, relatively rudimentary technologies, including manual flight logs, counting accelerometers, and limited strain gage data. Recent advances in sensing systems and data processing hardware have made it possible to greatly expand the type and amount of information used to assess the integrity of aircraft structural components. The joint US Air Force/Navy Smart Metallic Structures (SMS) program being conducted at the Northrop Grumman Corporation is investigating new sensors, sensing systems,

and hardware architecture technologies to augment current ASIP practices. In particular, the use of acoustic emission (AE) transducers and fiber optic sensors to provide damage detection and strain monitoring in metallic structures have been proven to be viable structural health monitoring techniques. Recent testing under the SMS program has successfully demonstrated each of these systems on increasingly complex structural components from simple coupons up through a full scale F/A-18 wing carry through bulkhead. In addition, a sophisticated distributed hierarchical architecture was created under the program to support the sensor array and provide a method to collect and analyze sensor data from remote processing stations. This paper first presents an overview of ASIP and its relationship to structural health monitoring (SHM), followed by a brief review of SHM requirements (a more detailed discussion of ASIP and SHM can be found in Reference 3). The bulk of the paper consists of a review of the SMS program, focusing on the health monitoring system architecture (specifically the sensors, processors, and analysis algorithms contained therein), the testing performed under the program, and the lessons learned. Health monitoring implementation payoffs are briefly discussed, and finally, conclusions and a preview of future programs are given.
Author
Structural Failure; Monitors; Full Scale Tests; Structural Design; Procedures; Life (Durability); Detection

19990046766 NASA Glenn Research Center, Cleveland, OH USA
Pyrometric Gas and Surface Temperature Measurements
Fralick, Gustave, NASA Glenn Research Center, USA; Ng, Daniel, NASA Glenn Research Center, USA; March 1999; 8p; In English; International Gas Turbine and Aerospace Technical Congress, 7-10 Jun. 1999, Indianapolis, IN, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): RTOP 523-21-13
Report No.(s): NASA/TM-1999-209059; NAS 1.15:209059; E-11595; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A multiwavelength pyrometer possessing advantages over the one- and two-wavelength designs is described. Results of its application to surface temperature measurements of ceramics is presented. Also described is a probe suitable for gas temperature measurements to temperatures is greater than 2600 K. The design of the probe includes a multiwavelength pyrometer with fiber optic input.
Author
Gas Temperature; Surface Temperature; Temperature Measurement; Ceramics; Pyrometers

19990046770 NASA Johnson Space Center, Houston, TX USA
Ammonia Monitor
Sauer, Richard L., Inventor, NASA Johnson Space Center, USA; Akse, James R., Inventor, NASA Johnson Space Center, USA; Thompson, John O., Inventor, NASA Johnson Space Center, USA; Atwater, James E., Inventor, NASA Johnson Space Center, USA; Mar. 16, 1999; In English; Provisional application of US-Patent-Appl-SN-022526, filed 10 Jul. 1996
Patent Info.: Filed 9 Jul. 1997; NASA-Case-MSC-22270-1; US-Patent-5,882,937; US-Patent-Appl-SN-903279; US-Patent-Appl-SN-022526; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Ammonia monitor and method of use are disclosed. A continuous, real-time determination of the concentration of ammonia in an aqueous process stream is possible over a wide dynamic range of concentrations. No reagents are required because pH is controlled by an in-line solid-phase base. Ammonia is selectively transported across a membrane from the process stream to an analytical stream to an analytical stream under pH control. The specific electrical conductance of the analytical stream is measured and used to determine the concentration of ammonia.
Official Gazette of the U.S. Patent and Trademark Office
Ammonia; Real Time Operation; Solid Phases; Dynamic Range

19990046772 NASA Pasadena Office, CA USA
Convex Diffraction Grating Imaging Spectrometer
Chrisp, Michael P., Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Mar. 09, 1999; In English; Continuation-in-part of abandoned US-Patent-Appl-SN-733751, filed 16 Oct. 1996
Patent Info.: Filed 24 Mar. 1998; NASA-Case-NPO-19293-2; US-Patent-5,880,834; US-Patent-Appl-SN-047083; US-Patent-Appl-SN-733751; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A 1:1 Offner mirror system for imaging off-axis objects is modified by replacing a concave spherical primary mirror that is concentric with a convex secondary mirror with two concave spherical mirrors M1 and M2 of the same or different radii positioned with their respective distances d1 and d2 from a concentric convex spherical diffraction grating having its grooves parallel to the entrance slit of the spectrometer which replaces the convex secondary mirror. by adjusting their distances d1 and d2 and their

respective angles of reflection alpha and beta, defined as the respective angles between their incident and reflected rays, all aberrations are corrected without the need to increase the spectrometer size for a given entrance slit size to reduce astigmatism, thus allowing the imaging spectrometer volume to be less for a given application than would be possible with conventional imaging spectrometers and still give excellent spatial and spectral imaging of the slit image spectra over the focal plane.
Official Gazette of the U.S. Patent and Trademark Office
Gratings (Spectra); Imaging Techniques; Imaging Spectrometers; Reflected Waves

19990046774 NASA Kennedy Space Center, Cocoa Beach, FL USA
Detector for Particle Surface Contamination
Mogan, Paul A., Inventor, NASA Kennedy Space Center, USA; Schwindt, Christian J., Inventor, NASA Kennedy Space Center, USA; Mattson, Carl B., Inventor, NASA Kennedy Space Center, USA; Feb. 09, 1999; In English
Patent Info.: Filed 15 Jul. 1997; NASA-Case-KSC-11809; US-Patent-5,870,186; US-Patent-Appl-SN-903196; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A system and method for detecting and quantizing particle fallout contamination particles which are collected on a transparent disk or other surface employs an optical detector, such as a CCD camera, to obtain images of the disk and a computer for analyzing the images. From the images, the computer detects, counts and sizes particles collected on the disk The computer also determines, through comparison to previously analyzed images, the particle fallout rate, and generates an alarm or other indication if the rate exceeds a maximum allowable value. The detector and disk are disposed in a housing having an aperture formed therein for defining the area on the surface of the disk which is exposed to the particle fallout. A light source is provided for evenly illuminating the disk. A first drive motor slowly rotates the disk to increase the amount of its surface area which is exposed through the aperture to the particle fallout. A second motor is also provided for incrementally scanning the disk in a radial direction back and forth over the camera so that the camera eventually obtains images of the entire surface of the disk which is exposed to the particle fallout.
Official Gazette of the U.S. Patent and Trademark Office
Detection; Light Sources; Illuminating

36
LASERS AND MASERS

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

19990044004 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
Laser Aperture Synthesis Imagery: Theory and Experiments ***Imagerie Laser par Synthese d'Ouverture: Theorie et Validation Experimentale***
Poupinet, Ludovic, Office National d'Etudes et de Recherches Aerospatiales, France; 1998; ISSN 0078-3780; 197p; In French; Original contains color illustrations
Report No.(s): ONERA-NT-1998-10; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

We studied an active aperture synthesis optical imaging technique. A laser lights an object. The backscattered light is measured by a moving receiver. Using heterodyne detection, this one is able to measure the amplitude and the phase of the optical field. The receiver displacement allows us to access different places in space. Then, a deconvolution algorithm reconstructs an image of the illuminated object. This algorithm uses knowledge on the object support to retrieve the optical field in a virtual aperture. The theoretical study allows us to compute the limits of the method (object size, measurement configuration) and the optical performance (signal to noise ratio, field of view, resolution), and to stress the hot points of the experimental set-up (moving precision, "a priori" knowledge). An experimental set-up is defined and realised. The move of the detector is performed by a periscope, less than hose spacing and position can change, allowing the detector to access different points in a plane. The modification of the optical length of the signal path have to be corrected before any reconstruction. The experimental set-up is tested with different objects. The results demonstrate the validity of our technique and show the points that have to be improved. As a conclusion, this imaging technique is interesting because the some set of measurement can be used for imaging with different focuses, wavefront analysis and distance measurement. This opens a wide variety of applications.
Author
Apertures; Synthetic Apertures; Imaging Techniques; Field of View; Backscattering; Lasers

19990044113 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Defense Acquisitions: DoD Efforts to Develop Laser Weapons for Theater Defense
Mar. 1999; 45p; In English; Report to Congressional Requesters.

Report No.(s): AD-A361676; GAO/NSIAD-99-50; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document reviews Department of Defense programs to develop laser weapons for missile defense. It identifies what laser weapons are being considered for missile defense and the coordination among the program offices developing the systems; determine the current status and cost of each system and identify the technical challenges each system faces.

DTIC

Acquisition; Laser Weapons; Missile Defense

19990044117 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Anti-Ballistic Missile Laser Predictive Avoidance of Satellites: Theory and Software for Real- Time Processing and Deconfliction of Satellite Ephemerides With a Moving Platform Laser, Book 2

Vloedman, David J.; Mar. 1999; 198p; In English

Report No.(s): AD-A361668; AFIT/GSO/ENY/M99-09; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The Anti-Ballistic missile Laser (ABL) project is committed to defense against attack from enemy-launched missiles using an airborne laser platform. Wielding a laser of this scope requires that collateral satellites be protected from accidental illumination during operational use. The Predictive Avoidance algorithm is designed to predict the path of a given laser firing sequence, and perform real-time deconfliction with the ephemerides of a given set of satellites. This thesis establishes the theoretical framework of this algorithm, and develops a modular software package that can be incorporated into the fire-control system of ABL to perform real-time forecasting within given time and error budgets.

DTIC

Ephemerides; Computer Programs; Applications Programs (Computers); Computer Systems Programs

19990044121 Lawrence Livermore National Lab., Livermore, CA USA

Laser conditioning methods for hafnia silica multiplayer mirrors

Stolz, C. J.; Sheehan, L. M.; Maricle, S. M.; Kozlowski, M. R.; Jennings, R. T.; Jan. 06, 1998; 11p; In English; BIOS ’98: an international symposium on biomedical optics

Report No.(s): DE98-057446; UCRL-JC-129318; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Large aperture multilayer hafnia silica high reflector coatings at 1064 nm, deposited by reactive electron-beam deposition, were prepared to examine different laser conditioning methods for manufacturing high fluence optics in the National Ignition Facility. Two laser conditioning methods were examined for coatings deposited from only oxide starting materials. Off-line laser conditioning consists of raster scanning a mirror past a 1-mm diameter Gaussian beam over the entire clear aperture; a process that takes approximately 24 hours per scan. On-line laser conditioning consisted of a large aperture 300 mm x 300 mm beam from the Beamlet laser that irradiated the entire full clear aperture of a series of mirrors; a process that was limited by a 2-4 hour shot rate. In both cases, a six-step process was used with the mirror first irradiated at a low fluence, then successively higher fluences increased in equal increments up to the peak laser operating fluence. An alternative off-line laser conditioning method was examined for coatings deposited from hafnia or metallic hafnium sources. Single-step laser conditioning consists of off-line raster scanning an optic at the peak operating fluence, thus decreasing the laser conditioning cost by reducing the number of scans and required laser conditioning stations to process all the mirrors for the National Ignition Facility. Between pulses, the optic is stepped approximately one fourth of the l/e* Gaussian beam diameter so each area of the coating is irradiated by different segments of the beam starting at a low fluence at the outer edge of the beam diameter and increasing to the peak fluence in the center of the beam. The one-step conditioning results appear positive, but the influence of the coating improvements due to the metallic hafnium process on laser conditioning is undefined.

NTIS

Mirrors; Hafnium Compounds; Silicon Dioxide; Apertures; Irradiation; Manufacturing; Reflectors; Raster Scanning

19990044122 Lawrence Livermore National Lab., Livermore, CA USA

Optimized, diode pumped, Nd:glass, prototype regenerative amplifier for the National Ignition Facility (NIF)

Martinez, M.; Crane, J.; Penko, F.; Browning, D.; Dec. 01, 1997; 12p; In English; BIOS ’98: an international symposium on biomedical optics

Report No.(s): DE98-057449; UCRL-JC-127940; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The National Ignition Facility (NIF) will house a 2 MJ Nd:glass laser system to be used for a broad range of inertial confinement fusion experiments. This record high energy laser output will be initiated by a single low energy, fiber-based master oscillator which will be appropriately shaped in time and frequency prior to being split into 48 beams for intermediate amplification. These 48 intermediate energy beams will feed the 192 main amplifier chains. We report on the baseline design and test results for an amplifier subsystem in the intermediate amplifiers. The subsystem is based on a diode pumped, Nd:glass regenerative amplifier.

Two fundamentally important requirements for this amplifier include output energy of 20 mJ and square pulse distortion of less than 1.45. This most recent design of the regenerative amplifier has increased the performance and reduced the cost, enabling it to become a solid baseline for the NIF laser system.
NTIS
Inertial Confinement Fusion; Neodymium Lasers; Solid State Lasers; High Power Lasers; Laser Outputs

19990045719 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Anti-Ballistic Missile Laser Predictive Avoidance of Satellites: Theory and Software for Real-Time Processing and Deconfliction of Satellite Ephemerides With a Moving Platform Laser, Book 1
vloedman, David J.; Mar. 1999; 219p; In English
Report No.(s): AD-A361667; AFIT/GSO/ENY/99M-09; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
The Anti-Ballistic missile Laser (ABL) Project is committed to defense against attack from enemy-launched Theater Ballistic Missiles using an airborne laser platform to disable an enemy missile in the boost phase of launch. Wielding a laser of this power and scope requires that no collateral damage be caused by laser energy which may escape from the theater of engagement. The most likely track of such a laser would pose a significant threat to space-based assets. The Predictive Avoidance algorithm is designed to predict the path of a given laser firing sequence, and perform real-time forecasting of, and deconfliction with, the ephemerides of a given set of satellites. The primary goal is to establish the theoretical framework of this algorithm. The secondary goal of this thesis is to develop a modular software package that can, with minor modifications, be incorporated into the fire-control system of ABL to perform real-time forecasting within given time and error budgets. This software takes the form of a Preprocessor, that filters the active satellites to determine which satellites are in view, and the Main Processor, which analyzes the satellites that are in view. The Main Processor determines whether any of the satellites in view will intersect the laser beam while it is illuminating a target.
DTIC
Computer Programs; Ephemerides; Applications Programs (Computers)

19990046057 Department of Energy, Washington, DC USA
Modeling a distributed spatial filter low-noise semiconductor optical amplifier
Ratowsky, R. P.; Dijaili, S.; Kallman, J. S.; Feit, M. D.; Walker, J.; Dec. 01, 1997; 7p; In English; 1998 Victoria meetings
Report No.(s): DE98-052117; UCRL-JC-129108; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
We show using a beam propagation technique how periodic spatial filtering can reduce amplified spontaneous emission noise in a semiconductor optical amplifier.
NTIS
Semiconductor Lasers; Low Noise; Light Amplifiers

19990046376 Vavilov State Optical Inst., Saint Petersburg, USSR
Crystalline Media for SRS Conversion of High Power 1.32 Micron Radiation ***Final Report***
Karpukhin, Sergey N.; Jan. 1999; 79p; In English
Contract(s)/Grant(s): F61708-97-W-0255
Report No.(s): AD-A361797; EOARD-SPC-97-4080; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This report results from a contract tasking Company as follows: The contractor will (1) deliver SRS crystal samples currently available, and analyze the principal limitations of SRS conversion of 1.32 micron radiation; (2) deliver SRS crystal samples available at this stage of the contract, and operate the laser with rep rate of up to 20 Hz and energy of 20 mJ single mode and 150 mJ multi-mode, and grow larger SRS-active crystals; and (3) produce final SRS crystal samples, and study SRS conversion parameters (vary beam focus within and outside the cavity), measure spectral and coherence properties of the radiation, investigate SRS amplification of single mode radiation with multi-mode pumping, and prepare final report.
DTIC
Crystallinity; Coherent Radiation; Raman Spectra

19990046578 Purdue Research Foundation, IN USA
Electrical Properties of Blue Laser Diodes ***Final Report, 1 Jul. 1994 - 31 Jul. 1998***
Gunshor, Robert L.; Jul. 1998; 3p; In English
Contract(s)/Grant(s): F49620-94-1-0395; AF Proj. 3484
Report No.(s): AD-A361825; AFRL-SR-BL-TR-99-0110; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The study focused on providing an explanation for the puzzling increase in the resistivity of the ZnSe alloys (doped with nitrogen) as the bandgap energy increased. When laser diodes are fabricated at wavelengths which move them further into the blue. it was found that the electrical performance tends to degrade by an apparent increase in the resistivity of the wider bandgap constituents.
DTIC
Electrical Properties; Semiconductor Lasers

37
MECHANICAL ENGINEERING

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

19990046248 Pratt and Whitney Aircraft, Liquid Space Propulsion, West Palm Beach, FL USA
Turbomachinery Design Quality Checks to Avoid Friction Induced Structural Failure
Moore, Jerry H., Pratt and Whitney Aircraft, USA; 1999; 8p; In English; Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA
Contract(s)/Grant(s): NAS8-36801; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A unique configuration of the P&W SSME Alternate Fuel Turbopump turbine disk/blade assembly, combined with a severe thermal environment, resulted in several structural anomalies that were driven by frictional contact forces. Understanding the mechanics of these problems provides new quality checks for future turbo machinery designs. During development testing in 1997 of the SSME alternate fuel turbopump at Stennis Space Center, several potentially serious problems surfaced with the turbine disk/blade assembly that had not been experienced in extensive earlier testing. Changes to the operational thermal environment were noted based on analytical prediction of modifications that affected performance and on stationary thermal measurements adjacent to the rotor assembly. A detailed structural investigation was required to reveal the mechanism of distress induced by the change. The turbine disk experienced cracking in several locations due to increased thermal gradient induced stress during start and shutdown transients. This was easily predictable using standard analysis procedures and expected once the thermal environment was characterized. What was not expected was the curling of a piston ring used for blade axial retention in the disk, indentation of the axial face of the blade attachment by a spacer separating the first and second stage blades, and most significantly, galling and cracking of the blade root attachment that could have resulted in blade release. Past experience, in gas turbine environments, set a precedent of never relying on friction for help and to evaluate it only in specific instances where it was obvious that it would degrade capability. In each of the three cases above, friction proved to be a determining factor that pushed the components into an unsatisfactory mode of operation. The higher than expected temperatures and rapid thermal transients combined with friction to move beyond past experience. The turbine disk/blade assembly configuration contributed to the potential for these problems to occur by limiting the radial deflection from thermals and centrifugal loading. The cooled solid bore configuration was chosen to improve rotordynamic stability by limiting the length of rotor overhang while still protecting the roller bearing by maintaining zero slope under the inner race. During a start transient, the rim area of the disk heats rapidly and expands axially and circumferentially and requires corresponding radial and axial growth of the disk to maintain relative positioning of the disk, blades, spacers and retainer rings. The stiffness, large thermal mass, and bore cooling flow combine to severely limit the disk rim radial growth which results in the potential for relative movement between these parts. Friction then becomes a player in the determination of component stress.
Derived from text
Design Analysis; Turbomachinery; Quality Control; Stress Analysis; Turbine Pumps; Gas Turbines; Friction Factor

19990046783 NASA Langley Research Center, Hampton, VA USA
Process for Making Carbon-Carbon Turbocharger Housing Unit for Intermittent Combustion Engines
Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; May 04, 1999; In English; Division of US-Patent-Appl-SN-811378, filed 4 Mar. 1997 and Provisional Application of US-Patent-Appl-SN-012940, filed 6 Mar. 1996
Patent Info.: Filed 3 Nov. 1997; NASA-Case-LAR-15496-2; US-Patent-5,900,089; US-Patent-Appl-SN-963291; US-Patent-Appl-SN-811378; US-Patent-Appl-SN-012940; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An improved. lightweight, turbine housing unit for an intermittent combustion reciprocating internal combustion engine turbocharger is prepared from a lay-up or molding of carbon-carbon composite materials in a single-piece or two-piece process. When compared to conventional steel or cast iron, the use of carbon-carbon composite materials in a turbine housing unit reduces

the overall weight of the engine and reduces the heat energy loss used in the turbo-charging process. This reduction in heat energy loss and weight reduction provides for more efficient engine operation.
Official Gazette of the U.S. Patent and Trademark Office
Turbocompressors; Carbon-Carbon Composites; Housings; Superchargers; Iron Alloys

38
QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990045670 Department of Defense, Washington, DC USA
Failure rate analysis using GLIMMIX
Moore, L. M.; Hemphill, G. M.; Martz, H. F.; Dec. 31, 1998; 9p; In English; International conference on probabilistic safety assessment and management (PSAM4)
Report No.(s): DE99-000684; LA-UR-98-1746; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper illustrates use of a recently developed SAS macro, GLIMMIX, for implementing an analysis suggested by Wolfinger and O'Connell (1993) in modeling failure count data with random as well as fixed factor effects. Interest in this software tool arose from consideration of modernizing the Failure Rate Analysis Code (FRAC), developed at Los Alamos National Laboratory in the early 1980's by Martz, Beckman and McInteer (1982). FRAC is a FORTRAN program developed to analyze Poisson distributed failure count data as a log-linear model, possibly with random as well as fixed effects. These statistical modeling assumptions are a special case of generalized linear mixed models, identified as GLMM in the current statistics literature. In the nearly 15 years since FRAC was developed, there have been considerable advances in computing capability, statistical methodology and available statistical software tools allowing worthwhile consideration of the tasks of modernizing FRAC. In this paper, the approaches to GLMM estimation implemented in GLIMMIX and in FRAC are described and a comparison of results for the two approaches is made with data on catastrophic time-dependent pump failures from a report by Martz and Whiteman (1984). Additionally, statistical and graphical model diagnostics are suggested and illustrated with the GLIMMIX analysis results.
NTIS
Failure Analysis; Applications Programs (Computers)

19990046198 National Inst. of Standards and Technology, Manufacturing Engineering Lab., Gaithersburg, MD USA
Technical Documentation for the Mass Calibration Laboratory Balance Automation
Lee, V. J.; Aug. 1999; 48p; In English
Report No.(s): PB99-121915; NISTIR-6283; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This internal report documents the development and integration of software and hardware components used for the partial automation of mass calibration process. The software follows the measurement sequence specified by the measurement design chosen by the operator. The measurement designs are those that are typically used in the mass calibration laboratory. After the operator places a weight on the electronic balance, the software automatically reads the balance and environmental transducers and their values are automatically recorded in a data file. When the measurements are done, the data are processed and formatted into a file used for the mass code.
NTIS
Mass Balance; Laboratory Equipment; Mass Distribution; Transducers; Calibrating

19990046297 National Inst. of Standards and Technology, Manufacturing Engineering Lab., Gaithersburg, MD USA
Operator's Manual; Balance Automation Software for the NIST Mass Calibration Laboratory
Lee, V. J.; Jul. 1998; 22p; In English
Report No.(s): PB99-117947; NISTIR-6276; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This user's manual documents the use of the computer software written for the partial automation of the sub-1 Kg precision mass comparators and environmental instruments used in the Mass Group's mass calibration laboratory.
NTIS
Mass Balance; Automation; Laboratory Equipment; Calibrating; Computer Programs

19990046303 Kansas State Univ., Manhattan, KS USA
Establishment of a Falling Weight Deflectometer Calibration Facility ***Final Report, Jul. 1995 - Dec. 1998***
Hossain, M.; Dec. 1998; 60p; In English

Report No.(s): PB99-137812; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Strategic Highway Research Program (SHRP) developed a protocol for calibration of Falling Weight Deflectometers (FWD) which is now being administered by the Long Term Pavement Performance (LTPP) Division of the Federal Highway Administration (FHWA). The calibration procedure for FWD's recommended by SHRP consists of two parts: (1) Reference Calibration, and (2) Relative Calibration. Reference calibration requires permanent facilities similar to those established by LTPP in Reno, Nev., Harrisburg, Penn., Minneapolis, Minn., and College Station, Tex. Relative calibration can be performed almost anywhere, using equipment provided by the FWD manufacturer. Since the center closest to Kansas is in Minneapolis, and considerable time is required for travel and calibration (usually a week), a local facility was considered to be very beneficial by the Kansas Department of Transportation. The FWD Reference Calibration facility, for the Dynatest model FWD, has been developed at Kansas State University and is available for calibration of FWD's in the surrounding area. The facility was established in accordance with the SHRP/LTPP FWD calibration protocol. The calibration center became operational in the spring of 1998. An independent quality assurance visit by PCS/LAW Engineering of Beltsville, Maryland has confirmed that the equipment and setup are working correctly.

NTIS

Calibrating; Deflection; Deformeters

19990046305 National Inst. of Standards and Technology, Office Weights and Measures Program, Gaithersburg, MD USA

National Type Evaluation Program. NIST Indices of NTEP Device Evaluations. 1999 Edition

Sebring, L.; Butcher, T. G.; Ugiansky, G. M.; 1999; 196p; In English

Report No.(s): PB99-134439; NISTIR-6304; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

;Index: Introduction (General; Guide to Certificate Numbers and Letters; Certificate Status; Copies of Certificates; Guidelines for when Certificates are required); Company Names and Addresses; Index of Device Evaluations by Certificate Number; Index of Device Evaluations by Device Sorted by Company; Index of Device Evaluations by Company Sorted by Model; and Inactive Certificate Serial Numbers.

NTIS

Indexes (Documentation); Metrology

19990046372 Battelle Columbus Labs., OH USA

Variation of Magnetic Properties in Pipeline Steels ***Interim Report, Jun. 1996 - Mar. 1998***

Nestleroth, J. B.; Crouch, A. E.; Mar. 1998; 130p; In English

Report No.(s): PB99-138364; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report documents the findings of an evaluation of the magnetic, mechanical, chemical, and metallurgical properties of 36 pipeline materials that were removed from gas-transmission service. There were three objectives of the evaluation. The first was to determine whether there were clear correlations between magnetic properties and mechanical properties. The second was to determine whether magnetic properties change significantly with the application of stresses and strains. The last was to assemble a database of both magnetic and mechanical properties for future developmental activities. Each of these goals was met. The results of this evaluation show that there is no clear correlation between magnetic properties and commonly measured mechanical properties. So, there is no easy way to predict magnetic properties for commonly known mechanical properties. In order to detect mechanical damage, the change in magnetic properties at the damage must be outside the natural variability of typical magnetic properties. The changes in magnetic properties due to compressive stresses and strains are large enough to fall outside the typical scatter band of properties. So, detecting compressive damage may be possible without measuring the magnetic properties of a pipeline steel. The same cannot be said of tensile stresses and strains.

NTIS

Magnetic Properties; Pipelines; Steels

19990046400 Georgia Inst. of Tech., Atlanta, GA USA

Ultrasonic Nondestructive Characterization of Adhesive Bonds ***Final Report, 22 Feb. 1996 - 22 Feb. 1999***

Qu, Jianmin, Georgia Inst. of Tech., USA; 1999; 26p; In English

Contract(s)/Grant(s): NAG1-1810; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Adhesives and adhesive joints are widely used in various industrial applications to reduce weight and costs, and to increase reliability. For example, advances in aerospace technology have been made possible, in part, through the use of lightweight materials and weight-saving structural designs. Joints, in particular, have been and continue to be areas in which weight can be trimmed from an airframe through the use of novel attachment techniques. In order to save weight over traditional riveted designs, to avoid the introduction of stress concentrations associated with rivet holes, and to take full advantage of advanced composite materials,

engineers and designers have been specifying an ever-increasing number of adhesively bonded joints for use on airframes. Nondestructive characterization for quality control and remaining life prediction has been a key enabling technology for the effective use of adhesive joints. Conventional linear ultrasonic techniques generally can only detect flaws (delamination, cracks, voids, etc) in the joint assembly. However, more important to structural reliability is the bond strength. Although strength, in principle, cannot be measured nondestructively, a slight change in material nonlinearity may indicate the onset of failure. Furthermore, microstructural variations due to aging or under-curing may also cause changes in the third order elastic constants, which are related to the ultrasonic nonlinear parameter of the polymer adhesive. It is therefore reasonable to anticipate a correlation between changes in the ultrasonic nonlinear acoustic parameter and the remaining bond strength. It has been observed that higher harmonics of the fundamental frequency are generated when an ultrasonic wave passes through a nonlinear material. It seems that such nonlinearity can be effectively used to characterize bond strength. Several theories have been developed to model this nonlinear effect. Based on a microscopic description of the nonlinear interface binding force, a quantitative method was presented. Recently, a comparison between the experimental and simulated results based on a similar theoretical model was presented. A through-transmission setup for water immersion mode-converted shear waves was used to analyze the ultrasonic nonlinear parameter of an adhesive bond. In addition, ultrasonic guided waves have been used to analyze adhesive or diffusion bonded joints. In this paper, the ultrasonic nonlinear parameter is used to characterize the curing state of a polymer/aluminum adhesive joint. Ultrasonic through-transmission tests were conducted on samples cured under various conditions. The magnitude of the second order harmonic was measured and the corresponding ultrasonic nonlinear parameter was evaluated. A fairly good correlation between the curing condition and the nonlinear parameter is observed. The results show that the nonlinear parameter might be used as a good indicator of the cure state for adhesive joints.
Author
Adhesive Bonding; Characterization; Joints (Junctions); Nondestructive Tests; Nonlinearity; Ultrasonic Tests

19990046497 National Inst. of Standards and Technology, Analytical Chemistry Div., Gaithersburg, MD USA
Initial CAALS Device Capability Dataset, Version 1.0.7
Staab, Torsten A., National Inst. of Standards and Technology, USA; Kramer, Gary W., National Inst. of Standards and Technology, USA; Dec. 1998; 52p; In English
Report No.(s): PB99-128001; NISTIR-6294; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
A Device Capability Dataset (DCD) describes the idiosyncratic characteristics of laboratory equipment, such as the equipment's identify, physical dimensions, location, supported command set, generated events, input-output (I/O) ports, and other resources. The DCD concept provides a means for standardizing the interfacing of laboratory automation devices in a descriptive rather than a prescriptive manner. Within the CAALS (Consortium on Automated Analytical Laboratory Systems) modular architecture logical model, this information is used by the Task Sequence Controller (TSC) to determine which tasks a Standard Laboratory Module (SLM) can perform.
NTIS
Automatic Control; Laboratory Equipment; Data Processing

19990046498 National Inst. of Standards and Technology, Materials Reliability Div., Gaithersburg, MD USA
Materials Reliability: 1998 Programs and Accomplishments
McHenry, Harry I., National Inst. of Standards and Technology, USA; Siewert, Thomas A., National Inst. of Standards and Technology, USA; Jan. 1999; 112p; In English
Report No.(s): PB99-131849; NISTIR-6248; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The Materials Reliability Division develops measurement technologies which enable the producers and users of materials to improve the quality and reliability of their products. Measurement technologies are developed for process control to improve the quality and consistency of materials, for nondestructive evaluation to assure quality of finished materials and products and for materials evaluation to assure reliable performance. Within these broad areas of measurement technology, the Division has focused its resources on three research themes.
NTIS
Reliability; Magnetic Materials

19990046499 Battelle Columbus Labs., OH USA
In-Line Inspection Technologies for Mechanical Damage and SCC in Pipelines ***Final Report, Jun. 1996 - Sep. 1999***
Bubenik, T. A., Battelle Columbus Labs., USA; Nestleroth, J. B., Battelle Columbus Labs., USA; Davis, R. J., Southwest Research Inst., USA; Crouch, A., Southwest Research Inst., USA; Udpa, S., Iowa State Univ. of Science and Technology, USA; Dec. 1998; 124p; In English

Contract(s)/Grant(s): DTRS56-96-C-0010
Report No.(s): PB99-138356; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The report is a summary of work conducted under a research and development contract entitled 'In-Line Inspection Technologies for Mechanical Damage and SCC(Stress-Corrosion Cracking) in Pipelines.' This project evaluated and developed in-line inspection technologies for detecting mechanical damage and cracking in natural gas transmission and hazardous liquid pipelines. The work consists of three major tasks. Task 1 covers inspection methods for mechanical damage. Task 2 covers methods of detecting stress-corrosion cracks. Task 3 covers verification testing. This report is a summary of the work completed in the first two tasks. Task 1 examined magnetic flux leakage (MFL) for detecting mechanical damage. It evaluated existing signal generation and analysis methods to establish a baseline from which today's tools can be evaluated and tomorrow's advances measured, and it developed improvements to signal analysis methods and verified them through pull rig testing. Finally, it built an experience base and defect sets to generalize the results from individual tools and analysis methods to the full range of practical applications. Task 2 evaluated two inspection technologies for detecting cracks. Three subtasks were conducted to evaluate velocity-induced remote-field techniques, remote-field eddy-current techniques, and external techniques for sizing stress-corrosion cracks.
NTIS
Inspection; Damage; Stress Corrosion Cracking; Pipelines

19990046781 NASA Kennedy Space Center, Cocoa Beach, FL USA
Non-Intrusive Cable Tester
Medelius, Pedro J., Inventor, NASA Kennedy Space Center, USA; Simpson, Howard J., Inventor, NASA Kennedy Space Center, USA; Apr. 13, 1999; In English
Patent Info.: Filed 24 Sep. 1997; NASA-Case-KSC-11865; US-Patent-5,894,223; US-Patent-Appl-SN-936643; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A cable tester is described for low frequency testing of a cable for faults. The tester allows for testing a cable beyond a point where a signal conditioner is installed, minimizing the number of connections which have to be disconnected. A magnetic pickup coil is described for detecting a test signal injected into the cable. A narrow bandpass filter is described for increasing detection of the test signal. The bandpass filter reduces noise so that a high gain amplifier provided for detecting a test signal is not completely saturate by noise. to further increase the accuracy of the cable tester, processing gain is achieved by comparing the signal from the amplifier with at least one reference signal emulating the low frequency input signal injected into the cable. Different processing techniques are described evaluating a detected signal.
Official Gazette of the U.S. Patent and Trademark Office
Nonintrusive Measurement; Signal Detection; Bandpass Filters

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.

19990044055 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Institute of Applied Physics, Delft, Netherlands
Vibrational Power Transmission in Built-Up Systems; Developments Towards Reduced Methods of Analysis
Fulford, R. A., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Petersson, B. A. T., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Oct. 15, 1998; 78p; In English
Contract(s)/Grant(s): A97/KM/132; TNO Proj. 827.215
Report No.(s): TD98-0120; TPD-HAG-RPT-980134; Copyright; Avail: Issuing Activity (TNO Inst. of Applied Physics, Stieljesweg 1, P.O. Box 155, 2600 AD Delft, The Netherlands), Hardcopy, Microfiche

For the development of simplified analysis methods for vibrational power transmission in built-up plate structures, an axially force excited circular can upon a thick recipient plate is considered. Where the thickness of the cans top-plate is twice as great as that of the wall, it is found that the moments at the upper and lower interfaces of the system have little influence upon the transmitted power. Henceforth, omitting such from the analysis results in a greatly reduced system. Where, conversely, the thickness of the top-plate is less than half that of the side-walls the formulation of the reduced model can also be maintained provided a guided boundary condition is imposed for the top-plate. Moreover, it is found that for typical dimensions there is an extended

frequency range over which the response of the side-walls is either mass or stiffness controlled. For such, it can be assumed that the input and transfer mobilities of the side-walls are comparable to each other and this leads to further reduction of the analysis. Author

Prediction Analysis Techniques; Vibration; Transmission Efficiency; Boundary Conditions

19990045739 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Comprehensive monitoring system for damage identification and location in large structural and mechanical systems

Farrar, C. R.; Doebling, S. W.; Prime, M. B.; Dec. 31, 1998; 12p; In English

Report No.(s): DE99-000828; LA-UR-98-2233; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project conducted at the Los Alamos National Laboratory (LANL). This project has focused on developing and experimentally verifying a suite of analytical tools for identifying the onset of damage in structural and mechanical systems from changes in their vibration characteristics. A MATLAB- based computer code referred to as Damage Identification and Modal Analysis of Data (DIAMOND) was developed. The code was then extensively exercised on data obtained from a variety of test structures. The most notable structure was an in situ bridge located ten mile north of Truth or Consequences, New Mexico. The suite of tools contained in DIAMOND is now being applied to the nuclear weapons enhanced surveillance program and an industrial partner has asked to enter into a partnership so that they can implement routines from DIAMOND into their commercial damage assessment hardware for large civil engineering structures. Because of the large volume of requests from around the world for DIAMOND, it can now be downloaded from the web site: http://esaea-www. esa.lanl.gov/damage(-) id.

NTIS

Damage Assessment; Structural Engineering

19990045753 Department of Energy, Washington, DC USA

Temperature measurements on a HSLA-100 steel confinement vessel

Lohsen, R. A.; May 07, 1998; 8p; In English

Report No.(s): DE99-000821; LA-UR-98-2080; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Temperature measurements have been made on HSLA-100 steel confinement vessel number 6-2-3-1. These measurements are intended to give a view of the vessel temperature response under conditions similar to operational conditions, starting from worst case. The vessel's temperature must be above the minimum operating temperature when used to contain an explosive event to ensure that the vessel material has the desired crack arrest properties. Several series of temperature measurements have been conducted over 24 and 48 hour periods during February 1998. These tests were intended to demonstrate that after running the heaters in the environmental shelter for some time, (1) the vessel warms up to temperatures well above the minimum operating temperature, (2) that through-thickness temperature gradients are negligible, and (3) that the temperature differences from one part of the vessel to another are small.

NTIS

Temperature Measurement; Steels; Pressure Vessels; Confinement

19990045862 National Inst. of Standards and Technology, Materials Reliability Div., Boulder, CO USA

Ultrasonic Measurement of Stress in Pin and Hanger Connections

Clark, A. V., National Inst. of Standards and Technology, USA; Gallagher, D., National Inst. of Standards and Technology, USA; Hehman, C. S., National Inst. of Standards and Technology, USA; Fuchs, P. A., Federal Highway Administration, USA; Lozev, M. G., Virginia Transportation Research Council, USA; Jan. 1999; 36p; In English

Report No.(s): PB99-131880; NISTIR-5080; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pin and hanger connections are used in bridges to suspend an interior span from the outer spans. The connections can sometimes lock up due to corrosion. If lockup occurs the stresses in the connection are cycled due to thermal expansion and contraction of the bridge; fatigue cracking and failure may occur. We constructed an apparatus to simulate a locked-up pin and hanger connection. We performed proof of concept tests of a method to detect stresses in pin and hanger connections. The method uses the stress-induced changes in sound velocity of shear waves polarized parallel and perpendicular to the hanger axis. The birefringence is the normalized difference in these shear wave velocities. We measured the birefringence at opposite sides of the hangers, at midsection. We simulated three scenarios: continuous monitoring of hanger status; intermittent monitoring from a known initial state; measurement with no 'a priori' knowledge of hanger status. Good agreement with strain gauge data was obtained for all three scenarios.

NTIS

Pins; Ultrasonic Tests; Stress Measurement; Bridges (Structures)

19990046346 Tokyo Denki Univ., Faculty of Engineering, Japan

Experimental Study on Shear Behaviour of Steel-Reinforced Concrete Columns Under High Compressive Axial Force

Tachibana, Masahiko, Tokyo Denki Univ., Japan; Misu, Tadasuke, Tokyo Denki Univ., Japan; Research Reports of The Faculty of Engineering, Tokyo Denki University; Dec. 1997, No. 45, pp. 65-72; In Japanese; See also 19990046342; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

An experimental study was conducted to investigate the shear behaviour of steel-reinforced concrete beam-columns whose steel cross section was open-web type by batten plate using 1/3 size beam-column members. The tests were designed to give variety for the parameters such as the size of steel sections. There were four test specimens. All specimens were subjected to constant high compressive axial force and cyclic shear load. Amplitudes of rotation angles of the members were controlled in the tests. All test specimens suffered shear fractures. The shear strength, shapes of hysteresis loop, and types of fractures were discussed.

Author

Composite Materials; Cyclic Loads; Fractures (Materials); Steels; Axial Loads; Shear Stress

19990046375 Maine Univ., Dept. of Civil and Environmental Engineering, Orono, ME USA

Studies of Fracture Processes in Cement-Based Materials under Compression with Microtomography and Computer Vision ***Final Report, 15 Jan. 1998 - 14 Nov. 1999***

Landis, Eric N.; Shah, Surendra P.; Feb. 14, 1999; 10p; In English

Contract(s)/Grant(s): F49620-98-1-0175

Report No.(s): AD-A361796; AFRL-SR-BL-TR-99-0099; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary objective of this research program was to provide experimental data to feed into the extensive modeling work of the AFOSR Shock Physics program. Two advanced complimentary experimental techniques were used: x-ray microtomography (XMT) and digital image correlation (DIC). The former is a three dimensional technique that is restricted to small specimens under static loading, while the latter is a surface-only technique that can be applied in a variety of conditions. In the initial stages of the program we sought to correlate the fracture measurements of both techniques. by doing this we hoped to be able to develop a method to extrapolate 2D surface measurements (a relatively easy process) to three dimensions (a relatively difficult process). Preliminary results indicate such a method could be developed, however confirmation over a wider range of experimental variables is necessary.

DTIC

Fracturing; Cements; Compressive Strength

19990046771 NASA Marshall Space Flight Center, Huntsville, AL USA

Design and Test of Low-Profile Composite Aerospace Tank Dome

Ahmed, R., NASA Marshall Space Flight Center, USA; May 1999; 56p; In English

Contract(s)/Grant(s): Proj. 96-28

Report No.(s): NASA/TP-1999-209267; M-928; NAS 1.60:209267; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report summarizes the design, analysis, manufacture, and test of a subscale, low-profile composite aerospace dome under internal pressure. A low-profile dome has a radius-to-height ratio greater than the square root of two. This effort demonstrated that a low-profile composite dome with a radius-to-height ratio of three was a feasible design and could adequately withstand the varying stress states resulting from internal pressurization. Test data for strain and displacement versus pressure are provided to validate the design.

Author

Design Analysis; Performance Tests; Domes (Structural Forms)

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GEOSCIENCES (GENERAL)

19990043995 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Importance of model resolution for predicting precipitation and runoff in complex terrain
Costigan, K. R.; Bossert, J. E.; Breshears, D. D.; Campbell, K.; Martens, S. N.; Dec. 31, 1998; 2p; In English; Conference on mountain meteorology
Report No.(s): DE99-001076; LA-UR-98-2256; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

As the demand for limited stores of fresh water grows, optimum use of water resources becomes paramount, especially in arid and semi-arid regions of the world. In order to make the best use of these limited resources, it is important to understand the entire hydrologic cycle in these regions and to be able to explore the potential effects of increased use and of changes in the regional climate. As part of Los Alamos' coupled environmental modeling initiative, the authors are linking a suite of environmental models to simulate the hydrologic cycle within river basins. Their goal is to produce a fully interactive coupling of atmospheric, surface hydrology, river, and groundwater models to allow feedbacks throughout the system. This paper focuses on the interaction between the atmospheric and surface hydrology models. The role of the complex topography in determining the spatial distribution of winter precipitation is investigated through sensitivity tests carried out using different horizontal resolutions in the modeling system.
NTIS
Environment Models; Terrain; Hydrology Models; Precipitation (Meteorology); Drainage

19990044087 Department of Energy, Office of Energy Research, Washington, DC USA
Energetics of melts from thermal diffusion studies. FY 1996 ***Progress Report***
Lesher, C. E.; Dec. 31, 1997; 2p; In English
Report No.(s): DE99-001168; DOE/ER/14240-T5; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This research program characterizes mass transport by diffusion in geological fluids in response to thermal, solubility, and/or chemical gradients to obtain quantitative information on the thermodynamic and kinetic properties of multicomponent systems. Silicate liquids undergo substantial thermal diffusion (Soret) differentiation, while the response in sulfide, carbonate, and aqueous fluids to an imposed temperature gradient is varied. The experimental observations of this differentiation are used to evaluate the form and quantitative values of solution parameters, and to quantify ordinary diffusion coefficients, heats of transport, and activation energies of multicomponent liquids. The diffusion, solution, and element partition coefficients determined for these geological fluids form a data base for understanding magmatic crystallization behavior and for evaluating geothermal, ore deposit, and nuclear waste isolation potentials.
NTIS
Activation Energy; Mass Transfer; Thermal Diffusion; Melts (Crystal Growth)

19990045785 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, Colorado Univ., USA; Payne, Steven, Mississippi State Univ., USA; Brahmachari, Shuvobroto, Mississippi State Univ., USA; May 20, 1998; 24p; In English
Contract(s)/Grant(s): NAS13-564; N00014-95-1-203
Report No.(s): AD-A348297; CAST-TR-1-98-Rev; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Under funding from the Office of Naval Research (ONR), 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 or oceanic region. Under Naval Oceanographic Office (NAVOCEANO) 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.
DTIC
Barotropism; Tides; Mathematical Models; Ocean Models; Oceanography

19990045857 Geological Survey, Water Resources Div., Albuquerque, NM USA

Water Resources Data for New Mexico, Water Year 1998, Volume 1, The Rio Grande Basin, the Mimbres River Basin, and the Tularosa Valley Rive ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***

Ortiz, David; Lange, Kathy; Beal, Linda; Apr. 1999; 432p; In English

Report No.(s): PB99-140675; USGS/WDR/NM-98/1; No Copyright; Avail: CASI; A19, Hardcopy; A04, Microfiche

Water-resources data for the 1998 water year for New Mexico consist of records of discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 158 gaging stations; stage and contents for 26 lakes and reservoirs; water quality for 34 gaging stations, 23 wells, and 41 partial-record stations and miscellaneous sites; and water levels at 122 observation wells. Also included are 36 crest-stage, partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the US Geological Survey and cooperating Federal, State, and local agencies in New Mexico.

NTIS

Surface Water; Water Quality; Lakes; Geological Surveys; Data Systems; Data Acquisition; Water Resources

19990045861 Geological Survey, Water Resources Div., Helena, MT USA

Simulation of Water and Salt Budgets and Effects of Proposed Management Strategies for Bowdoin National Wildlife Refuge, Northeastern Montana

Kendy, E.; Jan. 1999; 96p; In English

Report No.(s): PB99-134025; USGS/WRI-98-4260; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report describes simulation of the water and salt budgets of Bowdoin National Wildlife Refuge. Specifically, the report describes the application of the computer model developed by Hamilton and others (1989) to develop an understanding of the current water and salt budgets of the refuge lakes and to evaluate the relative merits of various proposed management strategies to reduce salinity in the lakes. Hydrologic and water-quality data for 1990-97 and climate data for 1972-97 were assembled and used in the model. The 1990-97 record of measured lake stages and specific conductance enabled calibration of the model to ensure that it adequately simulates measured records of lake stages and specific conductance. The calibrated model then was used to simulate long-term stage and salinity variations resulting from various management alternatives.

NTIS

Computerized Simulation; Water Quality; Salinity; Water Management

19990046012 Geological Survey, Water Resources Div., Augusta, ME USA

Water Resources Data for Maine, Water Year 1998 ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***

Nielsen, J. P.; Lippert, R. G.; Caldwell, J. M.; Mar. 1999; 204p; In English

Report No.(s): PB99-137937; USGS/WDR/ME-98/1; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Water-resources data for the 1997 water year for Maine consists of records of stage, discharge, and water quality of streams; and water levels of ground-water wells. This report contains discharge records for 46 gaging stations, water-quality data for 3 gaging stations; gage-height data for 2 gaging stations, precipitation quantity data for 5 stations, and water levels for 31 ground-water wells. Additional water data were collected at other sites, not part of the systematic data-collection program, and are published as miscellaneous measurements.

NTIS

Data Acquisition; Ground Water; Water Quality; Water Resources; Data Systems

19990046014 Geological Survey, Water Resources Div., Atlanta, GA USA

Hydrogeology of the Upper Floridan Aquifer in the Vicinity of the Marine Corps Logistics Base Near Albany, Georgia

McSwain, K. B.; 1999; 62p; In English

Report No.(s): PB99-134017; USGS/WRI-98-4202; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report describes the results of an investigation of the hydrogeology of the Upper Floridan aquifer in the vicinity of the Marine Corps Logistics Base (MCLB), located southeast of and adjacent to Albany, GA. Specifically, the hydrogeologic framework includes: a description of the geologic and hydrogeologic units that compose the ground-water system of the Upper Floridan aquifer; an evaluation of the lithologic and hydrologic heterogeneity within the Upper Floridan aquifer; a comparison of geologic and hydrogeologic conditions on the MCLB and in surrounding area; and a determination of ground-water-flow directions withinthe Upper Floridan aquifer. As part of this investigation, existing geologic and hydrogeologic data were compiled, 22 addi-

tional wells were drilled, 254 wells were inventoried, and undisturbed core samples, borehole geophysical logs, and ground-water levels were collected over a two-year period from 1995 to 1997.
NTIS
Hydrogeology; Ground Water; Geophysics; Wells

19990046019 Geological Survey, Water Resources Div., Lansing, MI USA
Water Resources Data for Michigan, Water Year 1998 ***Annual Report, 1 oct. 1997 - 30 Sep. 1998***
Blumer, S. P.; Behrendt, T. E.; Ellis, J. M.; Minnerick, R. J.; LeuVoy, R. L.; Mar. 1999; 502p; In English
Report No.(s): PB99-140352; USGA/WDR/MI-98/1; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche
The report contains discharge records for 141 streamflow-gaging stations; stage only records for 1 stream-gaging station and 20 lake-gaging stations; stage and contents for 1 reservoir; water-quality records for 26 streamflow-gaging stations and 1 lake-gaging station; water-level records for 35 ground-water wells. Also included are 31 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Miscellaneous data were collected at 45 discharge measuring sites and 71 water-quality sampling sites.
NTIS
Water Resources; Data Acquisition

19990046092 Geological Survey, Water Resources Div., Richmond, VA USA
Water Resources Data for Virginia, Water Year 1998. Volume 1. Surface-Water Discharge and Surface-Water Quality Records ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
White, R. K.; Hayes, D. C.; Eckenwiler, M. R.; Herman, P. E.; Mar. 30, 1998; 608p; In English
Report No.(s): PB99-140451; USGS/WDR/VA-98/1; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche
This volume contains records for water discharge at 152 gaging stations; stage only at 2 gaging station; stage and contents at 10 lakes and reservoirs; and water quality at 24 gaging stations. Also included are data for 55 crest-stage partial-record stations. Locations of these sites are shown on figures 4 and 5. Miscellaneous hydrologic data were collected at 199 measuring sites and 17 water-quality sampling sites not involved in the systematic data-collection program.
NTIS
Hydrology; Surface Water; Reservoirs; Water Resources

19990046185 Geological Survey, Water Resources Div., Richmond, VA USA
Potential for Saltwater Intrusion in the Potomac Aquifers of the York-James Peninsula, Virginia
Smith, B. S.; 1999; 34p; In English
Report No.(s): PB99-139453; USGS/WRI-98-4187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Chloride Project is a cooperative program of the U.S. Geological Survey (USGS) and the Hampton Roads Planning District Commission (HRPDC) that began in 1995. The first objective of the Chloride were evaluated with the aid of a two-dimensional, density-dependent, ground-water flow and solute-transport model. The USGS solute-transport model SUTRA (Voss, 1984) was used to represent a simplified vertical section of the Potomac aquifers and the hydraulic properties of the aquifers and associated confining units near Lee Hall, Va. The Lee Hall section was selected because more information about the aquifers and confining units was available there than elsewhere and because data collected during the prior to the Chloride Project indicated that saltwater could be moving in the Lower Potomac aquifer, but not in the shallower aquifers, near Lee Hall.
NTIS
Base Flow; Aquifers

19990046187 Geological Survey, Water Resources Div., Trenton, NJ USA
Water Resources Data for New Jersey, Water Year 1998. Volume 2. Ground-Water Data ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
Jones, W. D.; 1998; 232p; In English
Report No.(s): PB99-139255; USGS/WDR/NJ-98-2; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
Water-resources data for the 1998 water year for New Jersey are presented in three volumes, and consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. Volume 2 contains a summary of the hydrologic conditions for 1998 water year; a listing of current water resource projects in New Jersey; a bibliography of water-related reports, articles, and fact sheets completed by the Geological Survey in recent years; records of ground-water levels from 190 wells; and a table of discontinued observation wells for which

ground-water-level data are available. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Federal, State, and local agencies in New Jersey.
NTIS
Ground Water; Hydrology; New Jersey

19990046192 Geological Survey, Water Resources Div., Iowa City, IA USA
Water Resources Data for Iowa, Water Year 1998, Volume 1, Surface Water: Mississippi River Basin ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
May, J. E.; Gorman, J. G.; Goodrich, R. D.; Miller, V. E.; Turco, M. J.; Mar. 26, 1999; 394p; In English
Report No.(s): PB99-140329; USGS/WRD/IA-98/1-Vol-1; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche
This report volume contains discharge records for 90 gaging stations; stage or contents for 6 lakes and reservoirs and 3 streams; water quality for 1 stream-gaging station; sediment records for 10 stream-gaging stations; and precipitation record for 10 precipitation stations. Also included are data for 61 crest-stage partial record stations. Additional water data were collected at various sites, but are not part of the systematic data collection program and are published as miscellaneous discharge and miscellaneous water-quality analyses.
NTIS
Data Acquisition; Water Quality; Water Resources; Surface Water; Hydrology; Iowa

19990046194 Geological Survey, Water Resources Div., Oklahoma City, OK USA
Ground-Water-Quality Assessment of the Central Oklahoma Aquifer, Oklahoma: Results of Investigations, Chapter A
Christenson, S.; Havens, J. S.; 1998; 198p; In English
Report No.(s): PB99-139479; USGS/WATER-SUPPLY PAPER-2357-A-CH-A; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche
This collection of five papers is intend to summarize the results of the Central Oklahoma aquifer investigations and present the results of some of the investigations that are not presented in separate papers. The papers included in this collection, and a brief statement of their purposes are: Summary of Investigations; The Diagenetic History of Permian Rocks in the Central Oklahoma Aquifer; Geochemical Characterization of Solid-Phase Materials in the Central Oklahoma Aquifer; Summary of Geochemical and Geohydrologic Investigations of the Central Oklahoma Aquifer; and Arsenic, Chromium, Selenium, and Uranium in the Central Oklahoma Aquifer.
NTIS
Water Quality; Hydrogeology; Ground Water; Geochemistry; Aquifers

19990046206 Geological Survey, Water Resources Div., Tucson, AZ USA
Water Resources Data for Arizona, Water Year 1998 ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Tadayon, S.; Duet, N. R.; Fisk, G. G.; McCormack, H. F.; Partin, C. K.; Apr. 1999; 482p; In English
Report No.(s): PB99-140667; USGS/WDR/AZ-98/1; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche
Water discharge data for the 1998 water year for Arizona consist of records of stage, discharge, and water quality of streams; stage, contents, water quality of lakes and reservoirs; water levels of observation wells; and quality of ground water. The report contains discharge records for 167 gaging stations, annual peaks for 27 crest-stage partial-record stations; contents only records for 8 lakes and reservoirs; stage and (or) contents for 1 lake; elevation only for 1 streamflow station; included with gaging-station records, consisting of monthend or monthly stage, contents, and evaporation of lakes and reservoirs, diversions, and return flows; water-quality records for 14 continuous-record stations; water-quality data for water from 188 wells. The data represent that part of the National Water Data System operated by the US Geological Survey cooperating Federal and State agencies in Arizona.
NTIS
Water Resources; Water Quality; Data Systems; Geological Surveys; Ground Water; Surface Water; Arizona; Hydrology

19990046207 Geological Survey, Water Resources Div., Raleigh, NC USA
Water Resources Data for North Carolina, Water Year 1998, Volume 1, Surface-Water Records ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Ragland, B. C.; Smith, D. G.; Barker, R. G.; Robinson, J. B.; Mar. 31, 1999; 714p; In English
Report No.(s): PB99-140659; USGS/WDR/NC-98/1-Vol-1; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche
Water-resources data for the 1998 water year for North Carolina consist of records of stage, discharge, and water quality of streams; and stage and contents of lakes and reservoirs. The report contains discharge records for 176 gaging stations; stage only records for 33 gaging stations; stage and contents for 56 lakes and reservoirs; water quality for 33 gaging stations and 20 miscella-

neous sites; and continuous daily tide stage at 5 sites. Additional water data were collected at 62 sites not involved in the systematic data-collection program, and are published as miscellaneous measurements in the report. The collection of water-resources data in North Carolina is part of the National Water-Data System operated by the US Geological Survey in cooperation with Stage, municipal, and Federal agencies.
NTIS
Water Quality; Water Resources; Geological Surveys; Data Systems; Surface Water; Ground Water; North Carolina; Hydrology

19990046208 Geological Survey, Water Resources Div., Sacramento, CA USA
Water Resources Data for California, Water Year 1998, Volume 4, Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State Line ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Friebel, M. F.; Webster, M. D.; Anderson, S. W.; Rockwell, G. L.; Smithson, J. R.; 1999; 462p; In English
Report No.(s): PB99-140444; USGS/WDR/CA-98/4-Vol-4; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche
Volume 4 contains discharge records for 176 gaging stations and 1 partial-record station, stage and contents for 45 lakes and reservoirs, gage-height records for 1 station, precipitation data for 3 stations, and water quality for 14 stations and 7 water-quality partial-record sations.
NTIS
Water Quality; Water Resources; Geological Surveys; Surface Water; Hydrology; Data Systems

19990046210 Geological Survey, Water Resources Div., Bismarck, ND USA
Water Resources Data for North Dakota, Water Year 1998, Volume 1, Surface Water ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Harkness, R. E.; Berkas, W. R.; Norbeck, S. W.; Robinson, S. M.; Apr. 1999; 540p; In English
Report No.(s): PB99-140360; USGS/WDR/ND-98/1-Vol-1; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche
Volume 1 contains records of water discharge for 97 streamflow-gaging stations; stage only for 22 river-stage stations; contents and/or stage for 12 lake or reservoir stations; annual maximum discharge for 32 crest-stage stations; and water-quality for 99 streamflow-gaging stations, 3 river-stage stations, 9 lake or reservoir stations, and several miscellaneous sample sites on streams and lakes. Also included are water-quality data for 2 precipitation-chemistry stations.
NTIS
Surface Water; Water Quality; Water Resources; Hydrology; Geological Surveys; North Dakota; Data Systems

19990046211 Geological Survey, Water Resources Div., Salt Lake City, UT USA
Water Resources Data for Utah, Water Year 1998 ***Annual Report, Oct. 1997 - Sep. 1998***
Herbert, L. R.; Tibbetts, J. R.; Wilberg, D. E.; Allen, D. V.; Jun. 1999; 336p; In English
Report No.(s): PB99-140345; USGS/WDR/UT-98/1; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
The report contains discharge records for 158 gaging stations; stage and contents for 18 lakes and reservoirs; water quality for 11 hydrologic stations, and 185 wells; and water levels for 49 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements.
NTIS
Data Systems; Utah; Water Quality; Water Resources; Surface Water; Ground Water; Hydrology

19990046212 Geological Survey, Water Resources Div., Iowa City, IA USA
Water Resources Data for Iowa, Water Year 1998, Volume 2, Surface Water: Missouri River Basin, and Ground Water ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
May, J. E.; Gorman, J. G.; Goodrich, R. D.; Miller, V. E.; Turco, M. J.; Mar. 20, 1999; 298p; In English
Report No.(s): PB99-140337; USGS/WDR/IA-98/2-Vol-2; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
This report volume contains discharge records for 32 gaging stations; stage or contents for 2 lakes; water quality for 1 stream-gaging station, and sediment records for 3 stream-gaging stations. Also included are data for 34 crest-stage partial record stations and ground-water levels for 176 wells. Additional water data were collected at various sites, but are not part of the systematic data collection program and are published as miscellaneous discharge and miscellaneous water-quality analyses.
NTIS
Data Acquisition; Ground Water; Water Quality; Water Resources; Hydrology; Surface Water

19990046215 Geological Survey, Water Resources Div., Pearl, MS USA
Water Resources Data for Mississippi, Water Year 1998 ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
Plunkett, M. L.; Morris, F.; Oakley, W. T.; Turnipseed, D. P.; Mar. 1999; 304p; In English
Report No.(s): PB99-140261; USGS/WDR/MS-98/1; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

Water resources data for the 1998 water year for Mississippi consist of records of surface water and ground water in the State. Specifically, it contains: (1) Discharge records for 97 streamflow-gaging stations, stage records for 19 of these gaging stations, discharge records for 73 partial-record of miscellaneous streamflow stations, including 7 flood hydrograph parital-record stations, 51 crest-stage partial-record stations, and 15 special study and miscellaneous sites; (2) stage only at 1 gaging station; (3) water-quality records for 13 streamflow-gaging stations, 3 partial-record or miscellaneous sites, 8 short-term study sites, and 43 wells; and (4) water-level records for 34 observation wells. Records obtained from water-resources investigations are also included in special sections of the report.
NTIS
Surface Water; Hydrology; Ground Water

19990046216 Geological Survey, Water Resources Div., Nashville, TN USA
Water Resources Data for Tennessee, Water Year 1998 ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
Flohr, D. F.; Hamilton, J. T.; Lewis, J. G.; Thomas, L. B.; Mar. 1999; 362p; In English
Report No.(s): PB99-140097; USGS/WDR/TN-98/1; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

The report contains records for water discharge at 61 gaging stations; stage only for 1 gaging station, elevation and contents for 32 lakes reservoirs; water quality at 21 gaging stations and 21 wells; and water levels for 9 observation wells; and 1 precipitation station. Also included are data for 104 crest-stage partial-record stations. Additional water data were collected at various stream sites not involved in the systematic data-collection program, and are published as miscellaneous measurements and analyses.
NTIS
Surface Water; Ground Water; Hydrology

19990046217 Geological Survey, Water Resources Div., Columbus, OH USA
Water Resources Data for Ohio, Water Year 1998. Volume 2. St. Lawrence River Basin and Statewide Project Data ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
Shindel, H. L.; Mangus, J. P.; Trimble, L. E.; Mar. 1999; 506p; In English
Report No.(s): PB99-140089; USGS/WDR/OH-98/2; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

The report, in two volumes, contains records for water discharge at 127 gaging stations and 65 partial-record sites; water levels at 348 observation wells and 24 crest-stage gages; and water quality at 25 gaging stations, 317 observation wells, and 26 partial-record sites. Also included are data from miscellaneous and synoptic sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses.
NTIS
Surface Water; Ground Water

19990046218 Geological Survey, Water Resources Div., Rolla, MO USA
Water Resources Data for Missouri, Water Year 1998 ***Annual Report, (Annual) 1 Oct. 1997 - 30 Sep. 1998***
Hauck, H. S.; Huber, L. G.; Nagel, C. D.; Mar. 1999; 456p; In English
Report No.(s): PB99-140071; USGS/WDR/MO-98/1; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

Water-resources data for the 1998 water year for Missouri consist of records of stage, discharge, and water quality of streams; elevation, contents, and water quality of lakes and reservoirs. This volume contains discharge records for 134 gaging stations; elevation at 12 lakes and reservoirs; water quality at 62 sampling stations (including 2 lakes); data for 29 crest-stage stations; and water-level records for 25 ground-water monitoring wells.
NTIS
Surface Water; Ground Water; Hydrology

19990046219 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Vegetation Resources Inventory of Southwest Alaska: Development and Application of an Innovative, Extensive Sampling Design ***Topical Report***
van Hees, W. W. S.; Jan. 1999; 64p
Report No.(s): PB99-140055; FSRP-PNW-507; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An assessment of the vegetation resources of southwest Alaska was made by using an inventory design developed by the Pacific Northwest Research Station, Satellite imagery (LANDSAT MSS), high-altitude aerial photography, and ground sampling were the major components of the design. Estimates of area for all land cover classes in the southwest region were produced. Additionally, more intensive sampling provided data for estimation of timber resources in the forest land component. Field data collection was conducted from 1991 to 1994, and data compilation progress through 1995.
NTIS
Vegetation; Inventories; Alaska; Satellite Imagery

19990046317 Los Alamos National Lab., NM USA
Los Alamos coupled climate model
Jones, P. W.; Malone, R. C.; Lai, C. A.; Dec. 31, 1998; 10p; In English; International workshop on software engineering and code design in parallel meteorological and oceanographic applications
Report No.(s): DE99-001225; LA-UR-98-2675; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
To gain a full understanding of the Earth's climate system, it is necessary to understand physical processes in the ocean, atmosphere, land and sea ice. In addition, interactions between components are very important and models which couple all of the components into a single coupled climate model are required. A climate model which couples ocean, sea ice, atmosphere and land components is described. The component models are run as autonomous processes coupled to a flux coupler through a flexible communications library. Performance considerations of the model are examined, particularly for running the model on distributed-shared-memory machine architectures.
NTIS
Climate Models; Climate Change

19990046437 Bureau of Reclamation, Technical Service Center, Denver, CO USA
Transformation of Dissolved Organic Carbon in Constructed Wetland Systems. Summary. Project Report. Wetlands and Riparian Habitat Initiative ***Final Report***
Barber, Larry B., Geological Survey, USA; Leenheer, Jerry A., Geological Survey, USA; Noyes, Ted I., Geological Survey, USA; Stiles, Eric A., Bureau of Reclamation, USA; Jan. 1999; 152p; In English
Report No.(s): PB99-139024; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
Dissolved organic matter (DOM) is an important chemical constituent in natural and constructed wetlands. Although the concentrations of dissolved organic carbon have been studied, relatively little is known about the nature of DOM and the chemical transformations that control its fate in wetlands. This investigation examined the occurrence, character, and transformations of DOM in six treatment wetland sites located in the Western USA. The report presents the chemical data collected from each of the study sites and preliminary interpretations of the data.
NTIS
Dissolved Organic Matter; Carbon; Wetlands; Habitats; Waste Water; Transformations

19990046439 Geological Survey, Water Resources Div., Albuquerque, NM USA
Water Resources Data for New Mexico, Water Year 1998, Volume 2, The Arkansas River Basin, the San Juan River Basin, the Gila River Basin and Ground-Water Wells ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***
Ortiz, D., Geological Survey, USA; Lange, K., Geological Survey, USA; Beal, L., Geological Survey, USA; Apr. 1999; 216p; In English
Report No.(s): PB99-140683; USGS/WDR/NM-98/2; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
Water-resources data for the 1998 water year for New Mexico consist of records of discharge and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This report contains discharge records for 158 gaging stations; stage and contents for 26 lakes and reservoirs; water quality for 34 gaging stations, 23 wells, and 41 partial-record stations and miscellaneous sites; and water levels at 122 observation wells. Also included are 36 crest-stage, partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the US Geological Survey and cooperating Federal, State, and local agencies in New Mexico.
NTIS
Geological Surveys; Data Systems; Data Acquisition; River Basins; Ground Water; Surface Water; Water Quality; Water Resources; Hydrology

19990046440 Geological Survey, Water Resources Div., Boise, ID USA

Water Resources Data for Idaho, Water Year 1998, Volume 2, Upper Columbia River Basin and Snake River Basin below King Hill ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***

Brennan, T. S., Geological Survey, USA; Lehmann, A. K., Geological Survey, USA; O'Dell, I., Geological Survey, USA; Tungate, A. M., Geological Survey, USA; Mar. 31, 1998; 392p; In English

Report No.(s): PB99-140774; USGS/WDR/ID-98/2; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

Water resources data for the 1998 water year for Idaho consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; discharge of irrigating diversions; and water levels and water quality of groundwater. The two volumes of this report contain discharge records for 180 stream-gaging stations and 21 irrigation diversions; stage only records for 5 stream-gaging stations; stage only for 6 lakes and reservoirs; contents only for 16 lakes and reservoirs; water-quality for 59 stream-gaging stations and partial record sites, 4 lakes sites, and 571 groundwater wells; and water levels for 565 observation wells. Additional water data were collected at various sites not involved in the systematic data collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the US Geological Survey and cooperating State and Federal agencies in Idaho, adjacent States, and Canada.

NTIS

Geological Surveys; Water Resources; Data Acquisition; Data Systems; Hydrology; River Basins; Water Quality; Ground Water; Surface Water

19990046441 Geological Survey, Water Resources Div., Charleston, WV USA

Water Resources Data for West Virginia, Water Year 1998 ***Annual Report, 1 Oct. 1997 - 30 Sep. 1998***

Ward, S. M., Geological Survey, USA; Taylor, B. C., Geological Survey, USA; Crosby, G. R., Geological Survey, USA; Mar. 1999; 504p; In English

Report No.(s): PB99-140782; USGS/WDR/WV-98-1; No Copyright; Avail: CASI; A22, Hardcopy; A04, Microfiche

Water-resources data for the 1998 water year for West Virginia consist of records of discharge and water quality of streams and water levels of observation wells. The report contains discharge records for 65 streamflow-gaging stations; discharge records provided by adjacent states for 10 streamflow-gaging stations; annual maximum discharge at 37 crest-stage partial-record stations; water-quality records for 21 stations; and water-level records for 14 observation wells. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous sites. These data represent that part of the National Water Data System collected by the US Geological Survey and cooperating State and Federal agencies in West Virginia.

NTIS

West Virginia; Data Acquisition; Geological Surveys; Water Quality; Water Resources; Hydrology; Surface Water; Ground Water

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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.

19990044001 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Utilization of JERS-1 SAR Data for Soil Moisture and Backscatter Coefficient Retrieval Models ***Utilizacao de Dados do SAR JERS-1 em Modelos Preditivos de Umidade do Solo e Coefiiciente de Retroespalhamento***

Maximo, Orlando Alves, Instituto Nacional de Pesquisas Espacias, Brazil; 1997; 166p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-6744-TDI/634; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The objective of this study is to evaluate the feasibility of the use of Japanese Earth Resources Satellite (JERS-1) Synthetic Aperture Radar (SAR) data for soil moisture retrieval models based on radar images, and to compare the results with field data. Two models that relate the backscatter coefficient with soil parameters such as soil moisture and roughness were used (i.e., models by Oh and Dubois.) A 16 bits amplitude image was calibrated to obtain the backscatter coefficient. In order to minimize the influence of speckle, the calibration was taken using the average of 16 pixels. The model from Dubois reaches a higher correlation with calibrated JERS-1 SAR data than Oh's model. The latter could not be inverted because it includes a non-invertible function, namely the modulus of a complex number. The Dubois' model was inverted, but required the insertion of estimated values of roughness to be used with monochannel SAR data, such as JERS-1. The results were very satisfactory. The inversion model is

quite sensitive to the estimation of roughness values. For bare soils, with an error of 5 mm of height, the correlation between computed and measured data deteriorated.
Author
Earth Resources; Radar Imagery; Soil Moisture; Soil Science

19990044077 Department of Energy, Washington, DC USA
Multispectral thermal imaging
Weber, P. G.; Bender, S. C.; Borel, C. C.; Clodius, W. B.; Smith, B. W.; Dec. 31, 1998; 10p; In English; International symposium on optical science, engineering, and instrumentation
Report No.(s): DE99-001139; LA-UR-98-2334; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Many remote sensing applications rely on imaging spectrometry. Here the authors use imaging spectrometry for thermal and multispectral signatures measured from a satellite platform enhanced with a combination of accurate calibrations and on-board data for correcting atmospheric distortions. The approach is supported by physics-based end-to-end modeling and analysis, which permits a cost-effective balance between various hardware and software aspects. The goal is to develop and demonstrate advanced technologies and analysis tools toward meeting the needs of the customer; at the same time, the attributes of this system can address other applications in such areas as environmental change, agriculture, and volcanology.
NTIS
Imaging Techniques; Thermal Mapping; Spectroscopy

19990045642 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Vegetation Indices and Fraction Values to Characterize Primary Rainforest and Sucessional Stages in the Area of Influence of Tapajos National Forest- Para State ***Indices de Vegetacao e Valores de Proporcao na Caracterizacao de Floresta Tropical Primaria e Estadios Sucessionais na Area de Influencia da Floresta Nacional do Tapajos-Estado do Para***
Bernardes, Sergio, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 118p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6890-TDI/651; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

In May 1995, a field campaign was carried out in the innerside and proximities of Tapajos National Forest - Para State, aiming to measure dendrometric variables and leaf Area Index (LAI) in vegetation communities of tropical rainforest and regrowth, represented by three stages, classified in function of age: less than 5 years-, 5 to 10 years and more than 10 years. The vegetation communities were described according to the parameters: floristic composition, density, basal area, biomass (estimated by alometric equations) and LAI. The study, involving Remote Sensing techniques used a times series of rectified imagery from LANDSAT-TM 5 satellite, refered to the years of 1984, 1986 to 1989, 1991, 1992 and 1995. The image processing involved the calculation of digital values of vegetation indices (NDVI and SAVI) and fractions of vegetation (PVEG), soil (PSOL) and shade (PSOM), generated by a mixing model analysis. The digital data analysis was implemented by means of two approaches. The first one utilized samples of the digital values taken from the time series and analysing the evolution of the secondary sucession process. It was observed that the calculated NDVI values didn't allow to distinguish the sucessional stages, excepting "younger". The SAVI and PVEG values showed similar behaviors and reduction was verified in PSOM detriment, as sucessional process evolves. The second approach involved the jointed analysis of biophysical parameters and digital values, taken from representative segments of the studied sample units, from 1995 imagery. The analysis of these results indicated the existence of high correlation between biophysical parameters biomass and basal area and calculated digital values, excepting NDVI and PSOL.
Author
Biomass; Estimating; Leaf Area Index; Rain Forests; Remote Sensing; Time Series Analysis; Vegetation

19990045644 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
SAR Image Textural Classification by Autoregressive Modelling ***Classificacao Textural de Imagens SAR, por Modelagem Autorregressiva***
Soares, Sergio Monteiro, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 200p; In Portuguese
Report No.(s): INPE-6889-TDI/650; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The aim of this work is to present a method of textural feature extraction by autorregressive modelling to supervised SAR image classification. The classification is performed using a bidimensional processing. The autorregressive parameters are estimated using the Levinson-Durbin algorithm and they are used as the inverse filters elements. After that, two other approaches (whitening features by local autocorrelation function with lags (1,0) and (0,1) calculation and energy filter achievement) were applied over the original filtered SAR image, as a way to improve the classification on the edges of the classes. The method was tested over JERS-1 (L band) SAR image and RADARSAT (C band) image from "Floresta Nacional do Tapajos" (FLONA). The

identified classes for JERS-1 mosacic were Dense Primary Forest and Undulate Primary Forest. For continuous JERS-1 image and RADARSAT image the identified classes were Primary Forest, Secondary Forest and Bare Soil. For JERS-1 and RADARSAT images a LANDSAT TM image in color composition RGB-543, from the same area was used as ground truth. to experiment this modelling in other area a SAR-580 SAR image, from a Germany region, was also used, with identified classes Forest, Agricultural Area and Bare Soil. After the selection of samples from those classes (training and test regions) the method was tested, resulting a set of filtered bands from the original SAR image. Over this set of bands the Maximum Likelihood multibands classifier was used. The results were analysed using the confusion matrix.
Author
Agriculture; Algorithms; Autocorrelation; Color; Forests; Pattern Recognition

19990045770 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Remote Sensing and GIS Applied to Highway Planning, Case Study: Western Section of Sao Paulo Metropolitan Rodoanel
Tecnicas de Sensoriamento Remoto e SIG Aplicadas ao Planejamento de uma Rodovia: Estudo de Caso-Trecho Oeste do Rodoanel Metropolitano de Sao Paulo
Penido, Luciano Rodrigues, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 136p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6966-TDI/654; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This study presents a methodology on the use of both remote sensing and Geographical Information Systems techniques, in an investigation process performed during the survey phase of a road construction project. The test site is located within the Sao Paulo Metropolitan Region, and corresponds to the western section of the ”Sao Paulo Metropolitan Rodoanel”. This area was qualified according to its aptness to locate this highway, where two alternatives for the trace of this section of the Rodoanel were evaluated. Thematic data on geology, geomorphology, slopes, areas under environmental protection and industrial zones, as well as land use and land cover data were used. This information allowed a supervised classification of a TM-LANDSAT image, channels 1, 4 and 7. The themes of interest were integrated by mathematical operations and logic associations, producing a map of physical aptness, including five classes of aptness (very high, high, moderate, low and very low), which were discriminated as areas without restriction for use and as areas of environmental protection or industrial zones. In this map, the extent of the trace alternatives intercept each aptness class, was obtained. This study was performed in cooperation with Sao Paulo State Road Department (”Desenvolvimento Rodoviario S.A”. - DERSA), which supplied technical and operational support.
Author
Geographic Information Systems; Remote Sensing; Highways; Environment Protection; Mathematical Logic; Geomorphology

19990045779 Physics and Electronics Lab. TNO, The Hague, Netherlands
Geographical Information Extraction with Remote Sensing, Part 2, Technical Supplement
vandenBroek, A. C., Physics and Electronics Lab. TNO, Netherlands; vanPersie, M., Physics and Electronics Lab. TNO, Netherlands; Noorbergen, H. H. S., Physics and Electronics Lab. TNO, Netherlands; Rijckenberg, G. J., Physics and Electronics Lab. TNO, Netherlands; August 1998; 1p; In English; Original contains color illustrations
Report No.(s): FEL-98-A077-Pt-2; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., Oude Waalsdorperweg 63, PO Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, Microfiche

In this part of the report we give details about the sensors and platforms used. We furthermore describe extraction and visualisation techniques. Imaging sensors operating in three wavelength regions are considered: (1) optical/near-infrared; (2) thermal infrared; and (3) microwave. The sensors are mounted on a so-called platform. We discriminate here between airborne and spaceborne platforms. Spaceborne platforms are always called satellites, while airborne platforms can be conventional aircrafts, but also UAV’s, drones or even balloons. Main difference between space and airborne platforms is the distance between the sensor and the Earth surface, which ranges roughly from 100 km to 36,000 km for spaceborne and 10 meter to 20 km for airborne systems. The distance influences the information content of an image, especially the resolution and the imaging geometry. We will discuss here the resolution and imaging geometry in a general context. In the next sections we will discuss for the three wavelength domains the following topics in more detail: (1) physical background; (2) imaging geometry and image distortions; and (3) present and future systems.
Derived from text
Space Platforms; Remote Sensing; Imaging Techniques; Flying Platforms

19990046334 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Schlumberger soundings in the Oasis Valley near Beatty, Nevada
Bisdorf, R. J., Department of Energy, USA; Dec. 31, 1998; 44p; In English

Report No.(s): DE99-000508; USGS/OFR-98-363; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In 1997 the US Geological Survey made 36 direct current (dc) electrical soundings in the Oasis Valley near Beatty, Nevada, using the Schlumberger array. The soundings were made to determine the resistivity structure as an aid in evaluating the hydrological conditions. The purpose of this report is to present the sounding data and its automatic interpretation. A map of the sounding locations, number and direction of expansion of the Schlumberger array is included. The soundings are represented by circles and the direction of expansion by short bold lines adjacent to the circles. A table that gives the sounding number, x coordinate, y coordinate, and elevation of the soundings is also included.

NTIS

Hydrology; Geological Surveys; Direct Current; Electrical Resistivity

19990046747 NASA Goddard Space Flight Center, Greenbelt, MD USA

Utilization of Satellite Data in Land Surface Hydrology: Sensitivity and Assimilation

Lakshmi, Venkataraman, NASA Goddard Space Flight Center, USA; Susskind, Joel, NASA Goddard Space Flight Center, USA; February 1999; 34p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper investigates the sensitivity of potential evapotranspiration to input meteorological variables, viz- surface air temperature and surface vapor pressure. The sensitivity studies have been carried out for a wide range of land surface variables such as wind speed, leaf area index and surface temperatures. Errors in the surface air temperature and surface vapor pressure result in errors of different signs in the computed potential evapotranspiration. This result has implications for use of estimated values from satellite data or analysis of surface air temperature and surface vapor pressure in large scale hydrological modeling. The comparison of cumulative potential evapotranspiration estimates using ground observations and satellite observations over Manhattan, Kansas for a period of several months shows very little difference between the two. The cumulative differences between the ground based and satellite based estimates of potential evapotranspiration amounted to less that 20mm over a 18 month period and a percentage difference of 15%. The use of satellite estimates of surface skin temperature in hydrological modeling to update the soil moisture using a physical adjustment concept is studied in detail including the extent of changes in soil moisture resulting from the assimilation of surface skin temperature. The soil moisture of the surface layer is adjusted by 0.9mm over a 10 day period as a result of a 3K difference between the predicted and the observed surface temperature. This is a considerable amount given the fact that the top layer can hold only 5mm of water.

Author

Satellite Observation; Atmospheric Temperature; Evapotranspiration; Surface Layers; Surface Temperature; Hydrology Models

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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.

19990045870 Institute of Environmental Sciences, Energy Research and Process Innovation TNO, Apeldoorn (netherlands), Apeldoorn Netherlands

Advanced Rechargeable Batteries, Phase 2 ***Final Report, 1 Jan. 1997 - 31 Dec. 1998***

Schmal, Ir. D.; ter Veen, Ir. W.; Kluiters, Ing C.; Jan. 1999; 60p; In Dutch

Contract(s)/Grant(s): A97/KM/108

Report No.(s): AD-A362075; TNO-MEP-R,98/524; TDCK-TD-98-0392; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In the framework of the programme Advanced rechargeable batteries, intended to evaluate the suitability. the applicability and possible problems of advanced batteries on naval ships (both surface and submarine) studies and tests have been performed on two promising battery types, not only from a technical point of view, but also because it was expected that they could become available commercially in the mid term. The batteries investigated were the nickel metalhydride battery (from DAUG) and the sodium nickelchloride battery (from AABH. part of AEG). The nickel metalhydride battery has been tested on a number of general aspects. The sodium nickelchloride battery has been tested especially for submarine application, as an alternative for the current lead acid battery. Both types of batteries performed well and in agreement with the expectations from brochures and supplier information. Further it was proved that the batteries can withstand abnormal conditions, like short circuiting and overcharge. At the end of the testing period, however, AABH announced that they will stop with the further development of the sodium nickelchloride

battery. Therefore (as long as no other company takes over) it is adviced to do further detailed testing only with the nickel metalhydride battery. Beside that, it is adviced to pay also attention to the most interesting long term battery, viz. the lithium battery.
DTIC
Lead Acid Batteries; Electrolytic Cells; Nickel

19990046287 Los Alamos National Lab., NM USA
Comparison of General Purpose Heat Source testing with the ANSI N43.6-1977 (R1989) sealed source standard
Grigsby, C. O.; Mar. 26, 1998; 150p; In English
Report No.(s): DE99-001117; LA-UR-98-1826; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This analysis provides a comparison of the testing of Radioisotope Thermoelectric Generators (RTGs) and RTG components with the testing requirements of ANSI N43.6-1977 (R1989) 'Sealed Radioactive Sources, Categorization'. The purpose of this comparison is to demonstrate that the RTGs meet or exceed the requirements of the ANSI standard, and thus can be excluded from the radioactive inventory of the Chemistry and Metallurgy Research (CMR) building in Los Alamos per Attachment 1 of DOE STD 102792. The approach used in this analysis is as follows: (1) describe the ANSI sealed source classification methodology; (2) develop sealed source performance requirements for the RTG and/or RTG components based on criteria from the accident analysis for CMR; (3) compare the existing RTG or RTG component test data to the CMR requirements; and (4) determine the appropriate ANSI classification for the RTG and/or RTG components based on CMR performance requirements. The CMR requirements for treating RTGs as sealed sources are derived from the radiotoxicity of the isotope ((238)P7) and amount (13 kg) of radioactive material contained in the RTG. The accident analysis for the CMR BIO identifies the bounding accidents as wing-wide fire, explosion and earthquake. These accident scenarios set the requirements for RTGs or RTG components stored within the CMR.
NTIS
Heat Sources; Radioisotope Batteries; Thermoelectric Generators

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ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990043982 Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Washington, DC USA
Procedure for Analyzing Energy and Global Warming Impacts of Foam Insulation in U.S. Commercial Buildings
Kosny, J.; Yarbrough, D. W.; Desjarlais, A. O.; Dec. 31, 1998; 12p; In English
Report No.(s): DE99-000214; ORNL/CP-99302; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this paper is to develop a procedure for evaluating the energy and global warming impacts of alternative insulation technologies for US commercial building applications. The analysis is focused on the sum of the direct contribution of greenhouse gas emissions from a system and the indirect contribution of the carbon dioxide emission resulting from the energy required to operate the system over its expected lifetime. In this paper, parametric analysis was used to calculate building related CO2 emission in two US locations. A retail mail building has been used as a model building for this analysis. For the analyzed building, minimal R-values of insulation are estimated using ASHRAE 90.1 requirements.
NTIS
Thermal Insulation; Buildings; Global Warming

19990043990 Department of Energy, Assistant Secretary for Environment, Safety, and Health, Washington, DC USA
Evaluation of the area factor used in the RESRAD code for the estimation of airborne contaminant concentrations of finite area sources
Chang, Y. S.; Yu, C.; Wang, S. K.; Jul. 31, 1998; 32p; In English
Report No.(s): DE99-000492; ANL/EAD/TM-82; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The area factor is used in the RESRAD code to estimate the airborne contaminant concentrations for a finite area of contaminated soils. The area factor model used in RESRAD version 5.70 and earlier (referred to as the old area factor) was a simple, but conservative, mixing model that tended to overestimate the airborne concentrations of radionuclide contaminants. An improved and more realistic model for the area factor (referred to here as the new area factor) is described in this report. The new area factor model is designed to reflect site-specific soil characteristics and meteorological conditions. The site-specific parameters considered include the size of the source area, average particle diameter, and average wind speed. Other site- specific parameters (particle density, atmospheric stability, raindrop diameter, and annual precipitation rate) were assumed to be constant. The model uses the

Gaussian plume model combined with contaminant removal processes, such as dry and wet deposition of particulates. Area factors estimated with the new model are compared with old area factors that were based on the simple mixing model. In addition, sensitivity analyses are conducted for parameters assumed to be constant. The new area factor model has been incorporated into RESRAD version 5.75 and later.
NTIS
Meteorological Parameters; Contaminants; Soils; Contamination

19990044005 Norwegian Defence Research Establishment, Kjeller, Norway
Architecture of the Instrumental Parts of the Environmental Data Buoys MK-2 ***Instrumentell Arkitektur for FU-Boyene MK-II***
Furdal, Arne, Norwegian Defence Research Establishment, Norway; Nakjem, Morten, Norwegian Defence Research Establishment, Norway; Mar. 09, 1998; 30p; In Norwegian
Report No.(s): FFI/RAPPORT-98/01352; FFIU/693/132; ISBN 82-464-0238-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This document proposes an instrumental architecture for the Environmental Data Buoy MK-II.
Author
Personal Computers; Data Acquisition; Sensors

19990044053 Royal Netherlands Meteorological Inst., The Hague, Netherlands
A Sea of Research ***Een zee van Onderzoek: Oceangrafisch Speurwerk op Het KNMI***
Geurts, Harry, Royal Netherlands Meteorological Inst., Netherlands; 1998; 25p; In Danish; Original contains color illustrations; ISBN 90-369-2141-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Weather differs from year to year, and sometimes it deviates very strongly from the normal pattern. The most important source of great yearly variation is El Nino, a warming up of the surface water in the eastern Pacific Ocean along the equator. Once in three to seven years there is a strong El Nino that lasts around one year and throws the weather off vigorously. El Nino means ”Christ child.” We can thank Peruvian fishermen for this name, who catch no more fish when the season of warm water begins. The weather can be affected by El Nino worldwide, from Argentina to Zimbabwe.
Author
El Nino; Pacific Ocean; Surface Water; Weather; Research

19990044074 Lawrence Livermore National Lab., Livermore, CA USA
Maintenance and initiation of the intraseasonal oscillation in the NCEP/NCAR and ECMWF reanalyses and in the GLA and UKMO AMIP simulations
Sperber, K. R.; Slingo, J. M.; Innes, P. M.; Lau, W. K. M.; Jan. 01, 1998; 7p; In English; International conference on reanalyses
Report No.(s): DE98-057453; UCRL-JC-129364; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Julian Intraseasonal (Madden-Julian) oscillations are a dominant model of tropical variability. Satellite derived outgoing longwave radiation (OLR) and reanalyses from NCEP/NCAR and ECMWF are used as verification data in a study of intraseasonal variability in the Goddard Laboratory for Atmospheres (GLA) and the UK Meteorological Office (UKMO) atmospheric general circulation models. We examine the November-May period during which these models exhibited their strongest and most coherent IO’s. 1987/88 from observations and the reanalyses are compared with 1986/87 from GLA and 1980/81 from UKMO. During the active phase of the IO, convection migrates from the Indian Ocean to the western/central Pacific Ocean, and into the SPCZ. to demonstrate this, we have calculated an IO index to be used for lagged correlation analysis. Both models fail to simulate IO related convection over the Indian Ocean and the propagation eastward into the west Pacific. The maintenance and initiation of the intraseasonal oscillation has also been investigated. We have correlated the IO index with 20-100 day bandpass filtered latent heat flux from NCEP/NCAR reanalysis and ECWMF reanalysis. This result indicates that evaporative wind feedback is not the dominant process by which the eastward propagation of the intraseasonal oscillation is maintained.
NTIS
Atmospheric General Circulation Models; Weather; Weather Forecasting; Annual Variations

19990044079 Department of Energy, Office of Energy Research, Washington, DC USA
Extending the GTAP data base for analysis of climate change ***Final Report, 15 Sep. 1997 - 14 Sep. 1998***
Hertel, T. W.; Rutherford, T. F.; Dec. 31, 1998; 1p; In English
Report No.(s): DE99-001142; DOE/ER/62503-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

To date, studies of the trade impacts of carbon restrictions under the Framework Convention on Climate Change have suffered from severe data limitations. This project aimed to improve the analytical basis for the development of policies relating to such restrictions. In particular, the authors have constructed a publicly available data base which contains the combination of (a) comprehensive input-output data by region, (b) bilateral trade and protection data, and (c) energy price, quantity and tax data. The data have been pre-released for testing by a half-dozen key research groups around the world who are working on climate change, and based on their feedback the data set has been finalized.
NTIS
Data Bases; Climate Change; Data Base Management Systems

19990044081 Department of Energy, Office of Energy Research, Washington, DC USA
Ozonesonde measurements from the Atmospheric Radiation Measurement (ARM) site in Billings, Oklahoma
Dec. 31, 1998; 100p; In English
Report No.(s): DE99-001146; DOE/CH/10844-T3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Ozonesonde instruments were prepared and released at the Atmospheric Radiation Measurement (ARM) site located near Billings, Oklahoma. Ozone sensors, associated radiosondes, balloons, and other parts and pieces required for the ozone observations were provided by WFF on a reimbursable arrangement with ANL. Observations were scheduled daily at 1,700 UTC beginning on September 22, 1995. Attempts to maintain this schedule were frustrated by a few simultaneous operations involving different electronic devices in use resulting in considerable rf noise. Since radiosondes are necessarily low-cost instruments their reception is particularly susceptible to noisy rf fields. Overall, however, 36 ozonesonde flights were made with the last observation occurring on November 1, 1995. Ozone data were processed on-site through the ground-station software and preliminary data delivered to Mike Splitt at the ARM site.
NTIS
Ozone; Atmospheric Radiation; Radiation Measurement; Radiosondes; Air Pollution

19990044082 Department of Energy, Office of Energy Research, Washington, DC USA
Evaluation of the appropriate land-surface resolution for climate models ***Final Report, Aug. 1, 1992--Jul. 31, 1995***
Avissar, R.; Jul. 17, 1998; 10p; In English
Report No.(s): DE99-001155; DOE/ER/61453-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The land surface interacts strongly with the atmosphere at all spatial and temporal scales. Therefore, land-surface processes must be represented as accurately as possible in climate models. The investigation conducted under this project was aimed at answering two major questions related to land-surface processes: (1) What are the land-surface characteristics and processes that need to be represented in a climate model. (2) How does one average, in a nonlinear form, land-surface energy fluxes over heterogeneous domain at the scale that is not represented explicitly in the model. Correspondingly, two major tasks were conducted: (1) an evaluation of the relative importance of the various land-surface characteristics based on their impact on the redistribution of energy into turbulent sensible heat flux and turbulent latent heat flux at the ground surface; and (2) an evaluation of the impact of the heterogeneity of these characteristics on land-surface energy and mass fluxes into the atmosphere.
NTIS
Earth Surface; Climate Models

19990044083 Department of Energy, Office of Energy Research, Washington, DC USA
Solubilization of trace organics in block copolymer micelles for environmental separation using membrane extraction principles ***Final Report, May 1, 1992--Apr. 30, 1995***
Hatton, T. A.; Sep. 30, 1998; 50p; In English
Report No.(s): DE99-001156; DOE/ER/14262-3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The solubilization of a range of polycyclic aromatic hydrocarbons in block copolymer micelles has been studied as a function of polymer composition, architecture, and temperature. Micelle formation is favored at high temperatures, leading to significant enhancements in solubilization capacity. At low temperatures, however, micelles do not form and the solubilization capacity of the block copolymer solution for the organics is low; this provides a convenient method for the regeneration of micellar solutions used as solvents in the treatment of contaminated feed streams using membrane extraction principles. Other experiments and analysis point to the effectiveness of block copolymer micellar solutions as water-based adsorbents for the removal of trace organics from air streams. Theoretical calculations of the structure of block copolymer micelles in the presence and absence of solutes using self-consistent mean-field lattice theories and lattice Monte Carlo methods have successfully captured the trends observed with

changing polymer composition and architecture, often quantitatively. The temperature and composition dependence of the micellar properties were determined by allowing the individual polymer segments to assume both polar and non-polar conformations.
NTIS
Solutes; Block Copolymers; Membranes; Extraction; Polycyclic Aromatic Hydrocarbons

19990045691 NASA Goddard Space Flight Center, Greenbelt, MD USA
Perspective: Climate Forcings in the Industrial Era
Hansen, James E., NASA Goddard Space Flight Center, USA; Sato, Makiko, NASA Goddard Space Flight Center, USA; Lacis, Andrew, NASA Goddard Space Flight Center, USA; Ruedy, Reto, NASA Goddard Space Flight Center, USA; Tegen, Ina, NASA Goddard Space Flight Center, USA; Matthews, Elaine, NASA Goddard Space Flight Center, USA; Proceedings: National Academy of Sciences; October 1998; ISSN 0027-8424; Volume 95, pp. 12753-12758; In English; ACE2 Meeting, 13-16 Apr. 1999, Toulouse, France; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The forcings that drive long-term climate change are not known with an accuracy sufficient to define future climate change. Anthropogenic greenhouse gases (GHGs), which are well measured, cause a strong positive (warming) forcing. But other, poorly measured, anthropogenic forcings, especially changes of atmospheric aerosols, clouds, and land-use patterns, cause a negative forcing that tends to offset greenhouse warming. One consequence of this partial balance is that the natural forcing due to solar irradiance changes may play a larger role in long-term climate change than inferred from comparison with GHGs alone. Current trends in GHG climate forcings are smaller than in popular ”business as usual” or 1% per year CO growth scenarios. The summary implication is a paradigm change for long-term climate projections: uncertainties in climate forcings have supplanted global climate sensitivity as the predominant issue.
Author
Atmospheric Heating; Climate Change; Climatology; Greenhouse Effect; Land Use; Terrestrial Radiation; Aerosols

19990045717 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Optimal Pulsed Pumping Schedule Using Calculus of Variation Methodology
Johannes, Tay W.; Mar. 1999; 160p; In English
Report No.(s): AD-A361664; AFIT/GEE/ENC/99M-1; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Application of a variational optimization technique has demonstrated the potential strength of pulsed pumping operations for use at existing pump-and-treat aquifer remediation sites. The optimized pulsed pumping technique has exhibited notable improvements in operational effectiveness over continuous pumping. The optimized pulsed pumping technique has also exhibited an advantage over uniform time intervals for pumping and resting cycles. The most important finding supports the potential for managing and improving pumping operations in the absence of complete knowledge of plume characteristics. An objective functional was selected to minimize mass of water removed and minimize the non-essential mass of contaminant removed. General forms of an essential concentration function were analyzed to determine the appropriate form required for compliance with management preferences. Third-order essential concentration functions provided optimal solutions for the objective functional. Results of using this form of the essential concentration function in the methodology provided optimal solutions for switching times. The methodology was applied to a hypothetical, two-dimensional aquifer influenced by specified and no-flow boundaries, injection wells and extraction wells. Flow simulations used MODFLOW, transport simulations used MT3D, and the graphical interface for obtaining concentration time series data and flow/transport links were generated by GMS version 2.1.
DTIC
Aquifers; Ground Water; Calculus of Variations; Calculus; Time Series Analysis; Schedules

19990045755 Department of Defense, Washington, DC USA
Tests of the higher order turbulence model for atmospheric circulations (HOTMAC) at Deseret Chemical Depot
Costigan, K. R.; Dec. 31, 1998; 250p; In English
Report No.(s): DE99-000801; LA-UR-98-2059; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Deseret Chemical Depot is one of the US Army’s storage facilities for its stockpile of chemical weapon agents. Congress has directed the Department of Defense to eliminate the aging stockpiles, which have existed since the end of World War II, and the US Army is destroying these lethal chemical munitions. Although the danger is slight, accurate predictions of the wind field in the valley are necessary for dispersion calculations in the event of an accident involving toxic chemicals at the depot. There are several small communities in Rush and Tooele valleys, including the town of Tooele, and Salt Lake City is located 65 km to the Northeast of Deseret Chemical Depot South area, at 1,300 m MSL and beyond the Oquirrh Mountains. The purpose of this report is to carry out three-dimensional numerical simulations of the atmospheric circulations in the region around Deseret Chemical Depot with the Higher Order Turbulence Model for Atmospheric Circulations (HOTMAC) and to evaluate the performance of

the model. The code had been modified to assimilate local meteorological observations through the use of Newtonian nudging. The nudging scheme takes advantage of the extensive network of local observations in the valley.
NTIS
Turbulence Models; Meteorological Parameters; Atmospheric Circulation; Atmospheric Models

19990045758 Department of Energy, Washington, DC USA
Direct calculation of leak path factors for highly compartmentalized buildings
Leonard, M. T.; McClure, P. R.; Dec. 31, 1998; 9p; In English; Conference on integrating safety analysis into safety management
Report No.(s): DE99-000628; LA-UR-98-1880; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The large, highly compartmentalized configurations of buildings at many Department of Energy (DOE) facilities call the validity of traditional, simplistic methods for estimating contaminant leak path factors (LPFs) into question. Conversely, rigorous calculation of LPFs using detailed flow-field analysis computer codes is impractical for routine analysis. This paper describes a recent application of a rigorous, yet practical, method of calculating LPFs for the Chemical and Metallurgical Research (CMR) Facility at Los Alamos National Laboratory (LANL). The approach involves computer simulation of airborne contaminant transport using the MELCOR computer code. MELCOR is a general-purpose, fluid flow and aerosol transport analysis code originally developed by the US Nuclear Regulatory Commission to evaluate the release, transport, and deposition of radionuclides in nuclear reactor systems. However, the fundamental mathematical models in the code and the modular code architecture make it suitable to the CMR analysis.
NTIS
Leakage; Buildings; Computer Programs

19990045865 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Biodegradation of Aircraft Deicing Fluid Components in Soil
Burke, Baron W.; Mar. 1999; 189p; In English
Report No.(s): AD-A361762; AFIT/GEE/ENV/99M-O4; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Aircraft de-icing fluids (ADFs) are used worldwide to ensure safe aircraft operations. This research effort was conducted to analyze the biodegradation effects of two chemical components of ADFs, propylene glycol (PG) and tolyltriazole (TTA), in a high-clay soil. The research used four test methods; automated respirometry, high performance liquid chromatography (HPLC), microbial colony population counts (MCPC), and agar well diffusion tests (AWDT). The research was partitioned into two phases of investigation. Phase-one analyzed individual and combined ADF chemical components on uncontaminated soil. The presence of TTA, from 25 - 1,000 mg/kg, reduced the maximum respiration rate of 1,000 mg/kg PG alone; however, cumulative respiration over the two-week study period was proportionality higher for TTA (25 - 500 mg/kg). Rate and respiration totals for soil exposed to TTA (25 - 750 mg/kg) alone, were not significantly different from background soil; however, rate and respiration totals for PG (1,000 mg/kg) alone were significantly higher. The HPLC percentage of recovered TTA, with or without PG presence, indicated a loss (biodegradation and/or absorption) of TTA within the soil. Kellner (1999) conducted HPLC for absorption/desorption of TTA on the same (high-clay) soil. MCPC and AWDT indicated no measurable toxic effects to microbial populations/health occurred from ADF chemical components. Phase-two research conducted reapplication of ADF chemicals on acclimated soils from phase-one. Initial respiration rates from application of 1,000 mg/kg PG on acclimated soil (PG 1,000 mg/kg) compared to 1,000 mg/kg PG on uncontaminated soil. The acclimated soil produced a significantly larger initial rate of respiration.
DTIC
Chemical Composition; Soil Pollution; Liquid Chromatography; Contamination; Biodegradation; Deicers

19990046022 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Role of HO(x) in Super- and Subsonic Aircraft Exhaust Plumes
Hanisco, T. F., Harvard Univ., USA; Wennberg, P. O., Harvard Univ., USA; Cohen, R. C., Harvard Univ., USA; Anderson, J. G., Harvard Univ., USA; Fahey, D. W., National Oceanic and Atmospheric Administration, USA; Keim, E. R., National Oceanic and Atmospheric Administration, USA; Gao, R. S., National Oceanic and Atmospheric Administration, USA; Wamsley, R. C., National Oceanic and Atmospheric Administration, USA; Donnelly, S. G., National Oceanic and Atmospheric Administration, USA; DelNegro, L. A., National Oceanic and Atmospheric Administration, USA; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Kelly, K. K., National Oceanic and Atmospheric Administration, USA; Proffitt, M. H., National Oceanic and Atmospheric Administration, USA; Geophysical Research Letters; Jan. 01, 1997; ISSN 0094-8534; Volume 24, No. 1, pp. 65-68; In English
Report No.(s): Paper-96GL03724; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The generation of sulfuric acid aerosols in aircraft exhaust has emerged as a critical issue in determining the impact of supersonic aircraft on stratospheric ozone. It has long been held that the first step in the mechanism of aerosol formation is the oxidation of SO2, emitted from the engine by OH in the exhaust plume. We report in situ measurements of OH and HO, in the exhaust plumes of a supersonic (Air France Concorde) and a subsonic (NASA ER-2) aircraft in the lower stratosphere. These measurements imply that reactions with OH are responsible for oxidizing only a small fraction of SO2 (2%), and thus cannot explain the large number of particles observed in the exhaust wake of the Concorde.
Author
Exhaust Gases; Oxidation; Sulfur Dioxides; Sulfuric Acid; Supersonic Aircraft; Stratosphere; Jet Exhaust; Exhaust Emission

19990046184 Geological Survey, Water Resources Div., Sacramento, CA USA
Hydrogeology and Geochemistry of Acid Mine Drainage in Ground Water in the Vicinity of Penn Mine and Camanche Reservoir, Calaveras County, California: Summary Report, 1993-95
Alpers, C. N.; Hamlin, S. N.; Hunerlach, M. P.; 1999; 72p; In English
Report No.(s): PB99-139461; USGS/WRI-96-4287; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
The report presents results from the ground-water investigation at the Penn Mine by the U.S. Geological Survey from October 1991 to April 1995. The specific objectives of the investigation were to evaluate (1) the quantity and quality of ground water flowing toward Camanche Reservoir from the Penn Mine area; (2) the ground-water transport of metals, sulfate, and acidity between Mine Run and Camanche Reservoirs; and (3) the hydrologic interactions between the flooded mine workings and other ground water and surface water in the vicinity.
NTIS
Hydrogeology; Geochemistry; Surface Water; Drainage

19990046186 West Virginia Univ., Dept. of Mechanical and Aerospace Engineering, Morgantown, WV USA
Demonstration of a Heavy-Duty Vehicle Chassis Screening Test for Compliance Testing Heavy-Duty Engines ***Final Report***
Clark, N. N.; McKain, D. L.; Hoppie, J. A.; Lyons, D. W.; Gautam, M.; Jul. 1998; 198p; In English
Report No.(s): PB99-139297; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche
Emissions testing of new heavy-duty engines is performed to ensure compliance with governmental emissions standards. This testing involves operating the engine through the heavy-duty diesel transient Federal Test Procedure (FTP). While in-use engine emissions testing would be beneficial in aiding regions to meet standards dictated by the Clean Air Act, the process of removing the engine from the vehicle, fitting it to an engine dynamometer, testing, and refitting the engine in the chassis, combined with costs associated with removing the vehicle, fitting it to an engine dynamometer, testing, and refitting the engine in the chassis, combined with costs associated with removing the vehicle from service, is prohibitively expensive. A procedure for screening engine emissions testing with the engine in the vehicle using a chassis dynamometer was developed to mimic the FTP. Data from two engines and vehicles (a 195 hp Navistar T 444E in a single axle straight truck and a 370 hp Cummins N-14 in a tandem drive axle tractor) is presented as well as correlation between engine and chassis emissions tests. Also included was data gathered to gauge the effects of engine tampering and malfunctioning on emissions levels. It was concluded that engine and chassis emissions levels were well correlated with respect to oxides of nitrogen, but less well so with respect to particulate matter.
NTIS
Engine Tests; Dynamometers; Exhaust Emission

19990046209 Applied Analysis, Tiburon, CA USA
Remote Sensing Measurements of Real World High Exhaust Emitters ***Interim Report***
McClintock, P.; Mar. 12, 1999; 52p; In English
Report No.(s): PB99-140378; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Remote Sensing measurements were taken at five primary sites in the Denver Area between April 1997 and March 1998 using an RS2000 unit capable of measuring HC, CO, and NO. The RD unit also measures vehicle speed and acceleration to permit determination of the vehicle operating condition and captures an image of the vehicle plate for identification. RSD measurements were compared to results from subsequent IM240 tests for 10,000 vehicles. When average emissions measured by IM240 and RSD for each model year were plotted against each other, an excellent correlation was observed with an r(2) of 0.93 for HC and 0.99 for CO. Despite the older technology NO channel, an r(2) of 0.99 was obtained for NO. These results suggest that RSD measurements can be used to assess fleet emissions.
NTIS
Remote Sensing; Emitters

19990046220 Battelle Memorial Inst., Columbus, OH USA

Comprehensive Abatement Performance Pilot Study. Volume 2. Multi-Element Data Analyses ***Final Report***

Kinateder, J.; Ma, Z. J.; Jul. 1998; 82p; In English

Report No.(s): PB99-140030; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The report presents the results of the statistical analysis of multi-element data collected during a pilot study that preceded the Comprehensive Abatement Performance (CAP) Study. The goal of the CAP Study was to assess the long-term efficacy of lead-based paint abatement. For the multi-element analysis, concentrations of lead, as well as of aluminum, barium, cadmium, calcium, chromium, magnesium, nickel, potassium, titanium, and zinc in dust and soil samples were measured. Concentrations of barium, cadmium, chromium, titanium, and zinc were measured because these elements were regarded as possible constituents of paint. Concentrations of aluminum, calcium, magnesium, nickel, and potassium were measured because these elements were regarded as likely to be found in soil. The multi-element analysis was undertaken to determine whether relationships among these elements could provide a 'tracer' for identifying the sources and pathways of lead in households. Pilot study data were used to (1) characterize the concentrations of lead, aluminum, barium, cadmium, calcium, chromium, magnesium, nickel, potassium, titanium, and zinc samples in household dust and soil; (2) measure the differences in these concentrations associated with renovation and lead-based paint abatement; and (3) investigate the relationship among the elements by sample type (i.e., samples taken from different locations).

NTIS

Lead (Metal); Soil Sampling; Dust; Paints; Chemical Composition; Data Processing; Ecosystems

19990046222 Atmospheric and Environmental Research, Inc., San Ramon, CA USA

Simulation of Aerosol Dynamics: A Comparative Review of Algorithms Used in Air Quality Models

Zhang, Y.; Seigneur, C.; Seinfeld, J. H.; Jacobson, M. Z.; Binkowski, F. S.; Jan. 1999; 200p; In English

Report No.(s): PB99-134660; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

A comparative review of algorithms currently used in air quality models to simulate aerosol dynamics is presented. This review addresses coagulation, condensational growth, nucleation, and gas/particle mass transfer. Two major approaches are used in air quality models to represent the particle size distribution: (1) the sectional approach in which the size distribution is discretized into sections and particle properties are assumed to be constant over particle size sections and (2) the modal approach in which the size distribution is approximated by several modes and particle properties are assumed to be uniform in each mode. The results of this study provide useful information to select algorithms to simulate aerosol dynamics in air quality models and to improve the accuracy of existing algorithms.

NTIS

Air Quality; Aerosols; Algorithms; Environment Models; Mass Transfer

19990046306 Eastern Research Group, Inc., Morrisville, NC USA

Research and Development of a Field-Ready Protocol for Sampling of Phosgene from Stationary Source Emissions: Diethylamine Reagent Studies ***Topical Report, 11 Jul. 1995 - 30 Sep. 1996***

Steger, J. L.; Bursey, J. T.; Merrill, R. G.; Epperson, D.; Mar. 1999; 196p; In English; Sponsored by Environmental Protection Agency, Cincinnati, OH. National Exposure Research Lab

Report No.(s): PB99-132060; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This report presents the results of laboratory studies to develop and evaluate a method for the sampling and analysis of phosgene from stationary sources of air emissions using diethylamine (DEA) in toluene as the collection media. The method extracts stack gas from emission sources and stabilizes the reactive gas for subsequent analysis. DEA was evaluated both in a benchtop study and in a laboratory train spiking study. This report includes results for both the benchtop study and the train spiking study. Benchtop studies to evaluate the suitability of DEA for collecting and analyzing phosgene investigated five variables: storage time, DEA concentration, moisture/pH, phosgene concentration, and sample storage temperature. Prototype sampling train studies were performed to determine if the benchtop chemical studies were transferable to a Modified Method 5 sampling train collecting phosgene in the presence of clean air mixed with typical stack gas components. Four conditions, which varied the moisture and phosgene spike were evaluated in triplicate. In addition to research results, the report includes a detailed draft method for sampling and analysis of phosgene from stationary source emissions.

NTIS

Phosgene; Field Tests; Air Quality; Gas Analysis

19990046338 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Heterogeneous processing of bromine compounds by atmospheric aerosols: Relation to the ozone budget

Robinson, J. M., Department of Energy, USA; Henson, B. F., Department of Energy, USA; Dubey, M. K., Department of Energy, USA; Casson, J. L., Department of Energy, USA; Johal, M. S., Department of Energy, USA; Dec. 31, 1998; 18p; In English

Report No.(s): DE99-000551; LA-UR-98-1875; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The depletion of ozone, particularly above Antarctica, has been investigated extensively to formulate public policy on the use of halocarbons. While it has been shown that heterogeneous reactions of chlorine compounds on stratospheric particulates cause the ozone hole, little is known of the analogous bromine mechanisms, even though it has been recognized for two decades that catalytic destruction of ozone by bromine could be more efficient than chlorine. Furthermore, field measurements and modeling calculations suggest that these heterogeneous (gas/surface) reactions are not restricted to the Antarctic regions but occur globally. The authors have performed laboratory measurements of the uptake of bromine compounds and other halogens on simulated stratospheric aerosols to help elucidate their role in catalytic ozone destruction cycles. Their studies contribute to the data base required to make assessments of the effects of human activities on global change, including the Montreal Protocol.

NTIS

Ozonosphere; Air Pollution; Atmospheric Chemistry; Aerosols; Bromine Compounds; Chlorine Compounds; Ozone Depletion; Particulates

19990046387 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

Residual Risk Report to Congress

Mar. 1999; 238p; In English

Report No.(s): PB99-133654; EPA/453/R-99/001; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The 1970 CAA mandated a health-based program that required EPA to identify and list HAPs based on human health criteria. EPA was to then promulgate standards (national emission standards for hazardous air pollutants, or NESHAPs) for each pollutant at a level that would ensure the protection of public health with 'an ample margin of safety'. In the 20 years following enactment of the 1970 legislation, EPA identified eight pollutants as HAPs and regulated sources of seven of them. In the 1990 CAA Amendments, Congress shifted the focus from individual pollutants to industrial and commercial source categories, and a phased approach to controlling air toxics emissions was developed. In the first regulatory phase, EPA must promulgate national, technology-based emission standards for source categories emitting any of the 188 currently listed HAPs in amounts exceeding specific emission thresholds. The fundamental approach is the use of available control technologies or work practice changes to achieve emission reductions in a timely manner for as many of the listed HAPs as possible, without explicit consideration of a HAP's inherent toxicity and potential risk. This technology-based standards program is commonly referred to as the maximum achievable control technology (MACT) program. Regulation of air toxics emissions through the MACT program is expected to achieve significant reductions in emissions of HAPs. In the second regulatory phase, the 1990 Amendments provide for a human health risk and adverse environmental effects-base 'needs test.' In this phase, referred to as residual risk standard setting, EPA will consider the need for additional standards following regulation under section 112(d) to protect public health and the environment. Section 112(f) of the CAA specifies that such residual risk standards 'provide an ample margin of safety to protect public health'. Section 112(f) also requires EPA to determine whether residual risk standards are necessary to prevent 'an adverse environmental effect', taking into consideration 'costs, energy, safety, and other relevant factors' in deciding what level is protective. Also included in the 1990 CAA Amendments are provisions that EPA study several specific topics. In accordance with this mandate, EPA has published a number of reports to Congress, including the Mercury, Great Waters, and Utilities Reports to Congress, and continues to study these and other special topics. These programs, in combination with the residual risk program, will provide a coordinated federal approach to address air toxics.

NTIS

Risk; Exhaust Emission; Pollution Control; Exhaust Gases

19990046554 NASA Goddard Space Flight Center, Greenbelt, MD USA

Optical Properties of Aerosols from Long Term Ground-Based Aeronet Measurements

Holben, B. N., NASA Goddard Space Flight Center, USA; Tanre, D., Lille-1 Univ., France; Smirnov, A., NASA Goddard Space Flight Center, USA; Eck, T. F., NASA Goddard Space Flight Center, USA; Slutsker, I., NASA Goddard Space Flight Center, USA; Dubovik, O., NASA Goddard Space Flight Center, USA; Lavenu, F., Centre National de la Recherche Scientifique, France; Abuhassen, N., NASA Goddard Space Flight Center, USA; Chatenet, B., Lille-1 Univ., France; 1999; 4p; In English, 17-23 Jan. 1999,

Meribel, France; Sponsored by Centre National d'Etudes Spatiales, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

AERONET is an optical ground-based aerosol monitoring network and data archive supported by NASA's Earth Observing System and expanded by federation with many non-NASA institutions including AEROCAN (AERONET CANada) and PHOTON (PHOtometrie pour le Traiteinent Operatonnel de Normalisation Satellitaire). The network hardware consists of identical automatic sun-sky scanning spectral radiometers owned by national agencies and universities purchased for their own monitoring and research objectives. Data are transmitted hourly through the data collection system (DCS) on board the geostationary meteorological satellites GMS, GOES and METEOSAT and received in a common archive for daily processing utilizing a peer reviewed series of algorithms thus imposing a standardization and quality control of the product data base. Data from this collaboration provides globally distributed near real time observations of aerosol spectral optical depths, aerosol size distributions, and precipitable water in diverse aerosol regimes. Access to the AERONET data base has shifted from the interactive program 'demonstrat' (reserved for PI's) to the AERONET homepage allowing faster access and greater development for GIS object oriented retrievals and analysis with companion geocoded data sets from satellites, LIDAR and solar flux measurements for example. We feel that a significant yet under utilized component of the AERONET data base are inversion products made from hourly principal plane and almucanter measurements. The current inversions have been shown to retrieve aerosol volume size distributions. A significant enhancement to the inversion code has been developed and is presented in these proceedings.
Derived from text
Aerosols; Data Bases; Cloud Cover; Climatology; Atmospheric Effects; Clouds (Meteorology)

19990046760 Research Triangle Inst., Center for Engineering and Environmental Technology, Research Triangle Park, NC USA
Air Pollution Control Technologies Performance Verification: A Permit Tool
Farmer, J. R.; Trenholm, A.; Newman, B.; Brna, T. G.; 1998; 14p; In English; Environmental Permitting, 17-19 Feb. 1999, Research Triangle Park, NC, USA
Report No.(s): PB99-137416; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The U.S. Environmental Protection Agency (EPA) has instituted the Environmental Technology Verification (ETV) program to verify the performance of innovative or improved technical solutions to problems that threaten human health or the environment. The goal of the ETV program is to accelerate the entrance of new or improved environmental technologies into the domestic and international marketplace. The Research Triangle Institute (RTI) is EPA's partner organization for the Air Pollutant Control Technologies (APCT) ETV program, one of 12 pilot programs. This paper describes how the verification statements and other aspects of the APCT ETV program will help expedite the air permit process.
NTIS
Air Pollution; Pollution Control; Environment Protection

19990046761 Midwest Research Inst., Kansas City, MO USA
Emission Measurements of Particle Mass from Construction Activities
Cowherd, C., Midwest Research Inst., USA; Muleski, G. E., Midwest Research Inst., USA; Masser, C. C., Environmental Protection Agency, USA; 1999; 18p; In English; Emissions Inventory, 7-10 Dec. 1998, New Orleans, LA, USA
Report No.(s): PB99-137432; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper presents measurements for particulate matter (PM) emission particle size profiles from scraper loading, unloading, and transport operations. The exposure profiling technique was used to measure emissions. This technique for source testing of open PM sources is based on the isokinetic profiling profiling concept that is used in conventional (stack) testing. The passage of airborne pollutant immediately downwind of the source is measured directly by means of simultaneous multipoint sampling over the cross section of the open dust source plume. Within field measurement capabilities. Several types of PM collection devices were utilized to validate the test procedure and enhance the quality assurance goals of the test program. During the field testing. source activity data were gathered to combine with the emission measurements to develop emission source strengths. The sources activity data gathered red included: vehicle type, speed, number of axles and tires, rate of vehicle loading/unloading and start/stop time, silt and moisture content of soils, and data regarding water use for dust control and/or materials compaction.
NTIS
Emission; Particles; Particle Mass; Moisture Content

19990046763 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Effects of Tropical Cirrus Clouds on the Abundance of Lower Stratospheric Ozone
Dessler, A. E., NASA Goddard Space Flight Center, USA; Minschwaner, K., New Mexico Inst. of Mining and Technology, USA; Weinstock, E. M., Harvard Univ., USA; Hintsa, E. J., Harvard Univ., USA; Anderson, J. G., Harvard Univ., USA; Russell, J. M.,

III, NASA Langley Research Center, USA; Journal of Atmospheric Chemistry; 1996; Volume 23, pp. 209-220; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The distribution of many chemical constituents of the atmosphere (e.g., ozone) is at least partially determined by the. distribution of net radiative heating in the atmosphere. In this paper, we demonstrate the significant effect of high cirrus clouds on the net radiative heating of the tropical lower stratosphere. A model of tropical lower stratospheric ozone is then used to demonstrate the sensitivity of calculated ozone to the varying cloud cover used in the model. We conclude that calculated ozone is sensitive to the inclusion of clouds In models and that models of the atmosphere should include a realistic description of tropical cirrus clouds in order to accurately simulate the chemical composition of the atmosphere.

Author

Atmospheric Composition; Cirrus Clouds; Sensitivity; Atmospheric Effects; Stratosphere; Cloud Cover

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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.

19990044037 Geophysical Observatory, Sodankyla, Finland

Magnetic Results: Sodankyla Polar Year Observatory, 1882-1883

Nevanlinna, Heikki, Geophysical Observatory, Finland; Kultima, Johannes, Editor, Geophysical Observatory, Finland; 1998; ISSN 1456-3673; 32p; In English

Report No.(s): Rept-84; ISBN 951-42-6020-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Sodankyla was one of the 11 stations that were in operation during the First International Polar Year 1882-1883. In this yearbook we republish the magnetic observations carried out in Sodankyla (September 1, 1882 - August 31, 1883) in a similar manner that is the usual practice for modem geomagnetic observatory data. The motivation to publish and analyze more than 100-year old geomagnetic data arises from the fact that the quality of the data collected at Sodankyla is good for e.g. analysis of the time behaviour of the geomagnetic activity. The data, about 28 500 hourly readings of the declination (D), horizontal (H)-, and vertical component (Z) of the geomagnetic field is now in electronic form and will be distributed to the World Data Centers. The quality and homogeneity of magnetic observations of D and H is good but Z is less reliable. Similar data analysis of geomagnetic data from other geomagnetic observatories (like Helsinki 1844-1910) has been successful in reconstructing geomagnetic activity index series for the 19th century. Such analyzes, as well the utilization of Sodankyla Polar Year data presented here, promote the construction of long time series of geomagnetic activity that are important in studies of e.g. space climate. The magnetic field during the Polar Year period 1882-1883 was very disturbed. One of the greatest (eighth strongest according to the aa-statistics 1844-1998) magnetic storm occurred on November 20th, 1882.

Author

Magnetic Measurement; World Data Centers; Magnetic Storms; Geomagnetism

19990044080 Department of Energy, Office of Energy Research, Washington, DC USA

In-situ permeability determination using borehole and seismic logging data ***Final Report, Sep. 5, 1986--Mar. 14, 1997***

Toksoez, M. N.; Rieven, S. A.; Burns, D. R.; Dec. 31, 1997; 29p; In English

Report No.(s): DE99-001145; DOE/ER/13636-4(12/97); No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The objective of this project has been to identify, locate, and characterize in-situ fractures using downhole and surface seismic methods, the goal being to estimate the permeability of these fractures from the way that seismic waves interact with them. The work proposed under the renewal of this grand for the period of 1993--1996 included four specific areas of research. First was the use of full waveform acoustic logs and shear wave logs to characterize in-situ fractures. The second was the use of laboratory ultrasonic scale models to verify the effects of fractures and anisotropy on acoustic and shear logs. Third, the authors proposed to study methods of monitoring hydrofractures with passive seismic techniques. Finally, the authors planned to study the effect of rough fracture surfaces on fluid flow.

NTIS

Permeability; Boreholes; Fractures (Materials); Fracturing; Seismic Waves; Logging (Industry)

19990044099 California Univ., San Diego, Dept. of Applied Mechanics and Engineering Sciences, La Jolla, CA USA
Quasistatic Mechanics and Materials Stability of Particulate Media ***Final Report, 1 Jun. 1996 - 30 Nov. 1998***
Goddard, J. D.; Mar. 17, 1999; 9p; In English
Contract(s)/Grant(s): F49620-96-1-0246; AF Proj. 2302
Report No.(s): AD-A361716; AFRL-SR-BL-TR-99-0100; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is the final technical report on a three-year program of research on the microstructural and continuum mechanics of granular media and geomaterials initiated under the AFOSR Particulate Mechanics Program. The research has led to the development of new theoretical models of microstructure, numerical simulation of granular assemblages, and development of new experimental techniques. The overall goal of the work is to provide a sound microstructural basis for understanding continuum behavior and elucidating structurally and geologically important processes such as the propagation of acoustic an seismic waves, the quasi-static yield of granular media, the structural stability of soils and the noninvasive testing of geomaterials. The research effort has been mainly devoted to the mechanics of dense suspensions and granular media in the quasi-static flow regime, with emphasis on shearing and dilatational instabilities. A summary is given immediately below of accomplishments and plans for continuing efforts.
DTIC
Computerized Simulation; Continuum Mechanics; Microstructure

19990045643 Australian Geological Survey Organisation, Canberra, Australian Capital Territory, Australia
AGSO Research Newsletter, No. 29
Bladon, Geoff, Editor, Australian Geological Survey Organisation, Canberra, Australia; November 1998; ISSN 1039-091X; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The recently completed 'Metallogenic potential of Australian Proterozoic granites' project highlighted the 1590-Ma Hiltaba Suite and Gawler Range Volcanics (GRV) in the Grawler craton as having high potential for further substantial mineral finds. This extensive magmatic entity comprises two (geochemical) types with apparently different mineralization associations. The strongly oxidized (hematite-magnetite) and fractionated Roxby Downs type is related to Fe-oxide-Cu-Au deposits (including the giant Olympic Dam deposit). The Kokatha type is less oxidized (ilmenite-titanomagnetic) and fractionated, and is associated with vein-hosted Au(+/- Sn +/- Ag) deposits such as Earea Dam, Glenloth, and Tarcoola. Understanding the distribution of these two magmatic types has implications for the selection of exploration models to apply to a particular area.
Author
Geochemistry; Granite; Hematite; Ilmenite; Magnetite; Volcanology; Deposits; Minerals

19990046172 Hokkaido Univ., Div. of Earth and Planetary Sciences, Sapporo, Japan
An Attempt to Estimate the Energy of a Volcanic Explosion: Field Experiments Using Artificial Charge Explosions
Oshima, Hiromitsu, Hokkaido Univ., Japan; Maekawa, Tokumitsu, Hokkaido Univ., Japan; Okada, Hiromu, Hokkaido Univ., Japan; Geophysical Bulletin of Hokkaido University; Mar. 1997; ISSN 0439-3503, No. 60, pp. 29-43; In Japanese; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have conducted two field experiments using charge explosions for constructing a empirical low to estimate energy of an explosive eruption. Air shocks and seismic waves excited by TNT fired on the ground were observed in the first experiment. Water shocks, air shocks and seismic waves caused by underwater explosions were recorded in the second experiment. Accompanied surface phenomena were also recorded by a video camera. Results of these experiments are summarized and discussed in this report. It is recognized that the positive pressure duration of an air shock is proportional to the one-fourth power of TNT weight. This relationship suggests that the positive pressure duration allows to estimate energy, of an explosive eruption. The systematic discrepancy between the observed peak pressure of an air shock and the peak pressure-scaled distance relationship for blast waves is found, although the observed peak pressures can be roughly explained by the relationship. The peak pressure of first compressional phases in water shocks recorded with a piezo blast meter are very low in comparison with values expected from previous works. A week relationship of the overpressure of air shock, the peak amplitude of seismic head wave and the height of a water column (dome) to the depth of an explosion is found. An air shock is recorded whenever an underwater explosion produces a water column. The overpressure of an air shock and the height of water column decreases as the depth of an explosion increase. This shows that air shock observation is effective to monitor an underwater explosion with a water column or dome.
Author
Explosions; Volcanoes; Simulation; Volcanology

19990046389 State Univ. of New York, Atmospheric Sciences Research Center, Albany, NY USA

Use of an Existing Airborne Radon Data Base in the Verification of the NASA/AEAP Core Model ***Final Report, 1 May 1995 - 30 Apr. 1998***

Kritz, Mark A., State Univ. of New York, USA; 1998; 2p; In English

Contract(s)/Grant(s): NCC2-5125; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary objective of this project was to apply the tropospheric atmospheric radon (Rn222) measurements to the development and verification of the global 3-D atmospheric chemical transport model under development by NASA's Atmospheric Effects of Aviation Project (AEAP). The AEAP project had two principal components: (1) a modeling effort, whose goal was to create, test and apply an elaborate three-dimensional atmospheric chemical transport model (the NASA/AEAP Core model to an evaluation of the possible short and long-term effects of aircraft emissions on atmospheric chemistry and climate--and (2) a measurement effort, whose goal was to obtain a focused set of atmospheric measurements that would provide some of the observational data used in the modeling effort. My activity in this project was confined to the first of these components. Both atmospheric transport and atmospheric chemical reactions (as well the input and removal of chemical species) are accounted for in the NASA/AEAP Core model. Thus, for example, in assessing the effect of aircraft effluents on the chemistry of a given region of the upper troposphere, the model must keep track not only of the chemical reactions of the effluent species emitted by aircraft flying in this region, but also of the transport into the region of these (and other) species from other, remote sources--for example, via the vertical convection of boundary layer air to the upper troposphere. Radon, because of its known surface source and known radioactive half-life, and freedom from chemical production or loss, and from removal from the atmosphere by physical scavenging, is a recognized and valuable tool for testing the transport components of global transport and circulation models.

Derived from text

Atmospheric Chemistry; Atmospheric Circulation; Atmospheric Effects; Atmospheric Models; Troposphere; Radon Isotopes; Air Pollution

19990046764 Harvard Univ., Div. of Engineering and Applied Sciences, Cambridge, MA USA

Stratospheric Tracers of Atmospheric Transport (STRAT) Campaign: ER-2 Participation ***Final Report, 1 Mar. 1995 - 30 Sep. 1998***

Anderson, James G., Harvard Univ., USA; Mar. 23, 1999; 7p; In English

Contract(s)/Grant(s): NCC2-913; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The NASA Stratospheric Tracers of Atmospheric Transport (STRAT) mission was initiated to advance knowledge of the major transport mechanisms of the upper troposphere-lower stratosphere. This is the region of the atmosphere within which exchange processes take place that critically determine the response of the climate system and ozone distribution to changing conditions triggered by the release of chemicals at the surface. The mission series that extended from October 1995 to November 1997 was extremely successful. The scientific advances that emerged from that mission include analyses of: (1) troposphere-to-stratosphere transport in the lowermost stratosphere from measurements of H2O, CO2, N2O, and O3; (2) the effects of tropical cirrus clouds on the abundance of lower stratospheric ozone; (3) the role of HO(sub x) in super- and subsonic aircraft exhaust plumes; and (4) dehydration and denitrification in the arctic polar vortex during the 1995-96 winter. The abstracts from published papers are included.

Author

Arctic Regions; Atmospheric Circulation; Atmospheric Composition; Stratosphere; Tropical Regions

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990044011 NASA Goddard Space Flight Center, Greenbelt, MD USA

35 GHz Measurements of CO2 Crystals for Simulating Observations of the Martian Polar Caps

Foster, J. L., NASA Goddard Space Flight Center, USA; Chang, A. T. C., NASA Goddard Space Flight Center, USA; Hall, D. K., NASA Goddard Space Flight Center, USA; Tait, A. B., Universities Space Research Association, USA; Barton, J. S., General Sciences Corp., USA; ICARUS; 1998; 35p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to learn more about the Martian polar caps, it is important to compare and contrast the behavior of both frozen H2O and CO2 in different parts of the electromagnetic spectrum. Relatively little attention has been given, thus far, to observing the thermal microwave part of the spectrum. In this experiment, passive microwave radiation emanating from within a 33 cm snowpack was measured with a 35 GHz hand-held radiometer, and in addition to the natural snow measurements, the radiometer was

used to measure the microwave emission and scattering from layers of manufactured CO2 (dry ice). A 1 m x 2 m plate of aluminum sheet metal was positioned beneath the natural snow so that microwave emissions from the underlying soil layers would be minimized. Compared to the natural snow crystals, results for the dry ice layers exhibit lower' microwave brightness temperatures for similar thicknesses, regardless of the incidence angle of the radiometer. For example, at 50 degree H (horizontal polarization) and with a covering of 21 cm of snow and 18 cm of dry ice, the brightness temperatures were 150 K and 76 K, respectively. When the snow depth was 33 cm, the brightness temperature was 144 K, and when the total thickness of the dry ice was 27 cm, the brightness temperature was 86 K. The lower brightness temperatures are due to a combination of the lower physical temperature and the larger crystal sizes of the commercial CO2 Crystals compared to the snow crystals. As the crystal size approaches the size of the microwave wavelength, it scatters microwave radiation more effectively, thus lowering the brightness temperature. The dry ice crystals in this experiment were about an order of magnitude larger than the snow crystals and three orders of magnitude larger than the CO2 Crystals produced in the cold stage of a scanning electron microscope. Spreading soil, approximately 2 mm in thickness, on the dry ice appeared to have no effect on the brightness temperatures.
Author
Mars Surface; Carbon Dioxide; Water; Electromagnetic Spectra; Ice; Microwave Emission; Microwave Radiometers

19990044076 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Evaluation of precipitation predictions in a regional climate simulation
Costigan, K. R.; Bossert, J. E.; Langely, D. L.; Dec. 31, 1998; 5p; In English; Conference on hydrology
Report No.(s): DE99-001137; LA-UR-98-2326; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The research reported here is part of a larger project that is coupling a suite of environmental models to simulate the hydrologic cycle within river basins (Bossert et al., 1999). These models include the Regional Atmospheric Modeling System (RAMS), which provides meteorological variables and precipitation to the Simulator for Processes of Landscapes, Surface/Subsurface Hydrology (SPLASH). SPLASH partitions precipitation into evaporation, transpiration, soil water storage, surface runoff, and subsurface recharge. The runoff is collected within a simple river channel model and the Finite element Heat and Mass (FEHM) subsurface model is linked to the land surface and river flow model components to simulate saturated and unsaturated flow and changes in aquifer levels. The goal is to produce a fully interactive system of atmospheric, surface hydrology, river and groundwater models to allow water and energy feedbacks throughout the system. This paper focuses on the evaluation of the precipitation fields predicted by the RAMS model at different times during the 1992--1993 water year in the Rio Grande basin. The evaluation includes comparing the model predictions to the observed precipitation as reported by Cooperative Summary of the Day and SNOTEL reporting stations.
NTIS
Climate; Atmospheric Models; Meteorological Parameters; Environment Models; Precipitation (Meteorology); Computerized Simulation

19990045641 Royal Netherlands Meteorological Inst., De Bilt, Netherlands
Experiments with Horizontal Diffusion and Advection in a Nested Fine Mesh Mesoscale Model
deBruijn, E. I. F., Royal Netherlands Meteorological Inst., Netherlands; Nov. 1997; ISSN 0169-1651; In English
Report No.(s): KNMI-WR-97-08; ISBN 90-369-2129-5; Copyright; Avail: Issuing Activity (Royal Netherlands Meteorological Inst., Postbus 201, 3730 AE De Bilt, Wilhelminalaan 10, Netherlands), Hardcopy, Microfiche

Successful mesoscale forecasts are desirable for the improvement of regional weather forecasts. Considerable efforts have been put into the development of an operational mesoscate forecasting system. For instance, Nielsen described examples of forecasts obtained from a nested mesoscale model at the Danish Meteorological Institute. The potential and problems associated with high-resolution forecasts are discussed. Clarke reported about some nesting procedures. One-way nesting means that large scale information is fed in the embedded nested model, but the computational results are not returned to the larger scale model. The two-way nesting method allows the feed-back of modified high resolution data to the larger scale model. At KNMI a high resolution model has been developed, but the nesting strategy and the performance of the advection scheme has never been evaluated. The lateral boundaries of the high resolution model are predescribed by the coarser grid model. It is not clear whether a very high resolution model with a grid size of 5 kilometers can be embedded directly in the 55 kilometer HIRLAM. Perhaps an intermediate model is necessary. Another question is whether the large scale energy is correctly fed into the high resolution model. The dynamical part of the model can be described by a Eulerian or semi-Lagrangian advection scheme. The performance and efficiency of the advection schemes have never been studied in high resolution models at KNMI. In addition the setting of model parameters such as the timestep and the horizontal diffusion coefficients have never been checked. The values of the horizontal diffusion coefficients can be derived theoretically, but experimentation is still required to obtain optimal results. The semi-Lagrangian scheme offers advantages with respect to computer-time, but the performance in high resolution models is unknown. Generated noise can

be removed from the fields by horizontal diffusion. However to much smoothing leads to the loss of useful information. The semi-Lagrangian scheme is described by McDonald and Hatigen and McDonald and Haugen and is currently applied in HIRLAM. A method for testing and judging the model results will be developed. At first subjective verification is used to examine the model output. In addition Fourier analysis is applied to construct energy spectra. Spectra are decompositions of the model fields into waves of different wavelengths and thus give an idea about the way how waves of different sizes exchange energy with each other. Derived from text

Experimentation; Diffusion; Computational Grids; Scale Models; Performance Prediction; Mesoscale Phenomena; Energy Spectra; Diffusion Coefficient

19990045716 NASA Marshall Space Flight Center, Huntsville, AL USA

ALDF Data Retrieval Algorithms for Validating the Optical Transient Detector (OTD) and the Lightning Imaging Sensor (LIS)

Koshak, W. J., NASA Marshall Space Flight Center, USA; Blakeslee, R. J., NASA Marshall Space Flight Center, USA; Bailey, J. C., Raytheon STX Corp., USA; [1997]; 54p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A linear algebraic solution is provided for the problem of retrieving the location and time of occurrence of lightning ground strikes from in Advanced Lightning Direction Finder (ALDF) network. The ALDF network measures field strength, magnetic bearing, and arrival time of lightning radio emissions and solutions for the plane (i.e.. no Earth curvature) are provided that implement all of these measurements. The accuracy of the retrieval method is tested using computer-simulated data sets and the relative influence of bearing and arrival time data on the outcome of the final solution is formally demonstrated. The algorithm is sufficiently accurate to validate NASA's Optical Transient Detector (OTD) and Lightning Imaging System (LIS). We also introduce a quadratic planar solution that is useful when only three arrival time measurements are available. The algebra of the quadratic root results are examined in detail to clarify what portions of the analysis region lead to fundamental ambiguities in source location. Complex root results are shown to be associated with the presence of measurement errors when the lightning source lies near an outer sensor baseline of the ALDF network. For arbitrary noncollinear network geometries and in the absence of measurement errors, it is shown that the two quadratic roots are equivalent (no source location ambiguity) on the outer sensor baselines. The accuracy of the quadratic planar method is tested with computer-generated data sets and the results are generally better than those obtained from the three station linear planar method when bearing errors are about 2 degrees.

Author

Algorithms; Computerized Simulation; Data Retrieval; Lightning; Radio Direction Finders; Time Measurement; Linear Systems; Tracking (Position); Quadratic Programming

19990045945 Monash Univ., CRC-Southern Hemisphere Meteorology, Clayton, Australia

Planetary-Scale Coherent Structures of Tropical Moist Convection

Yano, Jun-Ichi, Monash Univ., Australia; Australian Journal of Physics; 1998; Volume 51, No. 5, pp. 865-874; In English; See also 19990045940; Copyright; Avail: Issuing Activity (Australian Journal of Physics, P.O. Box 1139 (150 Oxford St.), Collingwood, Victoria 3066, Australia), Hardcopy, Microfiche

Two competing pictures for planetary scale moist convective coherency in the tropical atmosphere exist. The nonlinear turbulent picture emphasizes the scaling nature of the system, whereas the traditional picture emphasizes the characteristic scales associated with the variability. Some idealized simulations were performed as an initial attempt ot reconcile these two competing pictures.

Author

Convection; Tropical Regions; Moisture; Two Dimensional Models; Turbulence; Nonlinearity; Clouds (Meteorology)

19990045970 Georgia Tech Research Inst., Electro-Optics and Environmental Materials Lab., Atlanta, GA USA

Measurement of OH, H2SO4, MSA, DMSO, DMSO2 on the NASA P-3B Aircraft, *1 Nov. 1995 - 31 Oct. 1998*

Eisele, F. L., Georgia Tech Research Inst., USA; 1998; 6p; In English

Contract(s)/Grant(s): NAG1-1766; GIT Proj. A5075; GIT-G-35-W89; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project involves the deployment of a variety of unique aircraft measurements for the PEM-Tropics program. These measurements were all to be accomplished on a near simultaneous basis using a two channel selected ion chemical ionization mass spectrometer instrument. The first year of this project consisted of four components; improve and perform additional testing of the OH, H2SO4, and MSA instrument which had only flown on one previous mission (ACE-I); develop and test the vacuum and electronic hardware and software which would allow two independent mass spectrometer systems to be operated from a single instrument (one vacuum/pumping system); construct an aircraft compatible DMSO/DMS02 ion source and calibration system;

and operate the above system on the NASA P-3B during PEM-Tropics. The first two of the components were to be accomplished at NCAR. The third component was to be completed at Georgia Tech and the fourth was to be conducted by researchers from both institutions on the NASA P-3B.
Author
Mass Spectrometers; Vacuum Systems; Tropical Regions; Ion Sources; Ionization

19990046018 National Aerospace Lab., Tokyo Japan
Technique of Flight GO-NOGO Decisions and Results of Analysis Using Wind Measured Data in ALFLEX Flight Trials
Murakami, Y.; Yanagihara, M.; Inaba, M.; Jul. 1998; 40p; In Japanese; Original contains color illustrations
Report No.(s): PB99-141541; NAL-TR-1356; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The flight trials of the ALFLEX (Automatic Landing Flight Experiment) vehicle were successfully concluded on August 15, 1996, at Woomera Airfield in South Australia. The flight trials were held in winter under especially bad weather conditions such as cross winds and tail winds for the AFLEX vehicle approaching runway 18. This paper describes the technique of making flight GO-NOGO decisions according to wind restrictions for ALFLEX trials based on both the wind speed data of Real Time Vector Representation Equipment (RTVRE) of surface wind and analysis of upper surface wind measurements data using OMEGA SONDE and GPS SONDE. It also compares these wind measurement results with the wind speed estimated using ADS and IMU sensors that were onboard the ALFLEX vehicle.
NTIS
Flight Tests; Wind Measurement; Automatic Landing Control; Global Positioning System; Real Time Operation

19990046073 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
Regional Estimates of Sensible and Latent Heat Fluxes on Forest and Pasture Areas in the Amazonia *Estimativa Regional de Fluxos de Calor Sensivel e Latente em Areas de Floresta e Pastagem na*
daSilva, Julio Tota, Instituto Nacional de Pesquisas Espacias, Brazil; Mar. 1998; 136p; In Portuguese; Original contains color illustrations
Report No.(s): INPE-6822-TDI/643; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Surface and Planetary Boundary Layer (PBL) measurements were carried out over forest (10deg 05minS - 10deg 19minS e 61deg 35minW - 61deg 57minW) and pasture (10deg 45minS e 62deg 22minW) areas at Ji-Parana, RO, during the Rondonia Boundary Layer Experiment - RBLE in the July/1993 (RBLE2) and August/1994 (RBLE3) dry seasons. These data sets were used to examine the structure and growth of the PBL, and to estimate regional fluxes of sensible and latent heat. These estimates were compared with surface fluxes of sensible and latent heat measurements made with an eddy correlation instrument (HYDRA). Profiles of the potential temperature and specific humidity were obtained through rawinsonde and tethered balloon data. These measurements were representative of the characteristics of each type of the covered surface. During of the daily cycle, the structure and growth of the PBL above the pasture area is more significant than above the forest area. The growth rate between 11 and 14 local hours at the pasture area reach values 65% greater than in the forest area during RBLE3, with values of 351.5 m/h and 229.2 m/h, respectively. Time series and daily mean of the PBL height and of the potential temperature and the specific humidity were examined in the forest and the pasture areas during both RBLE2 and RBLE3. The PBL heights were greater in pasture area, and the residual mixed layers for this area were maintained during the whole daily cycle. The estimates of sensible and of latent heat fluxes were made through the invertion of a simple slab model, initialized with parameters obtained from profiles of the PBL properties.
Author
Heat Flux; Forests; Grasslands; Atmospheric Boundary Layer; Planetary Boundary Layer; Estimates; Time Series Analysis

19990046710 NASA Goddard Space Flight Center, Greenbelt, MD USA
Water Isotopes in Precipitation: Data/Model Comparison for Present-Day and Past Climates
Jouzel, J., Commissariat a l'Energie Atomique, France; Hoffmann, G., Commissariat a l'Energie Atomique, France; Masson, V., NASA Goddard Space Flight Center, USA; [1998]; 32p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Variations of HDO and H2O-18 concentrations are observed in precipitation both on a geographical and on a temporal basis. These variations, resulting from successive isotopic fractionation processes at each phase change of water during its atmospheric cycle, are well documented through the IAEA/WMO network and other sources. Isotope concentrations are, in middle and high latitudes, linearly related to the annual mean temperature at the precipitation site. Paleoclimatologists have used this relationship to infer paleotemperatures from isotope paleodata extractable from ice cores, deep groundwater and other such sources. For this application to be valid, however, the spatial relationship must also hold in time at a given location as the location undergoes a series

of climatic changes. Progress in water isotope modeling aimed at examining and evaluating this assumption has been recently reviewed with a focus on polar regions and, more specifically, on Greenland. This article was largely based on the results obtained using the isotopic version of the NASA/GISS Atmospheric General Circulation Model (AGCM) fitted with isotope tracer diagnostics. We extend this review in comparing the results of two different isotopic AGCMs (NASA/GISS and ECHAM) and in examining, with a more global perspective, the validity of the above assumption, i.e. the equivalence of the spatial and temporal isotope-temperature relationship. We also examine recent progress made in modeling the relationship between the conditions prevailing in moisture source regions for precipitation and the deuterium-excess of that precipitation.
Author
Atmospheric General Circulation Models; Ice; Isotopes; Polar Regions; Water; Paleoclimatology; Heavy Water; Long Range Weather Forecasting; Numerical Weather Forecasting

19990046711 NASA Goddard Space Flight Center, Greenbelt, MD USA
Variance and Predictability of Precipitation at Seasonal-to-Interannual Timescales
Koster, Randal D., NASA Goddard Space Flight Center, USA; Suarez, Max J., NASA Goddard Space Flight Center, USA; Heiser, Mark, General Sciences Corp., USA; Feb. 10, 1999; 62p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A series of atmospheric general circulation model (AGCM) simulations, spanning a total of several thousand years, is used to assess the impact of land-surface and ocean boundary conditions on the seasonal-to-interannual variability and predictability of precipitation in a coupled modeling system. In the first half of the analysis, which focuses on precipitation variance, we show that the contributions of ocean, atmosphere, and land processes to this variance can be characterized, to first order, with a simple linear model. This allows a clean separation of the contributions, from which we find: (1) land and ocean processes have essentially different domains of influence, i.e., the amplification of precipitation variance by land-atmosphere feedback is most important outside of the regions (mainly in the tropics) that are most affected by sea surface temperatures; and (2) the strength of land-atmosphere feedback in a given region is largely controlled by the relative availability of energy and water there. In the second half of the analysis, the potential for seasonal-to-interannual predictability of precipitation is quantified under the assumption that all relevant surface boundary conditions (in the ocean and on land) are known perfectly into the future. We find that the chaotic nature of the atmospheric circulation imposes fundamental limits on predictability in many extratropical regions. Associated with this result is an indication that soil moisture initialization or assimilation in a seasonal-to-interannual forecasting system would be beneficial mainly in transition zones between dry and humid regions.
Author
Air Water Interactions; Annual Variations; Atmospheric Circulation; Atmospheric General Circulation Models; Boundary Conditions; Sea Surface Temperature; Simulation; Precipitation (Meteorology); Climatology; Meteorology; Oceans; Land Surface Temperature; Air Land Interactions

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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.

19990044063 Louisiana State Univ., Coastal Marine Inst., Baton Rouge, LA USA
Assessment of PAH Composition of Diesel Fuel Sorbed to Marine Sediments and Their Toxicity to Aquatic Food Webs
Carman, K. R.; Means, J. C.; Dec. 1998; 50p; In English
Report No.(s): PB99-134058; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In a 28-day microcosm study, the authors examined the effects of diesel-contaminated sediment on the sedimentary bacterial community of a Louisiana salt marsh that has been chronically exposed to petroleum hydrocarons for decades. Diesel contaminants in microcosms as determined from polycyclic aromatic hydrocarbon (PAH) concentration ranged from 0.55 to 55 ppm (dry weight). Two- and three-ring PAH, including naphthalenes, phenanthrenes, and dibenzothiophenes constituted the bulk of PAH composition of diesel and were rapidly metabolized. Alkylated PAH were also readily metablized. The rapid removal of PAH suggests that even if the marsh were exposed to chronically high levels of petroleum hydrocarbons, chemical evidence of the contaminants would not be detected in sediments. Collectively, these results are consistent with the hypothesis that the bacterial community in this salt marsh had adapted to chronic exposure to petroleum hydrocarbons.
NTIS
Polycyclic Aromatic Hydrocarbons; Sediments; Diesel Fuels; Contaminants; Toxicity; Contamination; Marshlands; Bioassay

19990044108 Woods Hole Oceanographic Inst., MA USA
Analysis of Subsurface Velocity Data from the Arctic Ocean ***Final Report, 1 Feb. 1997 - 31 Dec. 1998***
Plueddemann, Albert J.; Apr. 01, 1999; 6p; In English
Contract(s)/Grant(s): N00014-97-1-0135
Report No.(s): AD-A361684; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Velocity data in the upper 250 m observed by an Acoustic Doppler Current Profiler suspended below a buoy frozen into the Arctic pack ice were used for two investigations.

DTIC
Velocity; Doppler Effect; Acoustics

19990045845 Texas A&M Univ., Coll. of Geosciences, College Station, TX USA
Stability and Change in Gulf of Mexico Chemosynthetic Communities ***Interim Report, Oct. 1996 - Oct. 1997***
MacDonald, I. R.; Oct. 1998; 120p; In English
Report No.(s): PB99-136210; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The program was designed to aid the Minerals Management Service in the scientifically sound management of living resources found at hydrocarbon seeps on the northern Gulf of Mexico continental slope. This program includes community ecological, regional geological, microbial, and site-specific chemical and oceanographic studies. At the community level, efforts focus on the abiotic factors that control the distribution, abundance, and health of the major chemosynthetic and associated fauna. Investogations of the life-history of these organisms are also included. At the regional level, efforts focus on the geological, chemical, and oceanographic processes that support communities including larval dispersion and circulation processes that maintain the genetic stability of these communities.

NTIS
Gulf of Mexico; Oceanography; Microorganisms; Marine Biology

19990045860 University of South Florida, Dept. of Marine Science, Saint Petersburg, FL USA
Northeastern Gulf of Mexico Physical Oceanography Program: Eddy Monitoring and Remote Sensing ***Annual Report***
Muller-Karger, F. E.; Vukovich, F.; Lebon, R.; Nababan, B.; Myhre, D.; Nov. 1998; 58p; In English
Report No.(s): PB99-134082; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Cooperative Agreement between the University of South Florida (USF) and the Minerals Management Service (MMS) was established to jointly assess the value of merged satellite data and specific oceanographic field data in determining the circulation and biological productivity of waters within the NE Gulf of Mexico. The effort centers around collecting, processing, and merging historical and concurrent Infrared, Radar-Altimetry and Ocean Color satellite data as well as selected in situ information. We use various national and international sensors based upon availability of the data, honoring restrictions in the use and distribution of such data.

NTIS
Oceanographic Parameters; Oceanography; Remote Sensing; Water Circulation

19990046189 Little (Arthur D.), Inc., Cambridge, MA USA
Sediment Quality in Depositional Areas of Shelikof Strait and Outermost Cook Inlet. Sediment Profile Imaging Report
Jan. 31, 1998; 94p; In English
Report No.(s): PB99-137572; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A Sediment Profile Imaging (SPI) survey was conducted in July, 1997 in Shelikof Strait and Lower Cool Inlet as part of a larger study of sediment quality in relation to offshore oil development. The purpose of the SPI survey was to delineate sediment type, provide information on patterns of sediment deposition and erosion, and describe biological community characteristics in the region. A total of 57 stations were sampled during a nine-day cruise. Based on the reflectance contrast of the sediment profile, there were no areas suffering from excess carbon loading and no areas had indications of excess chemical contamination. All the data from the profile images point to both high sediment quality and benthic habitat values at depositional sites. In particular, the images from deep water (depositional) stations in Shelikof Strait indicate a largely undisturbed, low-energy depositional basin.

NTIS
Environment Effects; Cook Inlet (AK); Offshore Energy Sources

19990046191 MBC Applied Environmental Sciences, Inc., Costa Mesa, CA USA

Arctic Kelp Workshop Proceedings

Mitchell, K. L.; Aug. 1998; 56p; In English

Report No.(s): PB99-136897; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Minerals Management Service (MMS) recently released the Proceedings of an Arctic Kelp Workshop held in May 1998. The workshop was organized to review data on kelp growing near Beaufort Sea oil and gas prospects. The first workshop session was a series of presentations on visual observations and/or sonar records on the distribution of kelp. The presentations were primarily by scientists and engineers conducting site surveys for industry operations in the area. The second session was conducted by three well-recognized scientists who presented formal reviews or perspective on the quality of the data. The third session was a two-hour open discussion by the 50 participants, including 5 members of the interagency Arctic Biological Task Force.

NTIS

Seaweeds; Arctic Regions; Conferences

19990046223 Continental Shelf Associates, Jupiter, FL USA

Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Ecosystem Monitoring, Mississippi/Alabama Shelf *Annual Report*

Dec. 1998; 226p; In English

Contract(s)/Grant(s): 1445-CT09-96-0006

Report No.(s): PB99-134090; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This Annual Interim Report summarizes the second year (Phase 2) of a four-year program to characterize and monitor hard bottom features on the Mississippi/Alabama outer continental shelf. Phase 2 included two monitoring cruises that revisited nine previously established sites. Cruise M2 was conducted in October 1997. Cruise M3 began in April 1998 but was suspended due to poor weather and subsequently completed in August 1998. Two mooring servicing cruises also were conducted, in January and July 1998. Monitoring program components included geological characterization, sediment dynamics, geochemistry, physical oceanography and hydrography, hard bottom communities, fish communities, and two companion studies (micro-habitat studies and epibiont recruitment). For each component, the report presents study rationale, field and laboratory methods, results to date, and discussion.

NTIS

Marine Environments; Ecosystems; Coasts; Geochemistry; Hydrography; Ocean Dynamics; Environmental Monitoring; Geology; Oceanography

19990046502 Helsinki Univ. of Technology, Arctic Offshore Research Centre, Espoo, Finland

Ice Tank Tests on Ridging of Non-Uniform Ice Sheets

Tuhkuri, Jukka, Helsinki Univ. of Technology, Finland; Lensu, Mikko, Helsinki Univ. of Technology, Finland; 1998; ISSN 1456-3045; 138p; In English

Report No.(s): PB99-141137; ISBN 951-22-4241-9; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A test program has been carried out to study ridging and rafting of model ice sheets. During each test, a sheet of floating model ice was pushed against another similar ice sheet. Two types of ice sheets were used. Three different deformation modes were observed: simple ridging (Type A), simple rafting (Type C), and intermediate (Type B). It was discussed that all these deformation types can also be found in nature. The forces during the ridging and rafting processes were measured. The experiments suggested that there is a threshold force value which must be reached before the rafting and subsequent ridging starts. During the initial rafting phase, the force increased linearly. The measurement data shows further that the force continued to grow also after the initial linear trend, albeit at a lower rate. A further characteristic of the measured force was that in some tests the force appeared to cease increasing and reach a plateau value. This levelling of the force was observed to be connected with either onset of failure of the surrounding ice sheet against the ridge or onset of rafting at a new site. The report includes also literature reviews on models for ridge formations and for relations between ridging force and ridge geometry.

NTIS

Ice; Ridges; Deformation; Nonuniformity

51
LIFE SCIENCES (GENERAL)

19990043997 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Competency development in antibody production in cancer cell biology
Park, M. S.; Dec. 31, 1998; 7p; In English
Report No.(s): DE99-001118; LA-UR-98-1884; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). The main objective of this project was to develop a rapid recombinant antibody production technology. to achieve the objective, the authors employed (1) production of recombinant antigens that are important for cell cycle regulation and DNA repair, (2) immunization and specific selection of antibody-producing lymphocytes using the flow cytometry and magnetic bead capturing procedure, (3) construction of single chain antibody library, (4) development of recombinant vectors that target, express, and regulate the expression of intracellular antibodies, and (5) specific inhibition of tumor cell growth in tissue culture. The authors have accomplished (1) optimization of a selection procedure to isolate antigen-specific lymphocytes, (2) optimization of the construction of a single-chain antibody library, and (3) development of a new antibody expression vector for intracellular immunization. The future direction of this research is to continue to test the potential use of the intracellular immunization procedure as a tool to study functions of biological molecules and as an immuno-cancer therapy procedure to inhibit the growth of cancer cells.
NTIS
Antibodies; Cancer; Cells (Biology); Life Sciences; Physiological Effects; Biological Effects

19990044056 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Set-up of a System to Reliably Measure the Startle Response in Marmoset Monkeys; Application in Animal Models of Anxiety and Psychosis *Final Report*
Melchers, B. P. C., Prins Maurits Lab. TNO, Netherlands; Groen, B., Prins Maurits Lab. TNO, Netherlands; Vanwersch, R. A. P., Prins Maurits Lab. TNO, Netherlands; Philippens, I. H. C. H. M., Prins Maurits Lab. TNO, Netherlands; Bruijnzeel, P. L. B., Prins Maurits Lab. TNO, Netherlands; July 1998; 26p; In English
Contract(s)/Grant(s): TNO Proj. 215896404
Report No.(s): PML-1998-B42; TD98-0082; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., Lange Kleiweg 137, P.O. Box 45, 2280 AA Rijswijk, The Netherlands), Hardcopy, Microfiche

The acoustic startle response is a reflex motor response elicited by a sudden loud sound. In two psychiatric disorders, the startle reflex is altered. Normally, the startle response is decreased appreciably when a low intensity sound stimulus is given shortly before the startle eliciting stimulus. This prepulse inhibition of the startle is nearly absent in patients suffering from schizophrenia. In addition, the startle response is increased during periods of anxiety. In this study, a system is described by which the acoustic startle response in marmoset monkeys may be recorded in a reliable way. In using this system, it could be shown that marmosets possess a pr-e-pulse inhibition (PPI) of the ASR, similar as in other species. Furthermore, it was shown that a fear potentiation of the startle response may be elicited in the marmoset. Potentially, this system may be used for testing anti-psychotic or anxiolytic activity of drugs in primates. In this study, a series of drugs with a known activity on PPI or fear potentiation of the ASR was tested to validate the system. The effects of Buspiron and Diazepam were tested as examples of drugs with a known anxiolytic effect. In addition, Fluvoxamine and Haloperidol were used in these experiments. Amphetamine, Ketamine and Haloperidol were used as drugs to affect the PPI; in these experiments Diazepam was used as a negative control. These experiments were performed in a randomized, cross-over design. In the fear potentiated startle experiments, four animals were used. They received, following a training period to establish a stable baseline fear potentiation, three dose levels of each of the drugs. In addition, the animals were injected with saline 5 times spread evenly over the total duration of the experiment to test the stability of the baseline fear potentiation. The four animals used in the PPI group were subjected to a similar dosing schedule. Buspiron, Haloperidol and possibly Quinpirol had an effect on the control startle response. Although none of the effects of the drugs on either FPS, or PPI were statistically significant, Diazepam and to a lesser degree Fluvoxamine tended to decrease the FPS. Buspiron seemed to have a biphasic effect on the FPS whereas Haloperidol had no effect. Ketamine and Quinpirol seemed to reduce the PPI and Diazepam had no effect. Amphetamine probably was given at too low a dose to affect PPI.
Author
Acoustic Emission; Anxiety; Monkeys; Psychoses; Physiological Tests; Schizophrenia

19990044102 New Hampshire Univ., Durham, NH USA

Mesoscale Structure of Zooplankton In the California Current

Bucklin, Ann; Olson, Donald B.; Clarke, M. E.; Wiebe, Peter H.; Jan. 1999; 8p; In English

Contract(s)/Grant(s): NON00014-1-96-0302(UNH); N00014-1-96-0421(RSMAS)

Report No.(s): AD-A361709; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are examining how populations of euphausiids maintain high concentrations in coastal regions of the California Current despite the highly advective field. We are testing the hypothesis that mesoscale eddies and coastal counter currents create retention cells, where growth and reproduction are rapid and mortality is reduced. The immediate objective is to produce a data set on the biomass, population genetics, and physiological condition of the targeted euphausiids across the boundary between the eutrophic inshore of the California current and the oligotrophic central gyre waters. This work is supported by ONR Biological Oceanography.

DTIC

Marine Biology; Bioacoustics; Zooplankton

19990045981 Los Alamos National Lab., Theoretical Div., NM USA

Correlated mutations in protein sequences: Phylogenetic and structural effects

Lapedes, A. S.; Giraud, B. G.; Liu, L. C.; Stormo, G. D.; Dec. 31, 1998; 22p; In English; AMS/SIAM conference on statistics in molecular biology

Report No.(s): DE99-000640; LA-UR-98-1091; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Covariation analysis of sets of aligned sequences for RNA molecules is relatively successful in elucidating RNA secondary structure, as well as some aspects of tertiary structure. Covariation analysis of sets of aligned sequences for protein molecules is successful in certain instances in elucidating certain structural and functional links, but in general, pairs of sites displaying highly covarying mutations in protein sequences do not necessarily correspond to sites that are spatially close in the protein structure. In this paper the authors identify two reasons why naive use of covariation analysis for protein sequences fails to reliably indicate sequence positions that are spatially proximate. The first reason involves the bias introduced in calculation of covariation measures due to the fact that biological sequences are generally related by a non-trivial phylogenetic tree. The authors present a null-model approach to solve this problem. The second reason involves linked chains of covariation which can result in pairs of sites displaying significant covariation even though they are not spatially proximate. They present a maximum entropy solution to this classic problem of causation versus correlation. The methodologies are validated in simulation.

NTIS

Mutations; Proteins; Structural Analysis

19990046070 NASA Johnson Space Center, Houston, TX USA

Production of Normal Mammalian Organ Culture Using a Medium Containing Mem-Alpha, Leibovitz L 15, Glucose Galactose Fructose

Goodwin, Thomas J., Inventor, NASA Johnson Space Center, USA; Wolf, David A., Inventor, NASA Johnson Space Center, USA; Spaulding, Glenn F., Inventor, NASA Johnson Space Center, USA; Prewett, Tacey L., Inventor, NASA Johnson Space Center, USA; Jan. 12, 1999; 16p; In English; Division of US-Patent-Appl-SN-66292, filed 25 May 1993

Patent Info.: Filed 1 Mar. 1996; NASA-Case-MSC-21984-3; US-Patent-5,858,783; US-Patent-Appl-SN-613793; US-Patent-Appl-SN-066292; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Normal mammalian tissue and the culturing process has been developed for the three groups of organ, structural and blood tissue. The cells are grown in vitro under micro- gravity culture conditions and form three dimensional cells aggregates with normal cell function. The microgravity culture conditions may be microgravity or simulated microgravity created in a horizontal rotating wall culture vessel. The medium used for culturing the cells, especially a mixture of epithelial and mesenchymal cells contains a mixture of Mem-alpha and Leibovits L15 supplemented with glucose, galactose and fructose.

Official Gazette of the U.S. Patent and Trademark Office

Culture Techniques; Microgravity; Mammals; Cytology; Organs

19990046089 NASA Johnson Space Center, Houston, TX USA

Media Compositions for Three Dimensional Mammalian Tissue Growth Under Microgravity Culture Conditions

Goodwin, Thomas J., Inventor, NASA Johnson Space Center, USA; Dec. 08, 1998; 14p; In English; Division of US-Patent-Appl-SN-66292, filed 25 May 1993

Patent Info.: Filed 13 Feb. 1996; NASA-Case-MSC-21984-2; US-Patent-5,846,807; US-Patent-Appl-SN-600793; US-Patent Appl-SN-66292; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Normal mammalian tissue and the culturing process has been developed for the three groups of organ, structural and blood tissue. The cells are grown in vitro under microgravity culture conditions and form three dimensional cells aggregates with normal cell function. The microgravity culture conditions may be microgravity or simulated microgravity created in a horizontal rotating wall culture vessel.
Official Gazette of the U.S. Patent and Trademark Office
Microgravity; Tissues (Biology); Blood; Cytology; Culture Techniques

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AEROSPACE MEDICINE

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

19990044002 Istituto Superiore di Sanita, Rome, Italy
Advice of the Italian CCTN on the Toxicity of Cannabis Sativa ***Parere della CCTN Sulla Tossicita della Cannabis Sativa***
Camoni, Ivano, Editor, Istituto Superiore di Sanita, Italy; Mucci, Nicolina, Editor, Istituto Superiore per la Prevenzione e la Sicurezza del Lavoro, Italy; Paroli, Eugenio, Editor, La Sapienza Univ., Italy; 1998; ISSN 0394-9311; In English
Report No.(s): ISTISAN-98/2; Copyright; Avail: Issuing Activity (Istituto Superiore di Sanita, Viale Regina Elena, 299-00161 Rome, Italy), Hardcopy, Microfiche

The recommendation of the Italian National Toxicological Committee (CCTN) regards the possible toxic effects of some products derived from Cannabis savita, indica variety. The CCTN has especially evaluated genotoxic, immunological and toxic reproduction effects of these substances, on the basis of the results from both experimental studies and observations on humans.
Author
Marijuana; Toxicity; Toxicology

19990044003 Istituto Superiore di Sanita, Rome, Italy
Research Project: Chemical-Physical Properties of Drugs and Their Safety ***Progetto di Ricera: Proprieta Chimico-Fisiche dei Medicamenti e Loro Sicurezza d'Uso***
Cignitti, Maurizio, Editor, Istituto Superiore di Sanita, Italy; 1998; ISSN 1123-3117; In Italian
Report No.(s): ISTISAN-98/13; Copyright; Avail: Issuing Activity (Istituto Superiore di Sanita, Viale Regina Elena, 299-00161 Rome, Italy), Hardcopy, Microfiche

New researches on chirality, phototoxicity and solid state properties might improve the safety of some common registered drugs; specific problems on such issues were studied through the financial support of this project. In conformity with the Italian National Health Plan, the project focused also on 1) the use of gamma-radiation for drug sterilization procedures and 2) the pharmacokinetics behavior of major drugs in aged people.
Author
Research Projects; Drugs

19990044010 Texas Univ. Health Science Center, Houston, TX USA
MAPS of Cancer ***Final Report***
Gray, Lincoln, Texas Univ. Health Science Center, USA; Jun. 30, 1998; 9p; In English
Contract(s)/Grant(s): NCC9-36; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our goal was to produce an interactive visualization from a mathematical model that successfully predicts metastases from head and neck cancer. We met this goal early in the project. The visualization is available for the public to view. Our work appears to fill a need for more information about this deadly disease. The idea of this project was to make an easily interpretable visualization based on what we call "functional maps" of disease. A functional map is a graphic summary of medical data, where distances between parts of the body are determined by the probability of disease, not by anatomical distances. Functional maps often beat little resemblance to anatomical maps, but they can be used to predict the spread of disease. The idea of modeling the spread of disease in an abstract multidimensional space is difficult for many people. Our goal was to make the important predictions easy to see. NASA must face this problem frequently: how to help laypersons and professionals see important trends in abstract, complex data. We took advantage of concepts perfected in NASA's graphics libraries. As an analogy, consider a functional map of early America. Suppose we choose travel times, rather than miles, as our measures of inter-city distances. For Abraham Lincoln, travel times would have been the more meaningful measure of separation between cities. In such a map New Orleans would be close to Memphis because of the Mississippi River. St. Louis would be close to Portland because of the Oregon Trail. Oklahoma City would be far from Little Rock because of the Cheyenne. Such a map would look puzzling to those of us who have always

seen physical maps, but the functional map would be more useful in predicting the probabilities of inter-site transit. Continuing the analogy, we could predict the spread of social diseases such as gambling along the rivers and cattle rustling along the trails. We could simply print the functional map of America, but it would be more interesting to show meaningful patterns of dispersal. We had previously published the functional map of the head and neck, but it was difficult to explain to either patients or surgeons because that view of our body did not resemble anatomy. This discrepancy between functional and physical maps is just a mathematical restatement of the well-known fact that some diseases, such as head and neck cancer, spread in complex patterns, not always to the next nearest site. We had discovered that a computer could re-arrange anatomy so that this particular disease spreads to the next nearest site. The functional map explains over 95% of the metastases in 1400 patients. In a sense, we had graphed what our body ”looks like” to a tumor. The tumor readily travels between adjacent areas in the functional map. The functional map is a succinct visual display of trends that are not easily appreciated in tables of probabilities.
Derived from text
Mathematical Models; Mapping; Cancer; Visual Observation; Display Devices; Predictions; Probability Theory; Tumors

19990044067 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Validation of an Immunochemical Assay for the Detection of DNA Damage as a Tool for Biological Dosimetry of Human Exposure to Ionizing Radiation ***Final Report Ocena testu immunochemicznego wykrywania uszkodzen DNA jako metody dozymetrii biologicznej ekspozycji ludzi na promieniowanie joinzujace***
vanderSchans, G. P., Prins Maurits Lab. TNO, Netherlands; Timmerman, A. J., Prins Maurits Lab. TNO, Netherlands; Wojewodzka, M., Institute of Nuclear Chemistry and Technology, Poland; October 1998; 72p; In English
Contract(s)/Grant(s): A96/M/507; TNO Proj. 215096668
Report No.(s): TD98-0090; ICHTJ1997; PML-1998-A50; Copyright; Avail: Issuing Activity (TNO Prins Maurits Lab., Lange Kleiweg 137, P.O. Box 45, 2280 AA Rijswijk, The Netherlands), Hardcopy, Microfiche

A method for biological dosimetry based on the immunochemical detection of DNA damage in human white blood cells has been validated. to this end, the method developed at TNO-PML (Rijswijk, The Netherlands) was also set up at ICHTJ (Warsaw, Poland). Blood samples from 11 individuals were irradiated with 0 or 5 Gy of 170-kV X-rays at ICHTJ and analysed both at ICHTJ and TNO-PML. It appeared that damage can be detected to the same extent at both locations. The average background level of DNA damage amounted to 1.0 Gy-eq, with an inter-individual standard deviation of 0.25 Gy. The contribution of the sample variance to the total variance is only 14%. The radiosensitivity showed only a variation of about 10% and can, therefore, be neglected in estimating the radiation dose from the amount of DNA damage detected. In addition, the kinetics of DNA repair were studied in stimulated human lymphocytes exposed to an adaptive dose of hydrogen peroxide (10 micronM H2O2, 30 min, 37 C in PBS) followed by a challenge dose of X-rays (5 Gy). There were no differences in the DNA repair rate in non-adapted and adapted cells as measured by the sandwich ELISA.
Author
Immune Systems; Deoxyribonucleic Acid; Damage; Estimating; Dosimeters; Assaying; Proving

19990044090 Maryland Univ., Baltimore, MD USA
Effects of Endurance and Resistance Training on Cardiovascular Risk in Military Eligible Women ***Annual Report, 25 Sep. 1997 - 24 Sep. 1998***
Gardner, Andrew W.; Poehlman, Eric T.; Oct. 1998; 40p; In English
Contract(s)/Grant(s): DAMD17-96-1-6299
Report No.(s): AD-A361920; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The overall hypothesis is that the decline in physical activity habits and resultant increase in body fat reduces exercise capacity and muscle mass in military women. These lifestyle changes worsen cardiovascular risk factors. Therefore, continued involvement in resistance and endurance exercise programs which increases or preserves fat-free mass, as well as enhances physical activity will prevent functional declines in military-eligible women. Although exercise is frequently recommended to enhance overall fitness, it is unclear as to whether endurance or resistance exercise is more effective in attenuating functional and cardiovascular declines in women. We will systematically compare the effects of endurance and resistance exercise on physical activity, cardiovascular fitness, and fat metabolism in military eligible women.
DTIC
Cardiovascular System; Physical Exercise; Females; Human Performance

19990045774 Civil Aeromedical Inst., Oklahoma City, OK USA

Index to FAA Office of Aviation Medicine Reports: 1961 through 1998 ***Final Report, 1961-1998***

Collins, William E., Civil Aeromedical Inst., USA; Wayda, Michael E., Civil Aeromedical Inst., USA; January 1999; 90p; In English

Report No.(s): DOT/FAA/AM-99/1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An index to Federal Aviation Administration Office of Aviation Medicine Reports (1964-1998) and Civil Aeromedical Institute Reports is presented for those engaged in aviation medicine and related activities. The index lists all FAA aviation medicine reports published from 1961 through 1998: chronologically, alphabetically by author, and alphabetically by subject. A foreword describes aspects of the Civil Aeromedical Institute's 38 years of service, describes the index's sections, and explains how to obtain copies of published Office of Aviation Medicine technical reports.

Author

Aerospace Medicine; Documents

19990046001 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada

The Possible Relationship Between Patent Foramen Ovale and Decompression Sickness:

Saary, M. J.; Gray, G. W.; Jan. 1999; 36p; In English

Report No.(s): AD-A361756; DCIEM-TR-1999-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A patent foramen ovale (PFO) is a small opening between the right and left cardiac atria, a persisting remnant of a physiologic communication present in the fetal heart. This normally closes after birth, but remains patent through to adulthood in up to a third of normal adults. A patent PFO is a potential conduit for blood clot (resulting in a stroke), or venous gas bubbles during decompression, (resulting in type II neurologic decompression sickness). There has been considerable controversy about the significance of a PFO as a possible mechanism for type II decompression sickness. Despite the high prevalence of PFO in the general population and the relatively common occurrence of venous gas bubbles in diving and altitude exposures, the incidence of type II DCS in diving or with altitude exposure is low. This paper reviews the literature with respect to the potential for right-to-left embolization through a PFO, relation of PFO to DCS, screening techniques for PFO, and treatment options. The literature supports a relationship between the presence and size of PFO and cryptogenic stroke (stroke, generally in younger individuals with no other identifiable risk factors). The weight of evidence also favours an increased relative risk of type II DCS with a PFO, although the absolute increase in risk accrued is small. The gold standard for PFO screening is a trans-esophageal echocardiographic (TEE) and colour flow study, but trans-cranial Doppler (TCD) with contrast is a promising technique with good accuracy compared with TEE.

DTIC

Neurology; Decompression Sickness; Neurophysiology; Diving (Underwater); Stress (Physiology)

19990046023 Civil Aeromedical Inst., Oklahoma City, OK USA

Formation of an Interfering Substance, 3, 4-Dimethyl-5-Phenyl-1, 3-Oxazolidine, During A Pseudoephedrine Urinalysis

Lewis, Russell J., Civil Aeromedical Inst., USA; Huffine, Edwin F., Civil Aeromedical Inst., USA; Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Canfield, Dennis V., Civil Aeromedical Inst., USA; Mattson, Jerry, Civil Aeromedical Inst., USA; May 1999; 14p; In English

Contract(s)/Grant(s): AM-B-98-TOX-202

Report No.(s): DOT/FAA/AM-99/15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During fatal aviation accident investigations, bio-samples from the victims are submitted to the FAA Civil Aeromedical Institute for drug analysis. In the process of one such analysis, an unknown substance was found in a urine sample. Its initial analyses by thin layer chromatography and by liquid-liquid extraction/gas chromatography (GC) disclosed the presence of pseudoephedrine. Subsequent analyses of the reaccessioned sample by solid phase separation/GC Fourier transform infrared/GC mass spectrometry indicated that the retention times of the unknown substance matched with those of pseudoephedrine. However, its infrared and mass spectra were different--the -OH and -NH- groups were missing, a C-O-C group was present, and the molar mass was 12 atomic mass units (amu) more than that of pseudoephedrine. A subsequent literature search suggested that ephedrine-like amines react with aldehydes to form oxazolidines. Therefore, the 12-amu increase could be accounted for by condensation of pseudoephedrine with formaldehyde. Since this aldehyde is present in various grades of methanol, and methanol was used during the solid phase separation, 3,4-dimethyl-5-phenyl-1,3-oxazolidine was synthesized by using +/- pseudoephedrine.HCl and formaldehyde. The analytical and spectral findings of the synthesized compound were consistent with those of the unknown interfering substance, confirming that it was the oxazolidine. Aldehyde contaminants can transform the drug of interest and may result in

misidentification of a compound not originally present in specimens. Therefore, chemicals used in analyses should be of the highest available purity, and a multi-analytical approach should be adopted to maintain a high degree of quality assurance.
Author
Aircraft Accident Investigation; Aircraft Accidents; Gas Chromatography; Thin Layer Chromatography; Urinalysis

19990046068 NASA Johnson Space Center, Houston, TX USA
Cultured High-Fidelity Three-Dimensional Human Urogenital Tract Carcinomas and Process
Goodwin, Thomas J., Inventor, NASA Johnson Space Center, USA; Prewett, Tacey L., Inventor, NASA Johnson Space Center, USA; Spaulding, Glenn F., Inventor, NASA Johnson Space Center, USA; Wolf, David A., Inventor, NASA Johnson Space Center, USA; Dec. 22, 1998; 12p; In English; Continuation-in-part of abandoned US-Patent-Appl-SN-939791, filed 3 Sep. 1992
Patent Info.: Filed 27 Dec. 1993; NASA-Case-MSC-22119-1; US-Patent-5,851,816; US-Patent-Appl-SN-172962; US-Patent-Appl-SN-939791; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

Artificial high-fidelity three-dimensional human urogenital tract carcinomas are propagated under in vitro-microgravity conditions from carcinoma cells. Artificial high-fidelity three-dimensional human urogenital tract carcinomas are also propagated from a coculture of normal urogenital tract cells inoculated with carcinoma cells. The microgravity culture conditions may be microgravity or simulated microgravity created in a horizontal rotating wall culture vessel.
Official Gazette of the U.S. Patent and Trademark Office
Culture Techniques; Microgravity; Cancer

19990046084 NASA Johnson Space Center, Houston, TX USA
Method and Apparatus for the Collection, Storage, and Real Time Analysis of Blood and Other Bodily Fluids
Whiitson, Peggy A., Inventor, NASA Johnson Space Center, USA; Clift, Vaughan L., Inventor, NASA Johnson Space Center, USA; Feb. 02, 1999; 10p; In English; Continuation-in-part of abandoned US-Patent-Appl-SN-605300, filed 26 Jan. 1996
Patent Info.: Filed 7 Mar. 1997; NASA-Case-MSC-22463-3; US-Patent-5,866,007; US-Patent-Appl-SN-813570; US-Patent-Appl-SN-605300; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

The present invention provides a method and apparatus for separating a blood sample having a volume of up to about 20 milliliters into cellular and acellular fractions. The apparatus includes a housing divided by a fibrous filter into a blood sample collection chamber having a volume of at least about 1 milliliter and a serum sample collection chamber. The fibrous filter has a pore size of less than about 3 microns, and is coated with a mixture including between about 1-40 wt/vol % mannitol and between about 0.1-15 wt/vol % of plasma fraction protein (or an animal or vegetable equivalent thereof). The coating causes the cellular fraction to be trapped by the small pores, leaving the cellular fraction intact on the fibrous filter while the acellular fraction passes through the filter for collection in unaltered form from the serum sample collection chamber.
Official Gazette of the U.S. Patent and Trademark Office
Blood; Real Time Operation; Plasmas (Physics)

19990046201 NASA Langley Research Center, Hampton,VA USA
Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 493
Jun. 14, 1999; 37p; In English
Report No.(s): NASA/SP-1998-7011/Suppl493; NAS 1.21:7011/Suppl493; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.
Author
Data Bases; Aerospace Medicine; Bibliographies; Indexes (Documentation)

19990046203 NASA Marshall Space Flight Center, Huntsville, AL USA
Quantitative Method of Measuring Metastatic Activity
Morrison, Dennis R., Inventor, NASA Marshall Space Flight Center, USA; Feb. 09, 1999; In English; Continuation of abandoned US-Patent-Appl-SN-97186, filed 27 Jul. 1993
Patent Info.: Filed 16 Feb. 1995; NASA-CASE-MSC-21715-2; US-Patent-5,869,238; US-Patent-Appl-SN-390904; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

The metastatic potential of tumors can be evaluated by the quantitative detection of urokinase and DNA. The cell sample selected for examination is analyzed for the presence of high levels of urokinase and abnormal DNA using analytical flow cytome-

try and digital image analysis. Other factors such as membrane associated uroldnase, increased DNA synthesis rates and certain receptors can be used in the method for detection of potentially invasive tumors.
Official Gazette of the U.S. Patent and Trademark Office
Deoxyribonucleic Acid; Tumors; Detection; Cancer; Enzymes

19990046304 MetaWorks, Inc., Boston, MA USA
Systematic Review of the Literature Regarding the Diagnosis of Sleep Apnea. Evidence Report/Technology Assessment, Number 1
Ross, S. D.; Allen, I. E.; Harrison, K. J.; Kvasz, M.; Connelly, J.; Feb. 1999; 170p; In English
Report No.(s): PB99-134645; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The objective was to establish the evidence base for diagnosing sleep apnea (SA) in adult patients using systematic review methods. Tests covered were sleep monitoring devices, radiologic imaging, laboratory assays, and clinical signs and symptoms posited for use in screening or diagnosing SA. The standard sleep lab polysomnogram (PSG) was the gold standard. Literature published from 1980 through November 1, 1997 (cutoff) was searched using Medline and Current Contents, supplmeneted by a manual review of the bibliographies of all accepted papers. Studies of at least 10 adults suspected of or diagnosed with SA had to report the results of any test to establish or support a diagnosis of SA, relative to a standard PSG-derived apnea index (AI, the number of apneic episodes/hour sleep); apnea-hypopnea index (AHI, the total apneas plus hypopneas during total time asleep, divided by the number of hours asleep); or respiratory distress index (RDI). Eligible languages were English, German, French, Spanish, or Italian. Diagnostic papers reporting prevalence or clinical comorbidities of SA were also accepted.
NTIS
Sleep; Diagnosis; Signs and Symptoms; Technology Assessment; Assaying; Respiration

19990046433 Cincinnati Univ., OH USA
Female Reproductive Effects of Exposure to Jet Fuel at U.S. Air Force Bases ***Annual Report, 15 Oct. 1997 - 14 Oct. 1998***
Lemasters, Grace K.; Nov. 1998; 38p; In English
Contract(s)/Grant(s): DAMD17-96-2-6015
Report No.(s): AD-A361885; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

One of the most prevalent exposures at all Air Force (AF) bases is to jet fuel. Total consumption ranks in the billions of gallons. Jet fuel is composed of aliphatic/aromatic hydrocarbons and traces of metals that have potential adverse effects on health including menstrual disorders, infertility, spontaneous abortions, and fetal effects. The mean age of active enlisted female Air Force personnel is 27.6. This study addresses whether or not women are experiencing menstrual systems related to their work place from fuel exposures. This study evaluates environmental and internal dose measurements of jet fuel components during the course of each woman's usual work activities. Great strides have been made thus far. The number of women in pertinent job activities at each base has been identified and base commanders have received letters of request. Ten bases, thus far, have agreed to participate and have been visited. We have enrolled 165 women into the study. This team also developed and refined a new technique to measure internal dose levels. Specifically, the breath data indicates concentrations of toluene and the xylenes to range in concentrations between 10 and over 100 ppb.
DTIC
Exposure; Females; Personnel; Jet Engine Fuels; Menstruation; Reproduction

19990046489 Brown Univ., Dept. of Pathology, Providence, RI USA
Growth Factors and Tension-Induced Skeletal Muscle Growth ***Final Report***
Vandenburgh, Herman H., Brown Univ., USA; 1994; 8p; In English
Contract(s)/Grant(s): NAG2-914; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The project investigated biochemical mechanisms to enhance skeletal muscle growth, and developed a computer based mechanical cell stimulator system. The biochemicals investigated in this study were insulin/(Insulin like Growth Factor) IGF-1 and Steroids. In order to analyze which growth factors are essential for stretch-induced muscle growth in vitro, we developed a defined, serum-free medium in which the differentiated, cultured avian muscle fibers could be maintained for extended periods of time. The defined medium (muscle maintenance medium, MM medium) maintains the nitrogen balance of the myofibers for 3 to 7 days, based on myofiber diameter measurements and myosin heavy chain content. Insulin and IGF-1, but not IGF-2, induced pronounced myofiber hypertrophy when added to this medium. In 5 to 7 days, muscle fiber diameters increase by 71 % to 98% compared to untreated controls. Mechanical stimulation of the avian muscle fibers in MM medium increased the sensitivity of the cells to insulin and IGF-1, based on a leftward shift of the insulin dose/response curve for protein synthesis rates. (54). We developed a ligand binding assay for IGF-1 binding proteins and found that the avian skeletal muscle cultures produced three

major species of 31, 36 and 43 kD molecular weight (54) Stretch of the myofibers was found to have no significant effect on the efflux of IGF-1 binding proteins, but addition of exogenous collagen stimulated IGF-1 binding protein production 1.5 to 5 fold. Steroid hormones have a profound effect on muscle protein turnover rates in vivo, with the stress-related glucocorticoids inducing rapid skeletal muscle atrophy while androgenic steroids induce skeletal muscle growth. Exercise in humans and animals reduces the catabolic effects of glucocorticoids and may enhance the anabolic effects of androgenic steroids on skeletal muscle. In our continuing work on the involvement of exogenrus growth factors in stretch-induced avian skeletal muscle growth, we have performed experiments to determine whether mechanical stimulation of cultured avian muscle cells alters their response to anabolic steroids or glucocorticoids. In static cultures, testosterone had no effect on muscle cell growth, but 5alpha-dihydrotestosterone and the synthetic steroid stanozolol increased cell growth by up to 18% and 30%, respectively, after a three day exposure. We completed development of a new IBM-based mechanical cell stimulator system to provide greater flexibility in operating and monitoring our experiments. Our previous long term studies on myofiber growth were designed around a perfusion system of our own design. We have recently changed to performing these studies using a modified CELLCO cartridge bioreactor system Z since it has been certified as the ground-based model for the Shuttle's Space Tissue Loss (STL) F= Cell Culture Module. The current goals of this aspect of the project are three fold: 1) to design a Z cell culture system for studying avian skeletal myofiber atrophy on the Shuttle and Space Station; 0 2) to expand the use of bioreactors to cells which do not grow in either suspension or attached to the hollow fibers; and 3) to combine the bioreactor system with our computerized mechanical cell stimulator to have a better in vitro model to study tension/gravity/stretch regulation of skeletal muscle size. Preliminary studies also reported on involved : (1) how release of tension can induce rapid atrophy of tissues cultured avian skeletal muscle cells, and (2) a mechanism to transfer and maintain avian skeletal muscle organoids in modified cartridges in the Space Tissue Loss Module.
Derived from text
Biochemistry; Cells (Biology); Culture Techniques; Growth; Hormones; Insulin; Muscles; Musculoskeletal System; Proteins; Steroids; Aerospace Medicine

19990046722 NASA Ames Research Center, Moffett Field, CA USA
The Effect of Spaceflight on Bone Cell Cultures
Landis, William J., NASA Ames Research Center, USA; Apr. 19, 1999; 3p; In English
Contract(s)/Grant(s): NAG2-538; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Understanding the response of bone to mechanical loading (unloading) is extremely important in defining the means of adaptation of the body to a variety of environmental conditions such as during heightened physical activity or in extended explorations of space or the sea floor. The mechanisms of the adaptive response of bone are not well defined, but undoubtedly they involve changes occurring at the cellular level of bone structure. This proposal has intended to examine the hypothesis that the loading (unloading) response of bone is mediated by specific cells through modifications of their activity cytoskeletal elements, and/or elaboration of their extracellular matrices. For this purpose, this laboratory has utilized the results of a number of previous studies defining molecular biological, biochemical, morphological, and ultrastructural events of the reproducible mineralization of a primary bone cell (osteoblast) culture system under normal loading (1G gravity level). These data and the culture system then were examined following the use of the cultures in two NASA shuttle flights, STS-59 and STS-63. The cells collected from each of the flights were compared to respective synchronous ground (1G) control cells examined as the flight samples were simultaneously analyzed and to other control cells maintained at 1G until the time of shuttle launch, at which point they were terminated and studied (defined as basal cells). Each of the cell cultures was assayed in terms of metabolic markers- gene expression; synthesis and secretion of collagen and non-collagenous proteins, including certain cytoskeletal components; assembly of collagen into macrostructural arrays- formation of mineral; and interaction of collagen and mineral crystals during calcification of the cultures. The work has utilized a combination of biochemical techniques (radiolabeling, electrophoresis, fluorography, Western and Northern Blotting, and light microscopic immunofluorescence) and structural methods (conventional and high voltage electron microscopy, inununocytochemistry, stereomicroscopy, and 3D image reconstruction). The studies have provided new knowledge of aspects of bone cell development and structural regulation, extracellular matrix assembly, and mineralization during spaceflight and under normal gravity. The information has contributed to insights into the means in general by which cells respond and adapt to different conditions of gravity (loading). The data may as well have suggested an underlying basis for the observed loss of bone by vertebrates, including man, in microgravity; and these scientific results may have implications for understanding bone loss following fracture healing and extended periods of inactivity such as during long-term bedrest.
Author
Biochemistry; Bone Demineralization; Bones; Collagens; Aerospace Medicine; Bioastronautics; Biological Effects; Long Duration Space Flight; Physiological Effects; Weightlessness; Osteoporosis

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BEHAVIORAL SCIENCES

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

19990044057 Institute for Human Factors TNO, Soesterberg, Netherlands

Perception of Vibro-Tactile Asynchronies ***Interim Report Perceptie van vibro-tactiele asynchroniteiten***

Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; Oct. 20, 1998; 33p; In English

Contract(s)/Grant(s): B97-031; TNO Proj. 788.1

Report No.(s): TM-98-B013; TD98-0270; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy, Microfiche

Tactually presented information can potentially support operators in control tasks (tele-manipulation) and steering tasks (pilot's situation awareness). The success of tactile displays critically depends on how well their design is tuned to human tactile information processing characteristics. This study investigated the temporal sensitivity (duration discrimination) of the tactile channel and the consistency between tactually and visually perceived information. In a forced-choice discrimination task (Experiment 1) participants judged which of two empty intervals (a comparison and a standard interval, each defined by two pulses) was the longest. Standard interval lengths ranged from 100 to 400 ms. Intervals could be presented tactually IT: vibro-tactile pulses on finger tip; B: on the back) or visually (V: intensity pulses of a foveally presented square). Five conditions were examined: uni-modal discrimination (V-V, B-B and T-T) and cross-modal discrimination (V-T and V-B). In various experiments additional parameters were manipulated: uncertainty or the variation of standard intervals during sessions (Experiment 2) and the number of sessions (Experiment 3). In Experiment 4, a larger range of standard intervals was tested (56 ms ... 2000 ms) for the B-B condition. The dependent measures were the discrimination threshold and the point of subjective equivalence (PSE). In all (uni- and multi-modal) conditions thresholds increased substantially with uncertainty about the standard interval and with the number of sessions (though performance did not vary in time). Tactile thresholds varied between 1 9% (single session, constant standard) and 140% (multiple sessions, varying standard@. Effects of condition only show a trend (performance in the V-V condition is better than in the V-B condition). Overall, multi-modal discrimination shows higher thresholds than predicted by uni-modal discrimination, suggesting that additional noise enters multi-modal interval discrimination. Furthermore, the length of tactile intervals is systematically overestimated compared to visually presented intervals (24% for the finger tip and 1 0% for the back). Tactile discrimination performance JB-B) improves with interval length up to the maximum duration tested (2 s) for which the Weber-fractions are 19%.

Author

Display Devices; Human Performance; Selection; Sensitivity; Tactile Discrimination

19990046024 Civil Aeromedical Inst., Oklahoma City, OK USA

Differential Prediction of FAA Academy Performance on the Basis of Race and Written Air Traffic Control Specialist Aptitude Test Scores

Broach, Dana, Civil Aeromedical Inst., USA; Farmer, William L., Civil Aeromedical Inst., USA; Young, Willie C., Civil Aeromedical Inst., USA; May 1999; 30p; In English

Contract(s)/Grant(s): AM-98-B-HRR-509

Report No.(s): DOT/FAA/AM-99/16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The written air traffic control specialist (ATCS) aptitude test battery was evaluated for evidence of predictive bias within the framework of the Uniform Guidelines on Employee Selection Procedures (29 CFR 1607) in a retrospective analysis. Step-down hierarchical regression analysis (Lautenschlager & Mendoza, 1986) was used to investigate differential prediction of performance in initial ATCS training at the Federal Aviation Administration (FAA) Academy in a sample of 282 African-American and 8,542 white first-time competitive entrants. Analysis based on correlations without corrections for restriction in range found significant differences in the intercepts, but not slopes, for African Americans and whites. Analysis based on correlations, corrected for explicit and implicit restriction in range, found significant differences in slopes and intercepts by race, suggesting that separate regression equations were appropriate to predict Academy performance for the groups. The two analyses indicated that the composite score on the written ATCS test battery exhibited predictive bias as defined by the Uniform Guidelines on Employee Selection Procedures (29 CFR 1607) and Cleary (1968). Specifically, the composite score TMC over-predicted the performance of African Americans in initial training at the FAA Academy. As a consequence of the over-prediction, significantly more of the African Americans that were accepted into training for the ATCS occupation on the basis of their aptitude test scores went on to fail training than would have been expected on the basis of the common or majority (white) regression line. An alternative explanation is considered that the observed differential prediction reflected criterion bias or other group differences in factors such as

educational achievement and age. A path analytic approach is outlined for investigating the complex interactions between test score, the criterion, race, education, and age. Additional research on the consequences of over-prediction for African Americans in the FAA Academy is recommended in closing.
Author
Performance Prediction; Personnel Selection; Air Traffic Control; Examination; Education

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

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

19990044014 Department of Energy, Office of Energy Research, Washington, DC USA
SNS Target Test Facility for Remote Handling Design and Verification
Spampinato, P. T.; Graves, V. B.; Schrock, S. L.; Dec. 31, 1998; 5p; In English
Report No.(s): DE99-000212; ORNL/CP-99273; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The Target Test Facility will be a full-scale prototype of the Spallation Neutron Source Target Station. It will be used to demonstrate remote handling operations on various components of the mercury flow loop and for thermal/hydraulic testing. This paper describes the remote handling aspects of the Target Test Facility. Since the facility will contain approximately 1 cubic meter of mercury for the thermal/hydraulic tests, an enclosure will also be constructed that matches the actual Target Test Cell.
NTIS
Test Facilities; Neutron Sources

19990044075 Department of Energy, Washington, DC USA
ARIES NDA Robot operators' manual
Scheer, N. L.; Nelson, D. C.; May 31, 1998; 39p; In English
Report No.(s): DE99-001128; LA-UR-98-2365; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The ARIES NDA Robot is an automation device for servicing the material movements for a suite of Non-destructive assay (NDA) instruments. This suite of instruments includes a calorimeter, a gamma isotopic system, a segmented gamma scanner (SGS), and a neutron coincidence counter (NCC). Objects moved by the robot include sample cans, standard cans, and instrument plugs. The robot computer has an RS-232 connection with the NDA Host computer, which coordinates robot movements and instrument measurements. The instruments are expected to perform measurements under the direction of the Host without operator intervention. This user's manual describes system startup, using the main menu, manual operation, and error recovery.
NTIS
Robots; Assaying; Neutron Counters; Nondestructive Tests; User Manuals (Computer Programs)

19990045748 Norwegian Defence Research Establishment, Kjeller, Norway
Permeation Analyses of Protective Suits Against Jet Fuel (JP-8)
Pedersen, Bjorn, Norwegian Defence Research Establishment, Norway; Fullu, Lars, Norwegian Defence Research Establishment, Norway; Mar. 18, 1999; 26p; In English
Contract(s)/Grant(s): Proj. FFITOX/757/138
Report No.(s): FFI/RAPPORT-99/01305; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Permeation analyses with jet fuel have been carried out on three different protective suits. The analyses were preformed with a multiple cell permeation system developed at Norwegian Defence Research Establishment (FFI). A permeation rate of 1 micro g/sq cm min was used as breakthrough limit in these analyses. The analyses showed that the protective suit of standard Tyvek material had a limited protection against jet fuel based on our test criteria. The polylaminated Tyvek suit and the coated chemical protective garment showed better protection properties.
Author
Protection; JP-8 Jet Fuel; Research

19990045775 Institute for Human Factors TNO, Soesterberg, Netherlands
The Effect of Acceleration Curing on Braking Behaviour in a Driving Simulator *Final Report Het effect van toegevoegde acceleratie-informatie op remgedrag in een rijsimulator*
deVos, A. P., Institute for Human Factors TNO, Netherlands; Hoekstra, W., Institute for Human Factors TNO, Netherlands; Piet-

erse, M. T. J., Institute for Human Factors TNO, Netherlands; Dec. 09, 1998; 25p; In English; Original contains color illustrations
Contract(s)/Grant(s): A95/KL/306; TNO Proj. 730.3
Report No.(s): TM-98-A066; TD98-0278; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy, Microfiche

In this experiment the effect of additional motion cuing on braking behaviour in a driving simulator was addressed. Four groups of subjects drove the simulator in different motion conditions. As a base-line condition all subjects drove in a fixed base condition with only visual motion in the horizontal plane. The four experimental conditions were: visible pitch of the vehicle with respect to the road, generated by the computer image system, onset translation cues by means of high pass filtered translations generated by the moving base, a combination of visible pitch and onset translations, visible pitch and onset translations combined with simulation of low frequency sustained acceleration by means of tilt coordination of the moving base. When approaching a stationary vehicle, subjects were instructed to brake as late as possible, making a smooth maneuver without causing a collision. The instruction was to either brake normal or to brake hard. Trials were made at approach speeds of 30, 50, 70, and 90 km/h. The results showed no effects of additional motion cuing on the Time to Collision (TTC) at the onset of the braking maneuver, on the minimum TTC during the braking maneuver, on the stopping distance or on the percentage of collisions. The minimum acceleration during the maneuver showed that subjects braked more moderately in case of addition of motion cuing, most distinctly by the addition of visible pitch. Subjective responses showed that subjects felt the simulator was improved through the addition of motion cuing, especially in case of the combination of visible pitch, onset translation and tilt coordination. Further research is recommended involving other motion cuing aspects (vertical and lateral) and different tasks related to speed behaviour and lateral control.
Author
Acceleration Tolerance; Braking; Experimentation; Cues; Curing; Lateral Control; Simulation

19990045783 Michigan Univ., Medical Center, Ann Arbor, MI USA
Extracorporeal Life Support in Military Casualties ***Final Report, 31 Dec. 1996 - 1 Oct. 1998***
Barlett, Robert H.; Jan. 1999; 26p; In English
Contract(s)/Grant(s): DAMD17-97-C-7034
Report No.(s): AD-A361657; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this contract is to develop a portable extracorporeal life support (ECLS) device and a vascular access system. Part of this project includes the development of a non-thrombogenic surface to allow ECLS with minimal or no system anti-coagulation, During the second year of the contract the prototype device was completed by the subcontractor, animal models were refined, and the non-thrombogenic NO releasing surface was further tested.
DTIC
Life Support Systems; Heart Rate; Cardiovascular System; Lungs

19990045792 Civil Aviation Authority, Gatwick, UK
Human Factors in Maintenance
Hall, David, Civil Aviation Authority, UK; 1998; In English; See also 19990045788
Report No.(s): Paper-6; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The aviation maintenance community have been rather late on the scene regarding human factors. Pilots and Air traffic controllers, along with their immediate environment have been subject ot ergonomic study since at least World War Two. As far back as then it was established that 70% of aircraft accidents are attributable in some way to human error. This figure has not changed over the years, and could in fact be as high as 80% today. It is now internationally recognized that improvements in aircraft technology are unlikely to provide the necessary improvements in air safety that are being demanded in the face of increasing air traffic. In June 1990 the importance of human factors in maintenance was brought to the fore in the UK when a windscreen blew out of a BAC1-11 and landed in an Oxfordshire field. Since that time other near fatal accidents have occurred which has brought about the Civil Aviation Authority (CAA)'s and industry's acceptance of the importance of human factors in aircraft maintenance. A number of initiatives are now underway to increase awareness and apply human factors principles in the workplace.
Derived from text
Aircraft Maintenance; Aircraft Safety; Human Factors Engineering; Human Performance; Flight Safety

19990045793 Civil Aviation Authority, Safety Regulation Group, Gatwick, UK
Human Error Tolerance in Helicopter Cockpit Systems
Courteney, Hazel, Civil Aviation Authority, UK; Rotorcraft Flight Safety: Proceedings; 1998; In English; See also 19990045788

Report No.(s): Paper-7; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper is aimed at helicopter operators ho may be considering new cockpit equipment fits. It is intended to raise awareness of the effect that such systems can have on flight safety, because of their relationship to crew performance, and the possibility of error. One way to approach this si to identify the most important risk areas, then review the effects - positive and negative that the new system could have in these respects. The paper will begin by identifying the main risk areas for UK helicopter operations. An analysis or recent Mandatory Occurrence Reports (MORs) is presented. Comparisons will be made between difference categories of operators and between MOR events caused by technical versus human causal factors. It will be suggested that the greater risks currently lie with helicopter operations that are outside the Police / Ambulance (P/A) and other Public Transport (PT) categories, and with those events that arise from human - as opposed to technical - causes, although these are the minority of MORs. New cockpit technologies are likely to be available for helicopters within the next five years, for example, Flight Management Systems (FMS) that are comparable to their fixed wing counterparts. Drawing on the findings of the MOR analysis, and some feedback from fixed wing operators of FMS, suggestions will be made concerning the effects that such systems could have on helicopter flight safety. Finally, CAA activity to address the crew related aspects of light deck design in Type certification will be outlined.

Author

Cockpits; Helicopters; Human Performance; Aircraft Equipment; Flight Instruments; Human Factors Engineering; Flight Safety; Safety Devices

19990045858 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA

Heat Transfer Model for Fire Fighter's Protective Clothing

Mell, William E.; Lawson, J. Randall; Jan. 1999; 42p; In English

Report No.(s): PB99-134702; NISTIR-6299; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The paper presents the first stage in the development of a heat transfer model for fire fighter's protective clothing. The protective fabrics are assumed to be dry (e.g., no moisture from perspiration) and the fabric temperatures considered are below the point of thermal degradation (e.g., melting or charring). Many burn injuries to fire fighters occur even when there is no thermal degradation of their protective gear. A planar geometry of the fabric layers is assumed with one-dimensional heat transfer. The forward-reverse model is used for radiative heat transfer. The accuracy of the model is tested by comparing time dependent temperatures from both within and on the surface of a typical fabric assembly to those obtained experimentally.

NTIS

Protective Clothing; Fire Fighting; Radiative Heat Transfer

19990045885 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

Perspective Displays: A Review of Human Factors Issues

Naikar, Neelam, Defence Science and Technology Organisation, Australia; February 1998; 35p; In English

Report No.(s): DSTO-TR-0630; DODA-AR-010-466; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Three-dimensional displays may be a more effective way of presenting spatial information to operators than conventional two-dimensional displays because all three dimensions of space may be represented m a spatial format. Of several three-dimensional computer graphics systems that are currently available, perspective displays may be the most viable option for implementation at the present time. Previous research shows that perspective displays support better performance than plan-view displays on navigation, spatial awareness, and integration tasks. However, several issues need to be carefully considered and understood before perspective displays may be safely operationalized. This report reviews these issues; monocular cues for depth perception, multiple cue interaction, frame of reference, perspective geometry, and geometric and symbolic enhancement features.

Author

Human Factors Engineering; Three Dimensional Models; Display Devices; Computer Graphics

19990046580 Pacific Environmental Services, Inc., Herndon, VA USA

Report on Alpha and End-User Testing of the Level 1 Ergonomics Methodology Guide Supplement for Warehouse and Service Areas *Final Report*

Barker, Richard; Joyce, Marilyn; Nelson, Jeffrey; Crawford, Patricia; DAmato, Victor; Feb. 1999; 207p; In English

Contract(s)/Grant(s): F41624-95-D-9017

Report No.(s): AD-A361847; IERA-RS-BR-TR-1999-0003; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report describes the results of usability, reliability, and validity tests applied to the Level I Ergonomics Methodology Guide Supplement for Warehouse and Service Areas. Testing was performed in two phases. In phase one (Alpha test), five experiences ergonomists used the methodology to evaluate ten representative USA Air Force (USAF) warehouse and service jobs and develop recommendations to eliminate identified ergonomics hazards. The ergonomists also participated in a focus session to recommend enhancements to the guide. In phase two (end-user test), the exercise was repeated by eight USAF bioenvironmental engineering technicians. Inter-rater agreement on the presence/absence of specific ergonomic hazards ranged from slight to fair. Agreement was higher among experienced ergonomists than among USAF technicians. Technicians found the methodology highly usable. The average time to complete and score the hazard identification checklist was 23.0 minutes, and the average time to select corrective actions for identified hazards was 13.6 minutes. The results suggest the methodology can enable relatively inexperienced USAF technicians to develop the same types of solutions for ergonomic hazards that an experienced ergonomist would recommend.
DTIC
Human Factors Engineering; Musculoskeletal System; Occupational Diseases

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MATHEMATICAL AND COMPUTER SCIENCES (GENERAL

19990044071 Sandia National Labs., Livermore, CA USA
Experimental study of VBR video over various ATM switch architectures
Tsang, R. P.; Hsieh, J.; Du, D. H. C.; Dec. 31, 1997; 21p; In English; IFIP 1997 conference on high performance networking
Report No.(s): DE99-001419; SAND-97-8561C; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
One of the most important components of an Asynchronous Transfer Mode (ATM) network is the switch. Switch design is not a part of the ATM standards so vendors use a wide variety of techniques to build their switches. In this paper, the authors present experimental results of switching and multiplexing real- time Variable Bit Rate (VBR) video traffic (JPEG, MPEG-1, and MPEG-2) through two different ATM switch architectures. Real-time VBR traffic, such as digital video, is particularly interesting due to its high demands in terms of bandwidth, real-time delivery and processing requirements. The experiments show that the fastest switches, i.e., lowest latencies, do not necessarily perform better when transmitting VBR video. The impact of the high speed network components; characteristics, such as switch fabric architecture, buffering strategies, and higher layer transport protocols (i.e., UDP, TCP/IP), are illustrated through the experimental results.
NTIS
Asynchronous Transfer Mode; Data Transmission; Switches; Real Time Operation; Digital Television; Switching

19990045668 Department of Energy, Washington, DC USA
Hybrid local Born/Rytov Fourier migration method: Implementation of a stable scheme
Huang, L. J.; Fehler, M. C.; Burch, C. C.; Dec. 31, 1998; 12p; In English; International symposium on optical science, engineering, and instrumentation
Report No.(s): DE99-000769; LA-UR-98-2067; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Two efficient Fourier migration methods termed the extended local Born Fourier (ELBF) method and the extended Rytov Fourier (ELRF) method were developed recently for imaging 3D complex structures. They are based on local applications of Born and Rytov approximations within each marching interval. The ELBF method becomes unreliable when the lateral slowness variations are large and/or the frequency is high, while the ELRF method is reliable for these cases. However, the ELRF method is approximately 30--40% slower than the ELBF method because the ELRF method requires one more step where exponentials of complex numbers are calculated than the ELBF method during wave extrapolation within each marching interval. The authors investigate the stability condition of the ELBF method and propose an implementation scheme using variable marching intervals to make the ELBF method stable for all lateral slowness variations and frequencies. The variable marching interval depends on the lateral slowness variations within a given extrapolation region and the frequency, and consequently, the computational time of the ELBF with variable marching intervals increases with the lateral slowness variation and frequency. to take advantage of the faster computational speed of the ELBF method compared to the ELRF method and the better stability feature of the ELRF method than the ELBF method, the authors propose a hybrid local Born/Rytov Fourier migration method. In the hybrid method, the ELBF method is used for regions with small lateral slowness variations and/or low frequencies, otherwise, the ELRF method is used. Two synthetic datasets for complex structures are used to demonstrate the capabilities of the ELBF with variable marching intervals and the hybrid method for imaging complex structures with strong lateral slowness variations. Computational speeds of the split-step Fourier method, ELRF method, hybrid method, and ELBF method with single marching interval and variable

marching intervals are compared with each other. The results demonstrate that the hybrid method can save more than 10% of the CPU time required by the ELRF method.
NTIS
Migration; Fourier Transformation; Stability; Born Approximation

19990045979 Los Alamos National Lab., Space and Remote Sensing Group, NM USA
Multifractal analysis and modeling of one- and two-dimensional data with discrete wavelet transforms, isotropic or not
Davis, A. B.; Dec. 31, 1998; 7p; In English; International wavelet conference Tangier 1998
Report No.(s): DE99-000655; LA-UR-98-1522; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors compare several ways of uncovering multifractal properties of data in 1D and 2D using wavelet transforms. The WTMM or (Continuous) Wavelet Transform Maximum Modulus method has been extensively documented and widely applied by Dr. Alain Arneodo's (Bordeaux) group, to the point where their successes have overshadowed simpler techniques that use the Discrete WT. What the latter lack in robustness is gained in efficiency, thus enabling virtually real-time multifractal analysis of data as it is collected. Another advantage of DWT-based approaches is that tensor products of dyadic and triadic branching schemes enable a straightforward attack on strong anisotropy in natural and artificial 2D random fields.
NTIS
Fractals; Wavelet Analysis; Isotropy; Transformations (Mathematics); Data Processing

19990045982 Los Alamos National Lab., NM USA
Continued fractions: Yet another tool to overcome the course of dimensionality
Zardecki, A.; Dec. 31, 1998; 9p; In English; FLINS workshop: fuzzy logic and intelligent technologies for nuclear science and industry
Report No.(s): DE99-000638; LA-UR-98-1245; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors provide a rapid prediction method, in which a larger number of antecedents than currently considered is accounted for. to this end, they encode the successive (possibly rescaled) values of a time series, as the partial quotients of a continued fraction, resulting in a number from the unit interval. The accuracy of a ruled-based system utilizing this coding is investigated to some extent. Qualitative criteria for the applicability of the algorithm are formulated.
NTIS
Prediction Analysis Techniques; Coding

19990046197 National Inst. of Standards and Technology, Information Technology Lab., Gaithersburg, MD USA
Interactive 3D Visualization of Mathematical Functions Using VRML
Wang, Q.; Saunders, B.; Feb. 1999; 14p; In English
Report No.(s): PB99-130767; NISTIR-6289; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Although there have been no major revisions of the National Bureau of Standards Handbook of Mathematical Functions since its first publication in 1964, it continues to be widely used by the mathematical and scientific community. As a result, NIST is engaged in a large scale project to update and expand the handbook and disseminate it in digital format on the World Wide Web. This electronic handbook is being called the Digital Library of Mathematical Functions (DLMF). A key feature of the DLMF will be dynamic 3D visualizations of special functions. The paper discusses some of the visualization results obtained to date using NRML, the Virtual Reality Modeling Language, a standard file format for describing the behavior and geometry of a 3D virtual world.
NTIS
Scientific Visualization; Functions (Mathematics); Computer Graphics

19990046199 National Aerospace Lab., Tokyo Japan
Method for Eliminating Noise from Multiple Images for Reconstructing 3-D Objects
Furukawa, S.; Isobe, T.; Homma, K.; Aug. 1998; 18p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB99-141533; NAL-TR-1354; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Reconstructing 3-D objects from image data is one of the most important problems in enabling a robot to recognize the environment and work independently in a rocket. As the basis for reconstructing 3-D objects, a new method for identifying edges in images is presented. This method consists of three subprocedures: (1) Differences of brightness of two subsequent pixels are calculated and binary images are made, (2) Noise included in those image data is roughly eliminated by utilizing the properties of an edge in such images, and (3) Noise not recognized in the previous subprocedure is eliminated by the relation between 3-D objects in 3-D space and images, by using multi image data obtained by a camera moving on a rail. An experimental camera system has

been constructed in order to confirm the theoretical consideration, and various examples have been tested. The results show that almost all noise can be recognized and eliminated.
NTIS
Image Processing; Robots; Noise Reduction; Computer Vision; Brightness

19990046228 Geological Survey, Lawrence, KS USA
Development and demonstration of an enhanced spreadsheet-based well log analysis software ***Final Report, May 1998***
Watney, W. L.; Doveton, J. H.; Guy, W. J.; Oct. 31, 1998; 40p; In English
Report No.(s): DE98-000541; DOE/PC/91008-12; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Advanced Class Work Program is a field-based research and demonstration program for demonstration of advanced or improved technologies identified in the Department of Energy's Class Field Demonstration Projects. The objective of the Advanced Class Work program is to conduct field demonstrations of technologies for which a small, incremental amount of work will produce or improve a transferable, useful technology for oil recovery. The goal of the program is to enhance the products of near-term Class projects and maximize the applicability and effectiveness of project results. PfEFFER (Petrofacies Evaluation of Formations For Engineering Reservoirs) is a well log analysis computer package. The software was tested and successfully applied in Schaben Field, a DOE Class 2 Field Demonstration Project to assist in improving reservoir characterization and assessing reservoir performance. PfEFFER v.1 was released in January, 1996 as a commercial spreadsheet-based well-log analysis program developed and distributed through the Kansas Geological Survey. The objectives of this project were: Task 1 -- Enhance the PfEFFER software package; Task 2 -- Develop major new modules to significantly augment PfEFFER capabilities; Task 3 -- Conduct field demonstration of software application using the necessary reservoir data acquired from oil operators and construct a database; and Task 4 -- Perform technology transfer activities that include workshops, reports, presentations, or other methods to communicate results to interested parties.
NTIS
Applications Programs (Computers); Data Bases

19990046298 National Inst. of Standards and Technology, Information Technology Lab., Gaithersburg, MD USA
Directionality of an Electrically-Addressable Spatial Light Modulator and Its Application to a Joint Transform Correlator
Hsieh, M. L.; Paek, E. G.; Wilson, C. L.; Hsu, K. Y.; Dec. 1998; 12p; In English
Report No.(s): PB99-114464; NISTIR-6273; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have observed that the transfer function of an electrically addressable SLM is significantly different along the horizontal (fast scan) and the vertical (slow scan) directions. In this paper, we utilize the directionality of an electrically addressable SLM to improve the performance of a joint transfer correlator in terms of input space bandwidth product and efficiency.
NTIS
Optical Correlators; Light Modulators; Transfer Functions

19990046500 Rutherford Appleton Lab., Dept. for Computation and Information, Chilton UK
Constraint Preconditioning for Indefinite Linear Systems
Keller, Carsten, Oxford Univ., UK; Gould, Nicholas I. M., Rutherford Appleton Lab., UK; Wathen, Andrew J., Oxford Univ., UK; Feb. 24, 1999; 32p; In English
Report No.(s): PB99-141038; RAL-TR-1999-016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The problem of finding good preconditioners for the numerical solution of indefinite linear systems is considered. Special emphasis is put on preconditioners that have a 2 X 2 block structure and which incorporate the (1,2) and (2,1) blocks of the original matrix. Results concerning the spectrum and form of the eigenvectors of the preconditioned matrix and its minimum polynomial are given. The consequences of these results are considered for a variety of Krylov subspace methods. Numerical experiments validate these conclusions.
NTIS
Linear Systems; Polynomials

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COMPUTER OPERATIONS AND HARDWARE

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

19990045958 National Optical Astronomy Observatories, Tucson, AZ USA
A VBA Desktop Database for Proposal Processing at National Optical Astronomy Observatories
Brown, Christa L., National Optical Astronomy Observatories, USA; January 1999; 14p; In English; Astronomical Data Analysis Software and Systems 8, 1-4 Nov. 1998, Urbana, IL, USA
Report No.(s): NOAO-Preprint-830; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

National Optical Astronomy Observatories (NOAO) has developed a relational Microsoft Windows desktop database using Microsoft Access and the Microsoft Office programming language, Visual Basic for Applications (VBA). The database is used to track data relating to observing proposals from original receipt through the review process, scheduling, observing, and final statistical reporting. The database has automated proposal processing and distribution of information. It allows NOAO to collect and archive data so as to query and analyze information about our science programs in new ways. by taking advantage of VBA, NOAO has been able to appropriate the functionality, of Microsoft Office into its own custom application and develop a power solution in a short period of time. Using Access and VBA has proved to be a powerful, flexible, and easily adaptable development platform from the database developer's and user's perspective. The database developer can respond quickly to user requests for added features and changing user requirements. Database end-users can quickly and easily examine data and produce output on demand, without programming intervention. VBA allows the database to communicate with other Office applications, such as Word, to produce mail merges for notification letters and other support information distribution to a far-reaching user community. Reports can be saved easily in HTML format for publication to the Web, and Outlook is used to distribute information via e-mail. Author
Relational Data Bases; Computer Systems Design; Architecture (Computers); Data Base Management Systems; Software Engineering; Windows (Computer Programs); Operating Systems (Computers)

19990046011 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA
Electronics and Electrical Engineering Laboratory. Strategic Plan for Fiscal Years 1999-2004
Jan. 1999; 28p; In English
Report No.(s): PB99-138380; NISTIR-6285; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Electronics and Electrical Engineering Laboratory (EEEL) promotes U.S. economic growth by providing measurement capability high impact focused primarily on the critical needs of the U.S. electronics and electrical industries, and their customers and suppliers. This measurement capability promotes economic growth by improving the competitiveness of U.S. industries. This capability that U.S. industries need but cannot provide for themselves, for technical, economic, or other reasons. The beneficaries include U.S. industry, government, academic, other organizations, and the general public.
NTIS
Electrical Measurement; Electrical Engineering; Industries

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COMPUTER PROGRAMMING AND SOFTWARE

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

19990044054 Politecnico di Milano, Dipt. di Elettronica e Informazione, Milan, Italy
A Characterization of the Software Deployment Process and a Survey of Related Technologies
Carzaniga, Antonio, Politecnico di Milano, Italy; Sep. 18, 1997; In English
Report No.(s): Rept-97-48; No Copyright; Avail: Issuing Activity (Dipt. di Elettronica e Informazione, Politecnico di Milano, Piazza Leonardo da Vinci, 32, 20133 Milano, Italy), Hardcopy, Microfiche

Software applications are no longer stand-alone systems. They are increasingly the result of the integration of heterogeneous collections of components, possibly distributed over a computer network. Different components can be provided by different producers and they can be part of different systems at the same time. Moreover, components change and evolve very rapidly, making it difficult to manage the whole system in a consistent way. In this scenario, a crucial step of the software life cycle is deployment-that is, the activities related to the release, installation, activation, deactivation, update, and removal of components, as well as whole systems. This paper presents a characterization of the deployment process together with a framework for evaluating

technologies that are intended to address the software deployment problem. The framework highlights four primary factors that characterize the maturity of the technologies: process coverage; process changeability; interprocess coordination; and site, product, and deployment policy abstraction. A variety of existing technologies are survived and assessed against the proposed framework. Finally, we discuss promising research directions in software deployment.
Author
Computer Programming; Computer Networks; Software Engineering; Surveys

19990044096 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Generating Executable Code from Formal Specifications of Primitive Objects
Tankersley, Travis W.; Mar. 1999; 103p; In English
Report No.(s): AD-A361722; AFIT/GCS/ENG/99M-19; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The concept of developing a model for producing compilable and executable code from formal software specifications has long been a goal of software engineers. Previous research at the Air Force Institute of Technology (AFIT) has been focused on specification and domain analysis. An analysis model is populated using specifications written in Z. Then, a set of preliminary design transforms refines the specification in the analysis model. This research bridges the gap between analysis and design, allowing source code to be produced from formal specifications of primitive objects using transformational programming. The contribution of this thesis is to transform the analysis model for primitive objects into a design model representing the primitive objects, and to produce compilable and executable source code in Ada 95 from the resulting design model.
DTIC
Specifications; Ada (Programming Language); Operating Systems (Computers)

19990044106 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Two-Stage Stochastic Linear Programming with Recourse: A Characterization of Local Regions using Response Surface Methodology
Mills, David T.; Mar. 1999; 93p; In English
Report No.(s): AD-A361698; AFIT/GOR/ENS/99M-11; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
The LP recourse problem applies to two-stage optimization problems where uncertainty in resource availability of the second stage hinders informed decision making. The recourse function affords a way to compensate ”later” for an error in prediction ”now.” The literature provides a rich body of work on the optimization of such problems, but little research has been accomplished regarding the characterization of the surface in the local region of optimality, in particular sensitivity analysis. A decision maker faced with considerations other than the modeled objective function must be presented with a way to estimate the impact of operating at non-optimal decision variable values. This work develops and demonstrates a technique for characterizing the surface using response surface methodology. Specifically, the flexibility and utility of RSM techniques applied to this class of problems is demonstrated, and a methodology for characterizing the surface in the local region using a low-order polynomial is developed.
DTIC
Linear Programming; Polynomials; Decision Making

19990045671 Department of Energy, Office of Energy Research, Washington, DC USA
Toward FORTRAN 77 performance from object-oriented C++ scientific frameworks
Bassetti, F.; Davis, K.; Quinlan, D.; Dec. 31, 1998; 8p; In English; High performance computing, 1998, USA
Report No.(s): DE99-000679; LA-UR-98-260; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The use of object-oriented C++ frameworks has significantly simplified the development of numerous complex parallel scientific applications at Los Alamos National Laboratory and elsewhere. In spite of considerable use of, and commitment to, these frameworks, concerns about performance are nonetheless a significant issue; performance very close to that of FORTRAN 77 with message passing must be realized before the acceptance and use of such frameworks will be truly widespread. This paper identifies the primary source of inefficiency in using C or C++ for numerical codes with stencil- or stencil-like operations, and demonstrates two solutions--one portable, one not--to give genuine FORTRAN 77 performance.
NTIS
C++ (Programming Language); Object-Oriented Programming; FORTRAN; C (Programming Language)

19990045721 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Comparison of Genetic Algorithm Parametrization on Synthetic Optimization Problems
Eravsar, Mehmet; Mar. 1999; 88p; In English
Report No.(s): AD-A361725; AFIT/GOR/ENS/99M-05; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Meta-heuristics have been deployed to solve many hard combinatorial and optimization problems. Parameterization of meta-heuristics is an important challenging aspect of meta-heuristic use since many of the features of these algorithms can not be explained theoretically. Experiences with Genetic Algorithms (GA) applied to Multidimensional Knapsack Problems (MKP) have shown that this class of algorithm is very sensitive to parameterization. Many studies use standard test problems, which provide a firm basis for study comparisons but ignore the effect of problem correlation structure. This thesis applies GA to MKP. A new random repair operator, which projects infeasible solutions into feasible region, is proposed. This GA application is tested with synthetic test problems, which map possible correlation structures as well as possible slackness settings. Effect of correlation structure on solution quality found both statistically and practically significant. Depending on the Response Surface Methodology design, proposed is a GA parameter setting which is robust in both solution quality and computation time.
DTIC
Heuristic Methods; Genetic Algorithms; Maintenance

19990045728 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Graphical User Interface and Microprocessor Control Enhancement of a Pseudorandom Code Generator
Kos, John M.; Mar. 1999; 114p; In English
Report No.(s): AD-A361777; AFIT/GE/ENG/99M-15; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Modern digital communication techniques often require the generation of pseudorandom numbers or sequences. The ability to quickly and easily produce various codes such as maximal length codes, Gold codes, Jet Propulsion Laboratory ranging codes, syncopated codes, and non-linear codes in a laboratory environment is essential. This thesis addresses the issue of providing automated computer control to previously built, manually controlled hardware incorporating the Stanford Telecom STEL-1032 Pseudo-Random Number (PRN) Coder. By incorporating a microcontroller into existing hardware, the STEL-1032 can now be conveniently controlled from a MATLAB Graphical User Interface (GUI). The user can quickly create, save, and recall various setups for the STEL-1032 in an easy to use GUI environment. In addition to having complete control of the STEL-1032's internal actions, the microcontroller adds an extra measure of control possibilities by using various signals as possible interrupt sources. The microcontroller can sample the STEL-1032's various outputs at a rate up to 320 kHz and the data can be imported directly into MATLAB for further analysis.
DTIC
Graphical User Interface; Pseudorandom Sequences; Random Numbers; Pulse Communication

19990045778 Rutherford Appleton Lab., Mathematical Software Group, Chilton, UK
The EVEREST Post-Processor Module, 4.0
Ashby, J. V., Rutherford Appleton Lab., UK; Fowler, R. F., Rutherford Appleton Lab., UK; Greenough, C., Rutherford Appleton Lab., UK; Jan. 06, 1999; ISSN 1358-6254; 98p; In English
Report No.(s): RAL-TR-1998-088; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire OX11 0QX, UK), Hardcopy, Microfiche

In this report we describe Version 4.0 of the EVEREST Post Processor Module which forms part of the EVEREST suite of programs. The post-processor allows the user to visualize the results of the simulations performed by the Everest Solver module. The input required is the device geometry, mesh, doping and solution variables. Using cut planes through the device, the Post Processor supports contour, isometric, line and vector plots of most physical quantities of interest. Current-voltage characteristics and transient response can also be displayed. This report outlines the methods used and gives full details of the user interface. The EVEREST suite is one of the products of the ESPRIT project EVEREST (ESPRIT 962E-17, Three-Dimensional Algorithms for a Robust and Efficient Semiconductor Simulator with Parameter Extraction).
Author
Algorithms; Computational Grids; Simulation; Transient Response; Computer Programs

19990045786 National Inst. of Standards and Technology, Manufacturing Engineering Lab., Gaithersburg, MD USA
Initial Manufacturing Exchange Specification (IMES): Information Model for the Process Plan. Workstation Level
Lee, Y. T., National Inst. of Standards and Technology, USA; Mar. 1999; 32p; In English
Report No.(s): PB99-111569; NISTIR-6307; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Computer-Aided Manufacturing Engineering (CAME) program is developing a number of integrated software toolkits for design, manufacturing engineering, and production operations (1). One of these toolkits is the Manufacturing Engineering ToolKit (METK) (2). The goals of the METK project are (1) to develop generic interface specifications, data structures, information models, and data validation methodology for manufacturing engineering software; and, (2) to demonstrate an integrated toolkit using commercial, off-the-shelf software applications. The benefit will be an increase in the productivity of manufacturing

engineers, and a reduction in the time required getting error-free, engineering data to the shop floor. The US Navy Manufacturing Technology Program and the Systems Integration of Manufacturing Applications (SIMA) Program (3) at the National Institute of Standards and Technology (NIST) jointly fund the METK project.
NTIS
Computer Aided Manufacturing; Software Development Tools; Workstations; Software Engineering

19990045843 Rutherford Appleton Lab., Mathematical Software Group, Chilton, UK
The EVEREST Initial Mesh Generator, 4.0
Ashby, J. V., Rutherford Appleton Lab., UK; Fowler, R. F., Rutherford Appleton Lab., UK; Greenough, C., Rutherford Appleton Lab., UK; Jan. 06, 1999; ISSN 1358-6254; 22p; In English
Report No.(s): RAL-TR-1998-087; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

In this report we describe Version 4.0 of the EVEREST Initial Mesh Generator (Inimsh) which forms part of the EVEREST semiconductor device modelling suite of programs. This module is responsible for producing the coarse initial mesh which can be used as the starting point for automatic mesh refinement in the Solver module. Hence only simple controls are provided to specify manual refinement of the initial mesh. The alternative mesh generator built into the Pre-processor module should be used for manual mesh construction. Only Inimsh is capable of meshing geometries that have planes which are not perpendicular to a major axis, as occurs if prisms or tetrahedra are used in the blocks definition of a device. The Inimsh mesh generator will produce a mixed mesh of hexahedral and tetrahedral elements. The more computationally efficient hexahedral elements are produced whenever possible, with tetrahedra used to resolve surfaces that are not parallel to a principle axis. The EVEREST suite is one of the products of the ESPRIT project EVEREST.
Author
Computational Grids; Tetrahedrons; Grid Generation (Mathematics)

19990045880 Amtech, Inc., Newton, MA USA
Summary of Research Report Cooperative Agreement, *1 Oct. 1995 - 31 Mar. 1997*
1997; 11p; In English
Contract(s)/Grant(s): NCC2-648; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several areas of work related to commercialization of technology developed at NASA Ames Research Center (ARC) are discussed in this report. The areas are: (1) perform a feasibility study to develop a software commercialization center is at ARC; (2) perform preliminary work for formation of joint development of sensor technology for telemedicine applications; (3) development of a discovery interview process and staff training to assist the commercialization of technology developed at Ames, specifically aimed at working with researchers; (4) develop partners to further develop and commercialize image compression technology developed at AMES; (5) assist efforts to commercialize a software technology which imparts the ability to establish relevance-based retrieval in the handling of large repositories of information; (6) explore the development of cryocooler technology using pulse tube refrigeration; (7) assess interest in commercialization of a new method of measuring skin friction drag on wind tunnel models using liquid crystal material; (8) attempt to incorporate emerging technologies in the infrastructure of natural hazards mitigation; and (9) forming a nonprofit organization, ”The Bootstrap Alliance”, whose mission is to promote the use of digital technologies for collaborative problem solving. The results of these initiatives are discussed.
CASI
Feasibility; Technology Utilization; Aerospace Technology Transfer; Information Transfer

19990045996 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Asymmetric Load Balancing on a Heterogeneous Cluster of PCs
Bohn, Christopher A.; Mar. 1999; 202p; In English
Report No.(s): AD-A361740; AFIT/GE/ENG/99M-02; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In recent years, high performance computing with commodity clusters of personal computers has become an active area of research. Many organizations build them because they need the computational speedup provided by parallel processing but cannot afford to purchase a supercomputer. With commercial supercomputers and homogenous clusters of PCs, applications that can be statically load balanced are done so by assigning equal tasks to each processor. With heterogeneous clusters, the system designers have the option of quickly adding newer hardware that is more powerful than the existing hardware. When this is done, the assignment of equal tasks to each processor results in suboptimal performance. This research addresses techniques by which the size of the tasks assigned to processors is a suitable match to the processors themselves, in which the more powerful processors can do more work, and the less powerful processors perform less work. We find that when the range of processing power is narrow,

some benefit can be achieved with asymmetric load balancing. When the range of processing power is broad, dramatic improvements in performance are realized our experiments have shown up to 92% improvement when asymmetrically load balancing a modified version of the NAS Parallel Benchmarks' LU application.
DTIC
Asymmetry; Parallel Processing (Computers); Heterogeneity; Microcomputers; Supercomputers

19990045998 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
An Interactive Tool for Refining Software Specifications From a Formal Domain Model
Anderson, Gary L.; Mar. 1999; 125p; In English
Report No.(s): AD-A361745; AFIT/GCS/ENG/99M-01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
This work examines the process for refining a software specification from a formal object-oriented domain model. This process was implemented with interactive software to demonstrate the feasibility and benefits of automating what has been a tedious and often error-prone manual task. The refinement process operates within the framework of a larger Knowledge-Based Software Engineering system. A generic object-oriented representation is used to store a domain model, which allows the specification tool to access, select, and manipulate the required objects to form a customized specification. The specification is also stored as an object-oriented model, which in turn can be accessed by a design tool to transform the specification into source code. The tool has been designed as an interactive program that helps guide the user through the process of building the specification. The tool has been named the Elicitor-Harvester because of the functions it performs. It elicits application requirements from the user and harvests pre-existing knowledge from the formal domain.
DTIC
Software Engineering; Knowledge Based Systems; Errors

19990046010 Rutherford Appleton Lab., Oxford UK
Locking and Restarting Quadratic Eigenvalue Solvers
Meerbergen, K.; Feb. 17, 1999; 34p
Report No.(s): PB99-139321; RAL-TR-1999-011; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
This paper studies the solution of quadratic eigenvalue problems by the quadratic residual iteration method. The focus is on applications arising from finite-element simulations in acoustics. One approach is the shift-invert Arnoldi method applied to the linearized problem. When more than one eigenvalue is wanted, it is advisable to use locking or deflation of converged eigenvectors (or Schur vectors).
NTIS
Linearization; Eigenvectors; Inflatable Structures; Eigenvalues

19990046029 General Electric Co., Schenectady, NY USA
Conversion from 8800 to 8800PC -- Evaluation and experience
Miner, A. E.; Lawson, B. J.; Mar. 20, 1998; 50p; In English; Harshaw/NE 1998 TLD Users Group symposium
Report No.(s): DE99-001456; KAPL-P-000068; K-98037; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Though a final version of the software is pending the 8800PC operating system host computer is a welcomed change from the old Digital (DEC) host computer. The 8800PC host computer uses the Windows NT operating system and has proven to be very user friendly. Descriptive window messages replace the cryptic coding of the DEC host. Though numerous electrical components were replaced, system calibration remained constant. Calibrated Thermoluminescent (TL) output from a randomly selected 8815 field card was measured before and after the upgrade. The % difference, when comparing calibrated output from an upgraded reader to the non upgraded reader, ranged from 0.2 to 3%. The most disappointing aspect of the upgrade experience was the lag time between hardware installation and software completion.
NTIS
Conversion; Operating Systems (Computers)

19990046048 NASA Lewis Research Center, Cleveland, OH USA
Software Development Processes Applied to Computational Icing Simulation
Levinson, Laurie H., NASA Lewis Research Center, USA; Potapezuk, Mark G., NASA Lewis Research Center, USA; Mellor, Pamela A., NASA Lewis Research Center, USA; January 1999; 18p; In English; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 548-20-23

Report No.(s): NASA/TM-1999-208898; NAS 1.15:208898; E-11497; AIAA Paper 99-0248; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The development of computational icing simulation methods is making the transition form the research to common place use in design and certification efforts. As such, standards of code management, design validation, and documentation must be adjusted to accommodate the increased expectations of the user community with respect to accuracy, reliability, capability, and usability. This paper discusses these concepts with regard to current and future icing simulation code development efforts as implemented by the Icing Branch of the NASA Lewis Research Center in collaboration with the NASA Lewis Engineering Design and Analysis Division. With the application of the techniques outlined in this paper, the LEWICE ice accretion code has become a more stable and reliable software product.

Author

Ice Formation; Aircraft Icing; Software Engineering; Reverse Engineering; Computerized Simulation

19990046237 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil

Software Development by Engineers: Routes and Methodologies ***Desenolvimento de Software por Engenheiros: Diretrizes e Metodologias***

Thome, Adriana Cursion, Instituto Nacional de Pesquisas Espacias, Brazil; 1998; 356p; In Portuguese

Report No.(s): INPE-6891-TDI/652; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This dissertation proposes routes to help Engineers to develop small, medium, and large software systems, using the Classical Paradigm and the Object-Oriented Paradigm. In such case, this work traces a line of software development that goes since its conception until the implementation and tests phase; indicating methodologies, techniques, and precautions to be considered during the development process, helping thus the construction of quality software, without the need of becoming a Software Engineer specialist. This way, it allows Engineers, who many times have little knowledge about Software Engineering, to have a source of reference on how to proceed in software construction, and can in this manner easier build software systems appropriate to their goals.

Author

Computer Programs; Object-Oriented Programming; Accident Prevention; Procedures

19990046308 National Inst. of Standards and Technology, Information Technology Lab., Gaithersburg, MD USA

Parallel Algorithms for Entropy-Coding Techniques

Youssef, A.; Dec. 1998; 20p; In English

Report No.(s): PB99-118283; NISTIR-6113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the explosion of imaging applications, and due to the massive amounts of imagery data, data compression is essential. Lossless compression, also called entropy coding, is of special importance because it not only serves as a stand-alone system for certain applications such as medical imaging, it also is an inherent part of lossy compression. Therefore, fast entropy coding/decoding algorithms are desirable. In this paper we will develop parallel algorithms for several widely used entropy coding techniques, namely, arithmetic coding, run-length encoding (RLE), and Huffman coding.

NTIS

Parallel Processing (Computers); Algorithms; Entropy; Imagery

19990046418 Tennessee Univ., Computer Science Dept., Knoxville, TN USA

Parallel and Distributed System Simulation ***Final Report, 1 May - 1 Sep. 1998***

Dongarra, Jack, Tennessee Univ., USA; 1998; 2p; In English

Contract(s)/Grant(s): NAG2-1218; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This exploratory study initiated our research into the software infrastructure necessary to support the modeling and simulation techniques that are most appropriate for the Information Power Grid. Such computational power grids will use high-performance networking to connect hardware, software, instruments, databases, and people into a seamless web that supports a new generation of computation-rich problem solving environments for scientists and engineers. In this context we looked at evaluating the NetSolve software environment for network computing that leverages the potential of such systems while addressing their complexities. NetSolve's main purpose is to enable the creation of complex applications that harness the immense power of the grid, yet are simple to use and easy to deploy. NetSolve uses a modular, client-agent-server architecture to create a system that is very easy to use. Moreover, it is designed to be highly composable in that it readily permits new resources to be added by anyone willing to do so. In these respects NetSolve is to the Grid what the World Wide Web is to the Internet. But like the Web, the design that makes these wonderful features possible can also impose significant limitations on the performance and robustness of a NetSolve

system. This project explored the design innovations that push the performance and robustness of the NetSolve paradigm as far as possible without sacrificing the Web-like ease of use and composability that make it so powerful.
Author
Computer Programs; Internets; Computer Systems Simulation; Parallel Processing (Computers); Information Systems; On-Line Systems

19990046419 Tennessee Univ., Computer Science Dept., Knoxville, TN USA
Developing Information Power Grid Based Algorithms and Software ***Final Report, 1 Jul. - 1 Nov. 1998***
Dongarra, Jack, Tennessee Univ., USA; 1998; 3p; In English
Contract(s)/Grant(s): NCC2- 5274; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This was an exploratory study to enhance our understanding of problems involved in developing large scale applications in a heterogeneous distributed environment. It is likely that the large scale applications of the future will be built by coupling specialized computational modules together. For example, efforts now exist to couple ocean and atmospheric prediction codes to simulate a more complete climate system. These two applications differ in many respects. They have different grids, the data is in different unit systems and the algorithms for inte,-rating in time are different. In addition the code for each application is likely to have been developed on different architectures and tend to have poor performance when run on an architecture for which the code was not designed, if it runs at all. Architectural differences may also induce differences in data representation which effect precision and convergence criteria as well as data transfer issues. In order to couple such dissimilar codes some form of translation must be present. This translation should be able to handle interpolation from one grid to another as well as construction of the correct data field in the correct units from available data. Even if a code is to be developed from scratch, a modular approach will likely be followed in that standard scientific packages will be used to do the more mundane tasks such as linear algebra or Fourier transform operations. This approach allows the developers to concentrate on their science rather than becoming experts in linear algebra or signal processing. Problems associated with this development approach include difficulties associated with data extraction and translation from one module to another, module performance on different nodal architectures, and others. In addition to these data and software issues there exists operational issues such as platform stability and resource management.
Derived from text
Algorithms; Software Engineering; Computer Programs; Programming Environments; Distributed Processing; Software Reuse

19990046434 Naval Postgraduate School, Monterey, CA USA
Software Evaluation for Developing Software Reliability Engineering and Metrics Models
Brophy, Dennis J.; O'Leary, James D.; Mar. 1999; 73p; In English
Report No.(s): AD-A361889; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Today's software is extremely complex, often constituting millions of lines of instructions. Programs are expected to operate smoothly on a wide variety of platforms. There are continuous attempts to try to assess what the reliability of a software package is and to predict what the reliability of software under development will be. The quantitative aspects of these assessments deal with evaluating, characterizing and predicting how well software will operate. Experience has shown that it is extremely difficult to make something as large and complex as modern software and predict with any accuracy how it is going to behave in the field. This thesis proposes to create an integrated system to predict software reliability for mission critical systems. This will be accomplished by developing a flexible DBMS to track failures and to integrate the DBMS with statistical analysis programs and software reliability prediction tools that are used to make calculations and display trend analysis. It further proposes a software metrics model for fault prediction by determining and manipulating metrics extracted from the code.
DTIC
Reliability Analysis; Applications Programs (Computers); Computer Programs; Performance Prediction; Software Reliability

19990046436 NASA Langley Research Center, Hampton, VA USA
Configuration Management of an Optimization Application in a Research Environment
Townsend, James C., NASA Langley Research Center, USA; Salas, Andrea O., NASA Langley Research Center, USA; Schuler, M. Patricia, NASA Langley Research Center, USA; June 1999; 17p; In English; Engineering Foundation Conference on Optimization in Industry, 6-11 Jun. 1999, Banff, Alberta, Canada
Contract(s)/Grant(s): RTOP 509-10-11-01
Report No.(s): NASA/TM-1999-209335; NAS 1.15:209335; L-17868; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Multidisciplinary design optimization (MDO) research aims to increase interdisciplinary communication and reduce design cycle time by combining system analyses (simulations) with design space search and decision making. The High Performance

Computing and Communication Program's current High Speed Civil Transport application, HSCT4.0, at NASA Langley Research Center involves a highly complex analysis process with high-fidelity analyses that are more realistic than previous efforts at the Center. The multidisciplinary processes have been integrated to form a distributed application by using the Java language and Common Object Request Broker Architecture (CORBA) software techniques. HSCT4.0 is a research project in which both the application problem and the implementation strategy have evolved as the MDO and integration issues became better understood. Whereas earlier versions of the application and integrated system were developed with a simple, manual software configuration management (SCM) process, it was evident that this larger project required a more formal SCM procedure. This report briefly describes the HSCT4.0 analysis and its CORBA implementation and then discusses some SCM concepts and their application to this project. In anticipation that SCM will prove beneficial for other large research projects, the report concludes with some lessons learned in overcoming SCM implementation problems for HSCT4.0.
Author
Multidisciplinary Design Optimization; Configuration Management; Decision Making; Systems Analysis; Design Analysis

19990046443 Daresbury Nuclear Physics Lab., Computational Science and Engineering Dept., UK
Survey of Parallel Numerical Analysis Software
Allan, R. J., Daresbury Nuclear Physics Lab., UK; Hu, Y. F., Daresbury Nuclear Physics Lab., UK; Lockey, P., Southampton Univ., UK; Apr. 1999; ISSN 1362-041X; 34p; In English
Report No.(s): PB99-141095; DL-TR-99-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This report provides a survey of parallel numerical analysis software packages. The aim of this survey is to serve as a quick reference for users who work on scientific and engineering applications, and who encounter numerical analysis problems which they wish to solve in parallel. Areas covered include iterative and direct linear solvers, eigenvalue solvers, nonlinear equations solvers, optimization software, PDEs and ODEs solvers. For each package, a brief description is given along with other useful information such as availability, contact addresses and systems supported.
NTIS
Applications Programs (Computers); Numerical Analysis; Parallel Processing (Computers)

19990046483 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Structured Approach to Software Tool Integration
Noe, Penelope A.; Mar. 1999; 118p; In English
Report No.(s): AD-A361674; AFIT/GCS/ENG/99M-14; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
As the trend towards commercial off-the-shelf (COTS) software continues, civilian companies and government agencies alike are battling with the challenge of making multiple software packages and applications work together. Many of these companies and agencies have attempted to integrate the software tools to form a coherent system that satisfies their goals. often without the use of a step by step approach guiding the effort. Many researchers in the field of software tool integration have determined the areas that need to be addressed when tools are integrated. Some researchers have developed and expanded upon a theoretical model for integration. This model of tool integration aids in understanding what types of integration need to be performed, but does not provide a set of steps to aid in completing the integration. The methodology developed as part of this thesis research is based upon this model of integration. It provides a method of characterizing the tools being integrated and offers guidance on how to integrate them in a step by step manner. A software development tool, AFITtool, has been developed at the Air Force Institute of Technology (AFIT) to build software based on a formal requirements specification. The process of developing executable code from a requirements specification is based on mathematically provable, correctness-preserving transformations. Researchers at AFIT realized that some of AFITtool's shortcomings could be addressed by taking advantage of the capabilities of other tools. As part of this research, three tools were chosen to integrate with AFITtool and performing the integrations served to demonstrate the effectiveness of the methodology developed, while addressing specific shortcomings of AFITtool.
DTIC
Applications Programs (Computers); Software Development Tools

19990046484 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Transforming COBOL Legacy Software to a Generic Imperative Model
Moraes, DinaL.; Mar. 1999; 91p; In English
Report No.(s): AD-A361673; AFIT/GCS/ENG/99M-22; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
Legacy COBOL code presents challenges for organizations wishing to increase their effectiveness and improve their effi-

ciency. The systems that utilize this code are vital to enterprise operations, yet maintenance of code is expensive. This research presents an alternative that overcomes some of the problems of legacy COBOL code through the use of software reengineering techniques. This research develops a transformation system to convert COBOL code into a generic imperative model, recapturing the initial design and deciphering the requirements implemented by the legacy code, thereby making possible the documentation of legacy systems, design restructuring, and the re-design of a new, enhanced system.
DTIC
Computer Programs; Software Engineering; Programming Languages

19990046586 Air Force Research Lab., Directed Energy Directorate, Kirkland AFB, NM USA
Development of Visualization Modules for ICEPIC ***Final Report***
Robinson, Kimberly; Aug. 1998; 22p; In English
Report No.(s): AD-A361869; AFRL-DE-PS-TR-1998-1060; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
AVS/Express Developer's edition, by Advanced Visual Systems Inc, is a complex data visualization kit consisting of several hundred different modules, as well as a couple different editors, each serving a somewhat different function. In order to use this program, extensive training is required. In hopes of making things easier by designing a system with which people not familiar with the specifics of AVS can create visuals fairly quickly, an alternate method was developed. Through the custom designing of new modules specified to do certain things simply, graphs and movies are now considerably easier to make and include their own, easy to use, interfaces. This assists the computationalists at the Center for Plasma Theory and Computation by allowing them to view the results of their simulations more easily.
DTIC
Software Engineering; Plasma Physics; Scientific Visualization

19990046602 GenCorp Aerojet, Azusa, CA USA
Earth Observing System(EOS). Advanced Microwave Sounding Unit-A (AMSU-A), Special Test Equipment, Software Requirements
Schwantje, R., GenCorp Aerojet, USA; Aug. 24, 1998; 58p; In English
Contract(s)/Grant(s): NAS5-32314
Report No.(s): NASA/CR-1998-208624; NAS 1.26:208624; AEROJET-10457B; CDRL-306-2a; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This is EOS AMSU-A Special Test Equipment Software Requirements for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).
Author
Advanced Microwave Sounding Unit; Equipment Specifications; Earth Observing System (EOS); Earth Observations (From Space); EOS Data and Information System

19990046759 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Year 2000 Computing Crisis: The District of Columbia Faces Tremendous Challenges in Ensuring Vital Services Are Not Disrupted. Testimony Before Congressional Requesters
Oct. 02, 1998; 16p; In English
Report No.(s): PB99-136558; GAO/T-AIMD-99-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The District of Columbia, like other local and state governments, is extremely vulnerable to Year 2000 problems due to its widespread dependence on computer systems to deliver vital public services and carry out its operations. I discuss the Year 2000 risks facing the District, its progress to date in fixing systems, and our concerns with the District's remediation strategy.
NTIS
Services; District of Columbia; Computers; Governments

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COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990044109 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A Constructive Induction Approach to Computer Immunology
Cardinale, Kelley J.; O'Donnell, Hugh M.; Mar. 1999; 243p; In English
Report No.(s): AD-A361682; AFIT/GCS/ENG/99M-02; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

With the increasing birth rate of new viruses and the rise in interconnectivity and interoperability among computers, the burden of detecting and destroying computer viruses is severe. This research integrated four domains: computer virus detection, human immunology, computer immunology and an automated form of machine learning called constructive induction. First, a Computer Health System, based on the public health system, was defined to improve the 'global' approach to computer virus protection. Second, a computer immune model, based on the human immune system, was defined to improve the 'local' approach to virus detection. Third, the detection component of this computer immune model was developed, represented by the prototype MERCURY. This model utilized constructive induction, capturing the human immune characteristics of detection, self-adaptation and memory. The results of analyzing MERCURY demonstrate a lack of representational power of computer virus byte patterns using selective induction. Therefore, constructive induction is needed to provide new, potentially powerful, and often necessary representations. However, the results confirmed constructive induction's main deficiency, the explosion in the number of hypotheses generated. The effects of this deficiency can be improved by utilizing key pieces of knowledge to guide construction. Process optimization through statistical techniques provides insight into this knowledge.
DTIC
Computer Viruses; Statistical Analysis; Detection

19990045672 Department of Defense, Washington, DC USA
Adaptive synchronization protocol for parallel discrete event simulation
Bisset, K. R.; Dec. 31, 1998; 8p; In English; 1998 advanced simulation technologies conference
Report No.(s): DE99-000672; LA-UR-98-1344; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Simulation, especially discrete event simulation (DES), is used in a variety of disciplines where numerical methods are difficult or impossible to apply. One problem with this method is that a sufficiently detailed simulation may take hours or days to execute, and multiple runs may be needed in order to generate the desired results. Parallel discrete event simulation (PDES) has been explored for many years as a method to decrease the time taken to execute a simulation. Many protocols have been developed which work well for particular types of simulations, but perform poorly when used for other types of simulations. Often it is difficult to know a priori whether a particular protocol is appropriate for a given problem. In this work, an adaptive synchronization method (ASM) is developed which works well on an entire spectrum of problems. The ASM determines, using an artificial neural network (ANN), the likelihood that a particular event is safe to process.
NTIS
Synchronism; Protocol (Computers); Computerized Simulation; Parallel Processing (Computers)

19990045764 Department of Energy, Office of Energy Research, Washington, DC USA
Routing algorithms with end-to-end delay guarantees
Rao, N. S. V.; Batsell, S. G.; Dec. 31, 1998; 10p; In English; International conference on computer communications and networks
Report No.(s): DE99-000400; ORNL/CP-99336; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors consider the transmission of a message of size r from a source to a destination with guarantees on the end-to-end delay over a computer network with n nodes and m links. There are three sources of delays: (a) propagation delays along the links, (b) delays due to bandwidth availability on the links, and (c) queuing delays at the intermediate nodes. First, the authors consider that delays on various links and nodes are given as functions of the message size. If the delay in (b) is a non-increasing function of the bandwidth, they propose O(m(sup 2) + mn log n) time algorithm to compute a path with the minimum end-to-end delay for any given message size r. They then consider that the queuing delay in (c) is a random variable correlated with the message size according to an unknown distribution. At each node, the measurements of queuing delays and message sizes are available. They propose two algorithms to compute paths whose delays are close to optimal delays with a high probability, irrespective of the distribution of the delays, and based entirely on the measurements of sufficient size.
NTIS
Algorithms; Computer Networks; Time Lag

19990045859 National Inst. of Standards and Technology, Sensor Integration Group, Gaithersburg, MD USA

Multi-Network Access to IEEE P1451 Smart Sensor Information Using World Wide Web Technology

Schneeman, Rick, National Inst. of Standards and Technology, USA; Lee, Kang, National Inst. of Standards and Technology, USA; Apr. 1999; 26p; In English

Report No.(s): PB99-134447; NISTIR-6136; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

the features of IEEE P1451, a 'Draft Standard for a Smart Transducer Interface for Sensors and Actuators'. This paper presents the design of the demonstration system which uses a server architecture based on the demonstration system which uses a server architecture based on the industry standard UDP/IP protocol and the gateway software module that bridges the UDP Ethernet-based network and the specific control network technology. The definitions of a common set of ASCII-based message protocol units are defined units are defined to allow cross network and transducer device communication. Combining these approaches using Internet-based technologies such as World Wide Web browser software, Java, HTML Web pages, and the Internet Protocol suite, the demonstration shows the functionality and interoperable capability of the proposed interface for connecting sensors and actuators to control networks. It also shows that the implementation of the interface based on the draft specification is realizable. NTIS

World Wide Web; Sensors; Actuators; Client Server Systems

19990046000 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

A Modeling and Simulation Approach to Analyze the Workload Associated with the Growth of Network Router Access Control Lists

Lomsdalen, Douglas R.; Mar. 1999; 138p; In English

Report No.(s): AD-A361754; AFIT/GCS/ENG/99M-11; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Organizations can no longer isolate their networks from the rest of the world and still remain competitive. An organization willing to compete in the world market must take the necessary precautions to protect its network, the systems located on those networks, and its mission critical data. There are performance issues associated with the use of access control lists (ACL); however, if ACLs are implemented properly and periodically reviewed, a secure network can be attained. This research attempts to determine how the growth of an ACL affects packet flow and router CPU consumption, and also identify the specific length of an access control list, such that overall router performance is degraded. Additionally, the packet validation model developed for this thesis will be used to provide insights on how access control lists can be optimized. To accomplish the research goals, the ACL Model was built using BONeS Designer. The ACL Model simulated the packet validation component of a network router. Simulations showed packet latency grew linearly as the length of an ACL grows. Optimization efforts showed improvements in the mean packet latency by ordering the ACLs based on a frequency analysis of the incoming data packets and the proper use of ACL terminator entries.

DTIC

Computer Networks; Communication Networks; Packets (Communication); Workloads (Psychophysiology)

19990046076 National Optical Astronomy Observatories, Tucson, AZ USA

Observing Proposals on the Web at the National Optical Astronomy Observatories

Pilachowski, C. A., National Optical Astronomy Observatories, USA; Barnes, J., National Optical Astronomy Observatories, USA; Bell, D. J., National Optical Astronomy Observatories, USA; Mar. 1998; 9p; In English; Conference 3349, 20-21 Mar. 1998, Kona, HI, USA; Sponsored by International Society for Optical Engineering, USA

Report No.(s): NOAO-Preprint-784; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Proposals for telescope time at facilities available through the National Optical Astronomy Observatories can now be prepared and submitted via the World Wide Web. Investigators submit proposal information through a series of HTML(HyperText Markup Language) forms to the NOAO server, where the information is processed by Perl CGI scripts. PostScript figures and ASCII files may be attached by investigators for inclusion in their proposals using their browser's upload feature. Proposal information is saved on the server so that investigators can return in later sessions to continue work on a proposal and so that collaborators can participate in writing the proposal if they have access to the proposal account name and password. The system provides online verification of LATEX syntax and a spellchecker, and confirms that all sections of the proposal are filled out. Users can request a LATEX or PostScript copy of their proposal by email, or view the proposal on line. The advantages of the Web-based process for our users are convenience, access to online documentation, and the simple interface which avoids direct confrontation with LATEX. From the NOAO point of view, the advantage is the use of standardized formats and syntax, particularly as we begin

to receive proposals for the Gemini telescopes and some independent observatories. The NOAO WWW observing proposal pages can be found at http://www.noao.edu/noaoprop/.
Author
World Wide Web; Proposals

19990046202 SRI International Corp., Menlo Park, CA USA
The Formal Semantics of PVS
Owre, Sam, SRI International Corp., USA; Shankar, Natarajan, SRI International Corp., USA; May 1999; 74p; In English
Contract(s)/Grant(s): NAS1-18969; RTOP 519-50-11-01
Report No.(s): NASA/CR-1999-209321; NAS 1.26:209321; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
A specification language is a medium for expressing what is computed rather than how it is computed. Specification languages share some features with programming languages but are also different in several important ways. For our purpose, a specification language is a logic within which the behavior of computational systems can be formalized. Although a specification can be used to simulate the behavior of such systems, we mainly use specifications to state and prove system properties with mechanical assistance. We present the formal semantics of the specification language of SRI's Prototype Verification System (PVS). This specification language is based on the simply typed lambda calculus. The novelty in PVS is that it contains very expressive language features whose static analysis (e.g., typechecking) requires the assistance of a theorem prover. The formal semantics illuminates several of the design considerations underlying PVS, the interaction between theorem proving and typechecking.
Author
Programming Languages; Semantics; Prototypes; Specifications; Program Verification (Computers)

19990046267 Central Lab. of the Research Councils, Daresbury Lab., Warrington, UK
Chemical Process Simulation on Parallel Computers
Blake, R. J., Central Lab. of the Research Councils, UK; Emerson, D. R., Central Lab. of the Research Councils, UK; Sep. 1998; ISSN 1362-0193; 8p; In English
Report No.(s): DL-P-98-003; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
We have developed a core code to model the cylindrical polar and Cartesian incompressible turbulent Navier-Stokes equations with application to chemical reactor problems. A conventional co-located finite volume method is used to discretise the conservative form of the partial differential equations. The pressure velocity coupling is solved using the SIMPLE algorithm with the resulting sets of equations solved using tri-diagonal matrix or pre-conditioned conjugate gradient methods as appropriate. A parallel message passing version of the code has been developed within MPI and PVM. In this paper we will describe the core-code and the development of a specific module to model the industrial production of titanium particles resulting from the interaction at high pressures and temperatures of streams of titanium chloride and oxygen.
Author
Chemical Reactions; Parallel Computers; Computerized Simulation; Computer Programs; Finite Volume Method; Navier-Stokes Equation

19990046288 Los Alamos National Lab., NM USA
Dynamic traffic assignment on parallel computers
Nagel, K.; Frye, R.; Jakob, R.; Rickert, M.; Stretz, P.; Dec. 31, 1998; 12p; In English; ISCOPE '98: international symposium on computing in object oriented parallel environments
Report No.(s): DE99-001068; LA-UR-98-2250; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The authors describe part of the current framework of the TRANSIMS traffic research project at the Los Alamos National Laboratory. It includes parallel implementations of a route planner and a microscopic traffic simulation model. They present performance figures and results of an offline load-balancing scheme used in one of the iterative re-planning runs required for dynamic route assignment.
NTIS
Traffic; Parallel Computers

19990046309 National Inst. of Standards and Technology, Information Technology Lab., Gaithersburg, MD USA
Parallel Algorithms for Multi-Indexed Recurrence Relations with Applications to DPCM Image Compression
Youssef, A.; Dec. 1998; 32p; In English
Report No.(s): PB99-118267; NISTIR-6115; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Parallel solution of 1-indexed recurrence relations has received much attention, but no effort has been made to design parallel algorithms for multi-indexed recurrence relations, where the recurrence is in more than one index. Multi-indexed relations arise in JPEG-standard DPCM compression of images, which is an increasingly important area due to the explosion of imagery applications such as multimedia and medical imaging. In the paper we design and analyze novel parallel algorithms for solving multi-indexed recurrence relations of arbitrary order. to that end, we develop three techniques: index sequencing, index decoupling, and dimension shifting.
NTIS
Differential Pulse Code Modulation; Algorithms; Parallel Processing (Computers)

19990046587 Naval Postgraduate School, Monterey, CA USA
Development of the Information Infrastructure for the Ministry of Foreign Affairs of Ukraine
Illyashov, Oleksiy M.; Mar. 1999; 116p; In English
Report No.(s): AD-A361871; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The objective of thesis is to determine the needs of the Ministry of Foreign Affairs of Ukraine and design an appropriate information infrastructure. Choosing the best solution for this government organization requires an in-depth understanding of the methods and technologies available and the organizational problems and needs in conditions of the deep economical crisis in Ukraine. This thesis evaluated existing information systems, and reviewed the current architecture and problems. Research includes a detailed analysis of intranet technology, virtual private networks, secure messaging system and the development of a feasible solution for this government organization.
DTIC
Information Systems; Information Transfer; Information Resources Management

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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.

19990043985 Department of Energy, Office of Energy Research, Washington, DC USA
Identification Problem for a Wave Equation via Optimal Control
Lenhart, S.; Liang, M.; Protopopescu, V.; Dec. 31, 1998; 7p; In English; International conference on control of distributed parameter and stochastic systems
Report No.(s): DE99-000230; ORNL/CP-99483; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The authors approximate an identification problem by applying optimal control techniques to a Tikhonov's regularization. They seek to identify the dispersive coefficient in a wave equation and allow for the case of error or uncertainty in the observations used for the identification.
NTIS
Optimal Control; Wave Equations

19990044098 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Loop Gain Estimation for Adaptive Control
Sillence, Jamey P.; Mar. 1999; 101p; In English
Report No.(s): AD-A361718; AFIT/GE/ENG/99M-27; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
The identification of a linear discrete-time control system's loop gain is addressed. The classical Kalman filter theory for state estimation in linear control systems is extended, and the control system's loop gain and state are jointly estimated. A rigorous analysis of the measurement situation under consideration yields explicit formulae for the loop gain's unbiased estimate and estimation error's covariance.
DTIC
Flight Control; Adaptive Control; Covariance; Identifying

19990045661 Department of Energy, Office of Energy Research, Washington, DC USA
Distributed control of multi-robot teams: Cooperative baton passing task
Parker, L. E.; Dec. 31, 1998; 6p; In English; ISAS '98: 4th international conference on information systems analysis and synthesis
Report No.(s): DE99-000392; ORNL/CP-99113; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This research addresses the problem of achieving fault tolerant cooperation within small- to medium-sized teams of heterogeneous mobile robots. The author describes a novel behavior-based, fully distributed architecture, called ALLIANCE, that utilizes adaptive action selection to achieve fault tolerant cooperative control. The robots in this architecture possess a variety of high-level functions that they can perform during a mission, and must at all times select an appropriate action based on the requirements of the mission, the activities of other robots, the current environmental conditions, and their own internal states. Since such cooperative teams often work in dynamic and unpredictable environments, the software architecture allows the team members to respond robustly and reliably to unexpected environmental changes and modifications in the robot team that may occur due to mechanical failure, the learning of new skills, or the addition or removal of robots from the team by human intervention. After presenting ALLIANCE, the author describes the implementation of this architecture on a team of physical mobile robots performing a cooperative baton passing task.
NTIS
Distributed Parameter Systems; Robots; Active Control

19990046069 NASA Pasadena Office, CA USA
Priority Queues for Computer Simulations
Steinman, Jeffrey S., Inventor, NASA Pasadena Office, USA; Dec. 15, 1998; 24p; In English
Patent Info.: Filed 23 Apr. 1997; NASA-Case-NPO-20095-1; US-Patent-Appl-SN-845262; US-Patent-5,850,538; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche
The present invention is embodied in new priority queue data structures for event list management of computer simulations, and includes a new priority queue data structure and an improved event horizon applied to priority queue data structures. ne new priority queue data structure is a Qheap and is made out of linked lists for robust, fast, reliable, and stable event list management and uses a temporary unsorted list to store all items until one of the items is needed. Then the list is sorted, next, the highest priority item is removed, and then the rest of the list is inserted in the Qheap. Also, an event horizon is applied to binary tree and splay tree priority queue data structures to form the improved event horizon for event management.
Official Gazette of the U.S. Patent and Trademark Office
Computerized Simulation; Priorities; Data Structures

19990046204 Helsinki Univ. of Technology, Lab. of Telecommunications Technology, Espoo, Finland
Nonlinear Adaptive Filtering
Diniz, P. S. R.; 1998; ISSN 1455-5751; 72p; In English
Report No.(s): PB99-141152; HUT-4/98; ISBN 951-22-4274-5; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
This report presents a survey of nonlinear adaptive filtering techniques. The author introduces the Volterra filters and gradient-type algorithms for their adaptation. Then he treats the bilinear (recursive) filters. Then, neural network type algorithms like the multilayer perception and the radial basis functions are discussed. The report also includes several examples illustrating the performance of the algorithms.
NTIS
Nonlinear Filters; Adaptive Filters

19990046365 Katholieke Univ. te Leuven, Belgium
Corrosion Modelling and Monitoring: Neural Networks and Neural Network-Based Sensor Systems
Bogaerts, Walter, Katholieke Univ. te Leuven, Belgium; November 1998; 14p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche
The present results indicated that: the neural networks (NN) are suited for a variety of tasks; various factors determine whether or not it is opportune to apply NN to a certain application and NN may by a viable technology if th problem is not well-understood, or the problem area is rich in historical data or examples, or the application is data intensive and dependent upon multiple interacting parameters.
CASI
Corrosion; Models; Neural Nets; Monitors

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NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990043989 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Finite element-boundary element method for advection-diffusion problems with variable advective fields and infinite domains
Driessen, B. J.; Dohner, J. L.; Aug. 31, 1998; 29p; In English
Report No.(s): DE99-000469; SAND-98-1813; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper a hybrid, finite element--boundary element method which can be used to solve for particle advection-diffusion in infinite domains with variable advective fields is presented. In previous work either boundary element, finite element, or difference methods have been used to solve for particle motion in advective-diffusive domains. These methods have a number of limitations. Due to the complexity of computing spatially dependent Green's functions, the boundary element method is limited to domains containing only constant advective fields, and due to their inherent formulation, finite element and finite difference methods are limited to only domains of finite spatial extent. Thus, finite element and finite difference methods are limited to finite space problems for which the boundary element method is not, and the boundary element method is limited to constant advection field problems for which finite element and finite difference methods are not. In this paper it is proposed to split a domain into two sub-domains, and for each of these sub domains, apply the appropriate solution method; thereby, producing a method for the total infinite space, variable advective field domain.
NTIS
Finite Element Method; Boundary Element Method; Advection; Diffusivity; Domains

19990044094 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Application of the Finite Element Method to the Scattering of a Two-Dimensional, Semi-Infinite Periodic Structure
Villanueva, Perry N.; Mar. 1999; 129p; In English
Report No.(s): AD-A361785; AFIT/GE/ENG/99M-31; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Infinite periodic structures have been studied heavily because of their efficient filtering capabilities. They generally exhibit sharp frequency roll-offs at the frequency band of interest. In the RF region of the electromagnetic spectrum, periodic structures find applications such as radomes and photonic bandgap materials. Most studies have been done with infinitely periodic arrays because it is convenient to collapse an infinite array into one representative period using Floquet Analysis. Truncating an infinite array introduces an edge and invalidates Floquet analysis over the entire array. This thesis formulates a Finite Element Method (FEM) solution of a semi-infinite periodic array consisting of infinite cylinders. The array elements sufficiently far from the edge are implemented using the concept of a Physical Basis Function (PBF). The PBF concept is based on an a priori knowledge that the amplitudes of the currents in the periodic elements that are sufficiently far from an edge are constant. Implementation of the PBF concept allows the solution domain of the FEM to be bounded by introducing a periodic boundary that represents the truncated portion of the periodic array. The periodic boundary is implemented by relating the fields there with a Floquet phase factor based on one periodic element external to the FEM domain. Performance of the periodic boundary at normal incidence is promising. At off-normal incidence, the implemented boundary performs poorly. Implementation of a periodic boundary by relating the fields there with a Floquet phase factor with one interior periodic element is the next stage in improving off-normal incidence performance.
DTIC
Electromagnetic Scattering; Finite Element Method; Electromagnetic Spectra

19990045731 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A New Sequential Goodness-Of-Fit-Test for the Three-Parameter Weibull Distribution with Known Shape Parameter Value Based on Skewness and Q-Statis G.O.F. Test Statistics
Memis, Tibet; Mar. 1999; 834p; In English
Report No.(s): AD-A361794; AFIT/GOR/ENC/99M-01; No Copyright; Avail: CASI; A99, Hardcopy; A10, Microfiche

Due to its flexibility, the Weibull distribution has very wide applicability in a lot of disciplines and is very prevalent in reliability theory. Thus, a lot of statistical tests that generally have a substantial degree of computational complexity have been developed to determine if the data at hand can be represented with this distribution. This research presents a new omnibus goodness-of-fit test (G.O.F.) that has less computational complexity than the existing tests for the three-parameter Weibull distribution using a sequential application of two individual tests, sample skewness and Q-Statistic. A Monte Carlo procedure has been employed to generate critical values for the skewness and Q-Statistic (G.O.F.) tests for various Weibull distributions with specified shape

parameter values. Additionally, tables or charts of attained significance levels for the new sequential G.O.F. test procedure have been generated. Using the critical values and significance levels, a sequential G.O.F. test procedure can be used to determine if the given sample data agrees with a hypothesized Weibull distribution with known shape. A power study has been conducted against a variety of alternative hypotheses, and the results were compared with those obtained using conventional EDF type Cramer-von Mises, Ahderson-Darling and Kolmogorov-Smimov G.O.F tests, and the sequential procedure by Clough. Since the sequential test demonstrates better or equivalent power, it serves to significantly reduce the computational requirements for powerful G.O.F. testing.
DTIC
Weibull Density Functions; Monte Carlo Method; Skewness; Goodness of Fit; Kolmogorov Theory

19990045787 Rutherford Appleton Lab., Dept. for Computation and Information, Chilton, UK
Constraint Preconditioning for Indefinite Linear Systems
Keller, Carsten, Oxford Univ., UK; Gould, Nicholas I. M., Rutherford Appleton Lab., UK; Wathen, Andrew J., Oxford Univ., UK; Feb. 24, 1999; ISSN 1358-6254; In English
Report No.(s): RAL-TR-1999-016; Copyright; Avail: Issuing Activity (CLRD, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire)X11 0QX, UK), Hardcopy, Microfiche

The problem of finding good preconditioners for the numerical solution of indefinite linear systems is considered. Special emphasis is put on preconditioners that have a 2 x 2 block structure and which incorporate the (1, 2) and (2, 1) blocks of the original matrix. Results concerning the spectrum and form of the eigenvectors of the preconditioned matrix and its minimum polynomial are given. The consequences of these results are considered for a variety of Krylov subspace methods. Numerical experiments validate these conclusions.
Author
Linear Systems; Preconditioning; Convergence

19990046380 Naval Postgraduate School, Monterey, CA USA
Finite Element Model Updating and Damage Detection Using Artificial Boundary Conditions
DeGregory, Christopher P.; Mar. 1999; 93p; In English
Report No.(s): AD-A361817; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An experimental test of a structure results in a database of frequency response functions from which natural frequencies and mode shapes are identified for the given boundary conditions of the test. The natural frequencies of a system under a variety of boundary conditions can be identified by applying artificial boundary conditions (ABCs) at measurement locations and obtaining the frequency response function for the unrestrained degrees of freedom. These frequencies are found without any physical alterations of the test boundary conditions. Use of the ABCs in sensitivity-based model updating and damage detection in conjunction with baseline data provides improved error localization and results in a more accurate finite element model.
DTIC
Mathematical Models; Finite Element Method; Detection

19990046768 NASA Glenn Research Center, Cleveland, OH USA
A User's Guide for the Differential Reduced Ejector/Mixer Analysis "DREA" Program, 1.0
DeChant, Lawrence J., Texas A&M Univ., USA; Nadell, Shari-Beth, NASA Glenn Research Center, USA; April 1999; 50p; In English
Contract(s)/Grant(s): NGT-51244; RTOP 537-09-00
Report No.(s): NASA/TM-1999-209073; NAS 1.15:209073; E-11633; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A system of analytical and numerical two-dimensional mixer/ejector nozzle models that require minimal empirical input has been developed and programmed for use in conceptual and preliminary design. This report contains a user's guide describing the operation of the computer code, DREA (Differential Reduced Ejector/mixer Analysis), that contains these mathematical models. This program is currently being adopted by the Propulsion Systems Analysis Office at the NASA Glenn Research Center. A brief summary of the DREA method is provided, followed by detailed descriptions of the program input and output files. Sample cases demonstrating the application of the program are presented.
Author
Propulsion System Configurations; Systems Analysis; Propulsion System Performance

65
STATISTICS AND PROBABILITY

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

19990043996 Department of Energy, Washington, DC USA
Brief overview of kurtosis
Booker, J. M.; Ticknor, L. O.; Dec. 31, 1998; 7p; In English; Joint statistical meeting
Report No.(s): DE99-001078; LA-UR-98-2251; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The standardized fourth central moment (standardized according to the variance) is often regarded as the definition of kurtosis and has a history of usage for testing normality and multivariate normality. Its relationship to other standard central moments is also documented. However, the poor performance of the standardized central moments skewness and kurtosis as discriminators for normality has led to seeking alternative statistics and definitions to capture distribution shape characteristics. Included in these kurtosis statistics are quantile based statistics and L-kurtosis, which comes from L-moments. Balanda and MacGillivray provide a more general definition if kurtosis as the location-free and scale-free movement of the probability mass from the shoulders of the distribution to its center and tails. Different scaling techniques and positionings of the shoulders result in different forms for kurtosis related to peakedness and tail weight. Often counter to popular view, kurtosis is both tailedness and peakedness, simultaneously. It is related to skewness, spread, tail weight, quantiles, and influence functions. Various kurtosis statistics have been developed as indicators for bimodality, tail weight, peakedness and normality. These are also useful for distribution comparisons, such as goodness-of-fit, distribution crossings and distribution orderings. Kurtosis measures are related to Box-Cox transformations and Kullback-Leibler information. In the following sections, the authors examining various kurtosis measures, and illustrate their performance using a case study where understanding distribution shape is important for comparing simulated and mixtures of distributions. The concluding remarks include drawing attention to areas for further study.
NTIS
Kurtosis; Standardization

19990044095 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
The Quota Allocation Model: The Linear Optimization of a Markov Decision Process
Brown, David A.; Mar. 1999; 99p; In English
Report No.(s): AD-A361723; AFIT/GOA/ENS/99M-03; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

One of the many needs of the Air Force is advanced technical degrees. These degrees can be acquired in three ways: the Air Force can directly recruit personnel with the required degrees; Air Force personnel can obtain them during off duty time from local civilian colleges near their base; or the Air Force can provide advanced academic degrees (AADs) through the Air Force Institute of Technology (AFIT) or AFIT-sponsored programs. In 1995, the AFIT Commandant initiated a re-engineering study to review the AFIT mission. One of the initiatives of that study was the Quota Allocation Model (QuAM). The QuAM model is a two-phase mathematical model based on a Markov process that is used to feed a linear optimization. Outputs from the model provide the minimum number of officers, by grade and academic specialty, that must be educated annually to meet the needs and requirements of the Air Force in each of the Air Force education codes. This thesis effort entails: developing a user-friendly tool; migrating the model from lines of FORTRAN 77 code to an Excel spreadsheet environment; highlighting the assumptions necessitated by the Markov decision process; and testing for sensitivity to variations in model input parameters (AAD requirements, attrition, and inventory factors).
DTIC
Mathematical Models; Markov Processes; Armed Forces (USA); Computer Graphics; Personnel

19990045638 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
A New Sequential Goodness of Fit Test for the Three-Parameter Gamma Distribution with Known Shape Based on Skewness and Kurtosis
Park, Chil H.; Mar. 1999; 353p; In English
Report No.(s): AD-A361662; AFIT/GOR/ENC/99M-02; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

This research presents a new sequential goodness of fit test for the three-parameter gamma distribution with a known shape. The test is accomplished by employing two new tests, sample skewness and sample kurtosis, sequentially as test statistics. Unlike the typical goodness of fit test, using parameter estimation methods such as maximum likelihood estimation and minimum distance estimation, this test using the two test statistics above does not involve a substantial degree of computational complexity.

Large Monte Carlo simulation has been used to determine critical values and overall significance levels for all combinations of the two tests, and to conduct extensive power studies against a broad range of alternatives. The results have been compared with those of popular EDF tests such as the Anderson-Darling, Cramer-von Mises, and Komogrov-Smirov tests. The comparative study demonstrated the sequential tests superiority over a broad range of alternatives. Hence, with computational efficiency and good power properties, the new sequential test is powerful enough to be utilized in the goodness of fit test field.
DTIC
Goodness of Fit; Maximum Likelihood Estimates; Skewness; Shapes

19990046717 National Optical Astronomy Observatories, Tucson, AZ USA
Parameter Estimation in Astronomy with Poisson-Distributed Data, 1, The (CHI)2(gamma) Statistic
Mighell, Kenneth J., Kitt Peak National Observatory, USA; March 1999; 40p; In English
Contract(s)/Grant(s): NAG5-26555; NASA Order S-67046-F; NRA-95-OSS-16; GO-5386
Report No.(s): NOAO-Preprint-835; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Applying the standard weighted mean formula, [Sigma (sub i)n(sub i)ssigma(sub i, sup -2)], to determine the weighted mean of data, n(sub i), drawn from a Poisson distribution, will, on average, underestimate the true mean by approx. 1 for all true mean values larger than approx.3 when the common assumption is made that the error of the i th observation is sigma(sub i) = max square root of n(sub i), 1).This small, but statistically significant offset, explains the long-known observation that chi-square minimization techniques which use the modified Neyman'chi(sub 2) statistic, chi(sup 2, sub N) equivalent Sigma(sub i)((n(sub i) - y(sub i)(exp 2)) / max(n(sub i), 1), to compare Poisson - distributed data with model values, y(sub i), will typically predict a total number of counts that underestimates the true total by about 1 count per bin. Based on my finding that weighted mean of data drawn from a Poisson distribution can be determined using the formula [Sigma(sub i)[n(sub i) + min(n(sub i), 1)](n(sub i) + 1)(exp -1)] / [Sigma(sub i)(n(sub i) + 1)(exp -1))], I propose that a new chi(sub 2) statistic, chi(sup 2, sub gamma) equivalent, should always be used to analyze Poisson- distributed data in preference to the modified Neyman's chi(exp 2) statistic. I demonstrated the power and usefulness of,chi(sub gamma, sup 2) minimization by using two statistical fitting techniques and five chi(exp 2) statistics to analyze simulated X-ray power - low 15 - channel spectra with large and small counts per bin. I show that chi(sub gamma, sup 2) minimization with the Levenberg - Marquardt or Powell's method can produce excellent results (mean slope errors approx. less than 3%) with spectra having as few as 25 total counts.
Author
Statistical Analysis; Errors; Estimating; Data Flow Analysis; Mean

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

19990044091 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA
Quality Function Deployment from an Operations Research Perspective
Burke, Eve M.; Mar. 1999; 144p; In English
Report No.(s): AD-A361803; AFIT/GOR/ENS/99M-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The methodology of Quality Function Deployment (QFD) is compared to operations analysis standards. of special concern is how Air Combat Command (ACC) uses QFD for the Modernization Planning Process (MPP). ACC digresses from the traditional use of QFD for incorporating quality into manufacturing processes to use it as a planning tool. ACC's goal in implementing QFD is to incorporate the demands of the Air Force mission into the modernization planning effort. ACC's use of QFD to identify and quantify current deficiencies and quantify the value of alternative future solutions has led to the investigation of inconsistencies with QFD, both generally and with how ACC employs it. In short, the purpose of this thesis is to improve ACC's current method for optimizing combat capability through both near-term and far-term modifications.
DTIC
Management; Quality; Missions; Deployment; Operations Research

19990044105 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Analysis of a Non-Trivial Queueing Network

Bellamy, Kelly S.; Feb. 1999; 137p; In English

Report No.(s): AD-A361701; AFIT/GOA/ENS/99M-02; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

In studying complex queueing networks, one generally seeks to employ exact analytic solutions to reduce burden on computational resources. Barring the existence of an exact solution, the alternatives include approximation techniques and simulation. Approximation is the more attractive alternative from a time and effort perspective; however, cases exist that are not amiable to this technique. This work increases the flexibility of approximation techniques in obtaining estimates of congestion measures for complex, open queueing networks having several customer classes and class-dependent structures. We accomplish this by providing the procedure to aggregate multiple classes into a single class in order to apply an existing approximation technique. The resulting method is shown to yield good agreement with results obtained by simulation. The immediate application of this work is as a tool to focus a simulation study of multi-class queueing networks. For large networks, reasonable performance estimates can be obtained quickly. Once the basic input parameters are determined, different scenarios may be rapidly evaluated in a fraction of the time needed to modify a typical simulation model. This allows one to check ideas and determine where to invest time and funding when constructing a simulation model to obtain performance estimates on a by-class basis.

DTIC

Queueing Theory; Analysis (Mathematics)

19990044116 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Implementation of the Metaheuristic Tabu Search in Route Selection for Mobility Analysis Support System

Ryer, David M.; Mar. 1999; 112p; In English

Report No.(s): AD-A361669; AFIT/GOA/ENS/99M-07; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis employs a reactive tabu search heuristic implemented in the Java programming language to solve a real world variation of the vehicle routing problem with the objective of providing quality routes to Mobility Analysis Support System (MASS). MASS is a stochastic simulation model used extensively by Air Mobility Command (AMC) to analyze strategic airlift capabilities and future procurement decisions. This dynamic real world problem of strategic and tactical airlift possesses a number of side constraints such as vehicle capacities, route length and time windows in a sizeable network with multiple depots and a large fleet of heterogeneous vehicles. Finding optimal solutions to this problem is currently not practical. Currently, MASS requires all possible routes used in its simulation to be manually selected. As a result, the route selection process is a tedious and time consuming process that relies on experience and past performance of the model to obtain quality routes for the mobility system.

DTIC

Heuristic Methods; Support Systems; Heterogeneity; Mobility; Routes

19990046501 Daresbury Nuclear Physics Lab., UK

Multilevel Unsymmetric Matrix Ordering Algorithm for Parallel Process Simulation

Hu, Y. F., Daresbury Nuclear Physics Lab., UK; Maguire, K. C. F., Daresbury Nuclear Physics Lab., UK; Blake, R. J., Daresbury Nuclear Physics Lab., UK; Mar. 1999; ISSN 1362-0193; 42p; In English

Report No.(s): PB99-141087; DL-P-99-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Computer simulation of complex chemical processes is increasingly being used in the design, optimization and control of chemical facilities. Industrial-scale modeling involves the solution of large systems of algebraic differential equations. This is very computationally intensive with a large part of the computing time attributed to the repeated solution of large, sparse, unsymmetric systems of linear equations. One way of speeding up the simulation is to solve the linear systems efficiently in parallel by reordering the unsymmetric matrices into a bordered block-diagonal (BBD) form. In this paper a multilevel ordering algorithm is presented. A multilevel technique, which provides a global view, is combined with a Kernighan-Lin algorithm to form an effective unsymmetric matrix ordering algorithm - MONET (Matrix Ordering for minimal NET-cut).

NTIS

Matrices (Mathematics); Algorithms; Parallel Computers

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.

19990046227 Los Alamos National Lab., NM USA
Studies of modern and ancient solar energetic particles
Reedy, R. C.; Dec. 31, 1998; 14p; In English; International conference on isotopes in the solar system
Report No.(s): DE98-002982; LA-UR-98-1742; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Modern solar energetic particles (SEPs) have been studied for about 50 years by satellites and ground-based observations. These measurements indicate much about the nature of SEPs but cover too short a period to quantify the probabilities of very large solar particle events. Many SEPs have high enough energies to make nuclides in material in which they interact. Some nuclides measured in lunar samples have been used to extend the record about SEPs back several million years. Some new measurements of modern SEPs during the last solar cycle and new results for nuclides made by SEPs in lunar samples are presented and their implications discussed. Both the modern and ancient records need to be improved, and methods to get a better understanding of solar energetic particles are discussed. The SEP average fluxes from both sets of records are similar, and both sets can be used to show that huge fluxes of SEPs are very rare.
NTIS
Energetic Particles; Solar Physics; Lunar Geology

71
ACOUSTICS

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

19990046381 Scripps Institution of Oceanography, La Jolla, CA USA
Report on the Office of Naval Research, Long-Range Propagation Workshop 3-4 March 1997
Dec. 1998; 44p; In English
Report No.(s): AD-A361818; SIO-REF-98-8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Office of Naval Research, Code 321 OA, sponsored a workshop on long-range acoustic propagation in the ocean on March 3-4, 1997. The goals of the workshop were to clan the fundamental outstanding scientific issues in the propagation and scattering of sound transmitted over several hundred to several thousand kilometers in the ocean and to identify research opportunities to improve our understanding of long-range propagation. The workshop was also designed (i) to promote communication and integration among the basic research investigators and between the 6.1 and 6.2 communities on long-range acoustic propagation in the ocean, (ii) to suggest where field experiments are needed, and (iii) to identify potential Navy applicability. This report summarizes the recommendations emerging from the Workshop.
DTIC
Propagation; Acoustic Scattering; Acoustic Propagation

19990046431 Naval Undersea Warfare Center, Newport, RI USA
Three-Dimensional Analysis of Acoustic Scattering from a Coated Cylindrical Shell *Final Report*
Ko, Sung H.; Sandman, Bruce E.; Sep. 15, 1998; 58p; In English
Report No.(s): AD-A361855; NUWC-NPT-TR-11042; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A theoretical model was developed to evaluate the farfield pressure scattered from a coated cylindrical shell by a plane acoustic wave incident at an angle to the cylindrical axis (a three-dimensional problem). The model is a two-layer-structure comprising an outer layer of microvoided elastomer (coating) that is perfectly bonded to a cylindrical shell. The analysis of this model is based on the theory of elasticity, acoustic wave equations, and pertinent boundary conditions. The major results presented here are calculated directivity patterns using three-dimensional analysis.
DTIC
Cylindrical Bodies; Mathematical Models; Acoustic Scattering; Boundary Conditions; Elastomers

19990046588 Defence Research Establishment Atlantic, Dartmouth, Nova Scotia Canada

High Frequency Response of a Stiffened Box Structure

Gilroy, Layton E.; Smith, Malcolm J.; Oct. 1998; 113p; In English

Report No.(s): AD-A362052; DREA-TM-98/227; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Power Flow Finite Element Analysis (PFFEA) has been wider development at Defence Research Establishment Atlantic (DREA) in support of the Ship Noise Project. PFFEA is an analysis method for predicting high frequency structural acoustic and vibration response. The method is based on a vibrational conductivity approach in which the flow of vibrational energy is modelled in a similar fashion to heat conduction with convective losses. This report discusses experiments performed with DREA's ship tank test model to assist in the validation of the PFFEA software for high frequency structural vibrations. The experiments involved excitation of the steel box structure at relatively high frequencies using an electromagnetic shaker driving either the centre plate of the test model or one of three typical plate intersections (a symmetric and unsymmetric T-plate junction and an L-plate junction) making up the structure. Both the input mobility to and the response of the test model were measured under broadband excitation using an accelerometer. The input mobilities predicted by the PFFEA code compared extremely well with the experimental measurements. While the power flow method is unable to accurately predict modal response (in this case frequencies up to about 3 kHz), the model accurately predicted the average behaviour for all four cases. When looking at the response of the ship tank panels, in general, the PFFEA program was able to predict the amplitude of the transfer mobility with some degree of accuracy. However, there were significant variations in amplitude with frequency in the measured data which were not modelled with the PFFEA code. As a result, the PFFEA program should primarily be used when predictions are required over a band of frequencies rather than in support of a harmonic analysis.

DTIC

High Frequencies; Steel Structures; Frequency Response; Modal Response; Structural Vibration; Noise Measurement

19990046590 General Electric Co., Aircraft Engines, Cincinnati, OH USA

Acoustic Treatment Design Scaling Methods, Volume 2, Advanced Treatment Impedance Models for High Frequency Ranges

Kraft, R. E., General Electric Co., USA; Yu, J., Rohr Industries, Inc., USA; Kwan, H. W., Rohr Industries, Inc., USA; April 1999; 98p; In English

Contract(s)/Grant(s): NAS3-26617; RTOP 538-03-12-02

Report No.(s): NASA/CR-1999-209120/VOL2; NAS 1.26:209120/VOL2; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The primary purpose of this study is to develop improved models for the acoustic impedance of treatment panels at high frequencies, for application to subscale treatment designs. Effects that cause significant deviation of the impedance from simple geometric scaling are examined in detail, an improved high-frequency impedance model is developed, and the improved model is correlated with high-frequency impedance measurements. Only single-degree-of-freedom honeycomb sandwich resonator panels with either perforated sheet or "linear" wiremesh faceplates are considered. The objective is to understand those effects that cause the simple single-degree-of- freedom resonator panels to deviate at the higher-scaled frequency from the impedance that would be obtained at the corresponding full-scale frequency. This will allow the subscale panel to be designed to achieve a specified impedance spectrum over at least a limited range of frequencies. An advanced impedance prediction model has been developed that accounts for some of the known effects at high frequency that have previously been ignored as a small source of error for full-scale frequency ranges.

Author

Acoustic Impedance; High Frequencies; Aircraft Models; Scale Models; Aircraft Noise; Noise Prediction (Aircraft); Aeroacoustics

19990046608 NASA Langley Research Center, Hampton, VA USA

Inlet Noise Reduction by Shielding for the Blended Wing-Body Airplane

Clark, Lorenzo R., NASA Langley Research Center, USA; Gerhold, Carl H., NASA Langley Research Center, USA; 1999; In English; Aeroacoustics, 10-12 May 1999, Seattle, WA, USA

Report No.(s): AIAA Paper 99-1937; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Noise shielding benefits associated with an advanced unconventional subsonic transport concept, the Blended-Wing-Body, were studied using a 4-percent scale, 3-engine nacelle model. The study was conducted in the Anechoic Noise Research Facility at NASA Langley Research Center. A high-frequency, wideband point source was placed inside the nacelles of the center engine and one of the side engines in order to simulate broadband engine noise. The sound field of the model was measured with a rotating microphone array that was moved to various stations along the model axis and with a fixed array of microphones that was erected

behind the model. Ten rotating microphones were traversed a total of 22 degrees in 2-degree increments, Seven fixed microphones covered an arc that extended from a point in the exhaust exit plane of the center engine (and directly below its centerline) to a point 30 degrees above the jet centerline. While no attempt was made to simulate the noise emission characteristics of an aircraft engine, the model source was intended to radiate sound in a frequency range encompassing 1, 2, and 3 times the blade passage of a typical full-scale engine. In this study, the Blended-Wing-Body model was found to provide significant shielding of inlet noise. In particular, noise radiated downward into the forward sector was reduced by 20 to 25 dB overall in the full-scale frequencies from 2000 to 4000 Hz, decreasing to 10 dB or less at the lower frequencies. Also, it was observed that noise associated with the exhaust radiates into the sector directly below the model downstream to reduce shielding efficiency.
Author
Body-Wing Configurations; Aerodynamic Noise; Aircraft Noise; Engine Noise; Engine Inlets; Nacelles

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

19990044016 Department of Energy, Office of Energy Research, Washington, DC USA
Shell-Model Monte Carlo Studies of Nuclei Far from Stability
Dean, D. J.; Dec. 31, 1998; 7p; In English; ENAM '98: 2. international conference on exotic nuclei and atomic masses
Report No.(s): DE99-000207; ORNL/CP-99405; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The shell-model Monte Carlo (SMMC) technique transforms the traditional nuclear shell-model problem into a path-integral over auxiliary fields. The authors describe below the method and its applications to two physics issues: calculations of electron-capture rates, and exploration of pairing correlations in unstable nuclei.
NTIS
Nuclear Models; Molecular Structure; Nuclear Structure; Atomic Structure

19990044065 Lawrence Livermore National Lab., Livermore, CA USA
TART97 installation
Cullen, D. E.; May 18, 1998; 37p; In English
Report No.(s): DE98-057695; UCRL-ID-130839; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This document contains detailed instructions for the installation of the TART97 software.
NTIS
Applications Programs (Computers); Installing; Transport Properties; Computerized Simulation; Neutrons

19990045666 Department of Energy, Office of Energy Research, Washington, DC USA
Quarks and gluons in the nucleon, Volume 6
Dec. 31, 1997; 250p; In English; RIKEN BNL Research Center workshop on quarks and gluons in the nucleon
Report No.(s): DE99-000788; BNL-65234; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The purpose of the symposium was to discuss the quark and gluon structure of the nucleon as probed experimentally by hard processes with lepton and hadron beams and studied theoretically by perturbative Quantum Chromodynamics (QCD), lattice QCD and effective models on the one hand and to stimulate research activities in the fields related to RHIC and RHIC-SPIN projects on the other hand. There were 18 talks and 2 discussion sessions. About 50, including 5 from abroad participated in the symposium. An excellent summary in the form of 5 most important transparencies and a one-page explanation is included for each of the invited talks.
NTIS
Quarks; Gluons; Nucleons; Conferences

19990045688 Rutherford Appleton Lab., Chilton, UK
Photo-Induced Energy and Electron Transfer in Porphyrin Triad and Related Dyads: TMR Large-Scale Facilities Access Program
Seta, Patrick, Montpellier-2 Univ., France; Janot, Jean-Marc, Montpellier-2 Univ., France; Feb. 26, 1999; ISSN 1358-6254; In English
Report No.(s): RAL-TR-1999-004; Copyright; Avail: Issuing Activity (CLRD, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire)X11 0QX, UK), Hardcopy, Microfiche

This report describes the experiment entitled 'Photo-Induced Energy and Electron Transfer in Porphyrin Triad and Related Dyads' carried out at the Central Laser Facility (CLF) from November 2 to November 15 1997. The experiment, funded by the Framework IV Large-Scale Facilities Access Scheme, was proposed by Dr. P. Seta, Laboratoire des Materiaux et Procedes Membranaires, Montpellier and carried out by visiting researchers from the Laboratory. They were supported by researchers from the Central Laser Facility, Rutherford Appleton Laboratory.
Derived from text
Electron Transfer; Absorption Spectra; Porphyrins; Raman Spectra

19990045697 Department of Energy, Washington, DC USA
Near-LTE linear response calculations with a collisional-radiative model for He-like Al ions. Revision 1
More, R.; Kato, T.; Apr. 06, 1998; 18p; In English; Kyoto University workshop on spectroscopy of nonequilibrium plasmas
Report No.(s): DE98-057444; UCRL-JC-129333-REV.1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We investigate non-equilibrium atomic kinetics using a collisional-radiative model modified to include line absorption. Steady-state emission is calculated for He-like aluminum immersed in a specified radiation field having fixed deviations from a Planck spectrum. The calculated net emission is presented as a NLTE (Non-Local Thermodynamic Equilibrium) response matrix. In agreement with a rigorous general rule of non-equilibrium thermodynamics, the linear response is symmetric. We compute the response matrix for 1% and +/- 50% changes in the photon temperature and find linear response over a surprisingly large range.
NTIS
Aluminum; Metal Ions; Local Thermodynamic Equilibrium

19990045752 Rutherford Appleton Lab., Chilton, UK
Pseudoscalar Higgs Production in Association with Stop and Sbottom Pairs at the LHC in the MSSM
Dedes, A., Rutherford Appleton Lab., UK; Moretti, S., Rutherford Appleton Lab., UK; Dec. 1998; ISSN 1358-6254; 14p; In English; Original contains color illustrations
Contract(s)/Grant(s): ERB-FMBI-CT98-3438
Report No.(s): RAL-TR-1998-081; hep-ph/9812328; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

We study the processes gg yields (~)q1 (~)q(*)A, with q = t,b, within the theoretical framework of the Supergravity (SUGRA) inspired Minimal Supersymmetric Standard Model (MSSM) at the leading order (LO) in perturbative Quantum Chromo-Dynamics (QCD). Other than constituting a novel production mechanism of the neutral, CP-odd Higgs particle, they also allow one to relate the size of the corresponding production rates to the ratio of the vacuum expectation values of the two Higgs fields tan Beta, to the trilinear couplings A(sub o) and to the sign of the Higgsino mass term sign(mu). This interplay is made easier by the absence of any mixing in the (~)q1 (~)qA vertices, contrary to the case of all other Higgs bosons of the theory.
Author
Higgs Bosons; Quantum Chromodynamics; Supergravity; Supersymmetry; Quarks; Scattering

19990045892 NASA Johnson Space Center, Houston, TX USA
Radial Distribution of Electron Spectra from High-Energy Ions
Cucinotta, Francis A., NASA Johnson Space Center, USA; Katz, Robert, Nebraska Univ., USA; Wilson, John W., NASA Langley Research Center, USA; Radiat. Environ. Biophys.; 1998; Volume 37, pp. 259-265; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The average track model describes the response of physical and biological systems using radial dose distribution as the key physical descriptor. We report on an extension of this model to describe the average distribution of electron spectra as a function of radial distance from an ion. We present calculations of these spectra for ions of identical linear energy transfer (LET), but dissimilar charge and velocity to evaluate the differences in electron spectra from these ions. to illustrate the usefulness of the radial electron spectra for describing effects that are not described by electron dose, we consider the evaluation of the indirect events in microdosimetric distributions for ions. We show that folding our average electron spectra model with experimentally determined frequency distributions for photons or electrons provides a good representation of radial event spectra from high-energy ions in 0.5-2 micrometer sites.
Author
Linear Energy Transfer (LET); Energy Spectra; Ions; High Energy Electrons; Electron Irradiation; Ion Irradiation

19990045908 Rutherford Appleton Lab., Chilton, UK

Particle Physics Experiments Report, 1997

Roberts, B. A., Compiler, Rutherford Appleton Lab., UK; Feb. 1998; ISSN 1358-6254; 295p; In English; See also 19990045909 through 19990045939

Report No.(s): RAL-TR-98-014; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

This report describes work carried out in 1997 on experiments approved by the Particle Physics Experiments Selection Panel. The contents consist of unedited contributions from each experiment.

Author

Elementary Particles; Experiment Design; Particle Accelerators; Progress

19990045909 Institut Laue-Langevin, Grenoble, France

Search for the Neutron Electric Dipole Moment Using Ultracold Neutrons

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 1-4; In English; See also 19990045908

Report No.(s): Proposal-157; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

During 1997, the neutron electric-dipole moment (EDM) experiment continued to be developed and to collect high-quality data that will eventually enable us to measure (or set limits upon) this fundamental quantity with an unprecedented sensitivity. Currently our collaboration is the only group in the world able to improve upon this measurement.This experiment uses the Ramsey resonance technique to measure with very high precision the precession frequency of ultracold neutrons in a weak magnetic field. The precession frequency will change in the presence of an electric field if the neutron has an EDM. The most recent result from our collaboration, published in 1990, was d(sub n) = (-3+ or -2+ or -4) x 10(exp -26) e cm; that of LNPI in Russia was d(sub n) = (+3+ or -4 + or -2) x 10(exp -26) e cm. The systematic errors in each of these measurements were dominated by fluctuations in the magnetic field, for which it was impossible to compensate adequately with the external magnetometers in use at the time. In contrast, this experiment uses a ”cohabiting magnetometer” of polarised mercury atoms whose precession frequency provides an extremely accurate measurement of relative changes in the magnetic field within the neutrons’ storage volume. We can therefore calculate the expected (i.e., zero-EDM) resonant frequency of the neutrons on a cycle-by-cycle basis, and then fit the neutron counts to a ”Ramsey lineshape” which moves in the appropriate way as the magnetic field drifts. The net effect is to fit the ratio of the precession frequencies of the neutrons and mercury; it is this ratio which is directly sensitive to the neutron EDM and independent of magnetic field drift. The effects of the fluctuating magnetic field are thus eliminated; this is demonstrated in the graph below. The performance of this magnetometer is the subject of a paper written by our group which is due to appear shortly in Nuclear Instruments and Methods A.

Derived from text

Electric Dipoles; Neutrons; Resonant Frequencies

19990045910 Argonne National Lab., IL USA

Soudan 2 Proton Decay Experiment

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 5-8; In English; See also 19990045908

Report No.(s): Proposal-240; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The Soudan 2 experiment was originally designed to search for proton decay. However, as often happens in research, the background to that search, the interaction of neutrinos produced in cosmic ray interactions in the atmosphere, has proved more exciting than the primary objective. The water cherenkov detectors, Kamiokande and IMB, observed that the ratio of nu(sub mu) to nu(sub e), interactions in their detectors was not what was predicted by the Monte Carlo simulations of their experiments. There appeared to be a significant deficit of nu(sub mu) interactions (or slightly less likely, an excess of nu(sub e)). The effect is measured in terms of the double ratio: R= [nu(sub mu) / nu(sub e) Data] / [nu(sub mu) / nu(sub e) Monte Carlo]. Experimentally nu(sub mu) events are characterized by the presence of long non-interacting mu track and nu(sub e) events by an electron shower. The Soudan 2 detector continues to operate with a very good efficiency (approaching 90% of calendar time) and with no sign of reduced sensitivity or ageing problems. In October the PPESP approved a further two years of operation which ill take us to our initial target of a 5 kton-year exposure. We would like to continue running Soudan 2 up to the start of operation of the MINOS nu beam in 2001/2002. Soudan 2 will provide an operating fine-grained detector for the MINOS experiment, albeit with considerably less tonnage than the main MINOS detector.

Derived from text

Neutrinos; Particle Decay; Protons

19990045911 Bonn Univ., Germany

KARMEN: Neutrino Spectroscopy at ISIS. Veto Upgrade

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 9-12; In English; See also 19990045908
Report No.(s): Proposal-244; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

A new large area veto counter has been installed on the KARMEN experiment. The counter comprises 136 plastic scintillator modules with a total area of about 300 square m viewed by nearly 1100 two inch photomultiplier tubes. It has been located within the massive 7000 tonne iron shield which surrounds the 56 tonne liquid scintillator neutrino detector (LSND). Thus its installation involved the nearly complete removal of this shielding and its subsequent rebuilding. The arrangement of the new veto counter is shown in Figure 1. The purpose of the counter is to veto cosmic ray muons which can produce neutrons by deep inelastic scattering in the iron in the inner part of the shielding. The neutrons can enter the liquid scintillator tank and produce signals which are indistinguishable from neutrino events. Monte Carlo simulations had confirmed that prior to the upgrade this gave an irreducible background of 0.2 events per day. After five years of data taking this limited the sensitivity of our search for neutrino oscillations in the muon anti-neutrino to electron anti-neutrino channel tantalisingly at the point where we could only partially exclude the parameter space defined by the positive result reported by the LSND experiment at Los Alamos. The new veto counters have high light output and transmission resulting in excellent muon detection efficiency without an excessive rate of accidental vetoing. Their overall veto efficiency for muons is 99.6%, the remaining inefficiency being almost entirely geometrical. The measured reduction in background is energy dependent and varies from a factor of 22 to 75 for sequential events and 20 to 50 for single prong events. This is consistent with a factor of 40 predicted by Monte Carlo calculations. Thus the upgrade has fully met its design specifications. Since the upgrade, data has been taken for 119 days in 1997 during which there were 1414 coulombs on target. Analysis of sequential events has not found a single candidate for muon anti-neutrino to electron anti-neutrino oscillations, with an estimated background of less than one event. An oscillation probability of P = 1 would have produced 375 events, hence we deduce P is less than = 3.1 x 10(exp -3) at 90% CL. Our sensitivity to this oscillation channel is already comparable with that obtained from the whole of our pre-upgrade data, even with only about 15% of the beam time. The results of our exclusion of parameter space are shown. We plan to take data for a further two years, by which time we should either confirm or unambiguously exclude the LSND result.
Author

Neutrinos; Oscillations; Photomultiplier Tubes; Scintillation Counters

19990045912 Birmingham Univ., UK

An Exposure of the Hybridised 15-Foot Bubble Chamber with a Neon-Hydrogen Mixture to a Quad-Triplet Neutrino Beam from the Tevatron running at 800 GeV/c

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 13; In English; See also 19990045908
Report No.(s): Proposal-254; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK); Abstract Only, Hardcopy, Microfiche

The last official collaboration meeting of this experiment took place in 1997. Nevertheless, it is envisaged that several analyses, which are now at a fairly advanced stage, will be published in 1998.
Author

Atomic Energy Levels; Bubble Chambers; Neutrino Beams

19990045913 Athens Univ., Greece

The Study of CP Violation in the Neutral Kaon System at LEAR

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 37-54; In English; See also 19990045908
Report No.(s): Proposal-265; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The CPLEAR experiment investigates CP, T and CPT symmetries in the decay of neutral kaons produced at LEAR. Unlike other experiments which use beams of Kaon (sub L) and/or Kaon(sub S), this experiment measures the difference between the decays of initially pure Kaon and bar-Kaon to a variety of final states pion+pion-, pion e nu, pion+pion-pion, pion pion and pion pion pion. The principle of the method is to compare the process of the initial kaon decaying into a well defined eigenstate at a well defined eigentime t with that of bar-kaon, into the ”same” state. Any difference is a sign of CP violation. This difference arises mainly through the Kaon(sub L) - Kson(sub S) interference term. The relevant parameters are then extracted from time dependent decay rate asymmetries. The use of such asymmetries has the advantage that all acceptances which are common to Kaon and bar-kaon, cancel, thus considerably reducing the systematic uncertainties. In addition, it is possible to make detailed comparisons between the different rates to provide a better knowledge of the detector performance. The origin of CP violation is at present

unclear. It can be incorporated into the Standard Model by introducing a complex phase into the CKM matrix which should show up as an effect in the decay amplitudes. However, the recent discovery of the top mass at a value of around 180 GeV means that direct CP violation will be very difficult to determine. It is therefore essential to rule out other possible sources such as CPT violation or anomalies in T violation. The experiment completed its final data taking phase at the end of 1996. The 1996 running period was devoted to a special measurement of the regeneration correction to our pion+ pion- data sample. This was poorly known in our momentum range and its uncertainty dominated the systematic error on phi+-. World class measurements are now available from the CPLEAR experiment on the CP violation parameters, on the K(sub L)/K(sub S) mass difference deltqam, and on limits on a possible CPT violation in a region where quantum gravity effects could modify conventional quantum field theory.
Author
Decay Rates; Kaons; Pions; Quantum Theory

19990045914 Carnegie-Mellon Univ., Pittsburgh, PA USA
The Crystal Barrel: Meson Spectroscopy at LEAR with a 4 Pi Neutral and Charged Detector
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 55-64; In English; See also 19990045908
Report No.(s): Proposal-268; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The Crystal Barrel experiment used a 4pi spectrometer designed to provide complete and precise information on almost all final states produced in bar-p p and bar-p d annihilations at low energy. The physics goal is to identify all light mesons in the mass range from 0.14 to 2.3 GeV/c(exp 2), to determine their quantum numbers and decay properties and to study the annihilation dynamics. The main interest is to find and identify the glueballs and hybrid mesons predicted by QCD. Subsidiary aims are studies of radiative and rare meson decays.
Derived from text
Annihilation Reactions; Gluons; Mesons; Particle Decay; Quantum Chromodynamics

19990045916 California Univ., Lawrence Berkeley Lab., Berkeley, CA USA
Sudbury Neutrino Observatory (SNO)
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 71-74; In English; See also 19990045908
Report No.(s): Proposal-276; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The Sudbury Neutrino Observatory (SNO) is a Joint Canadian, US and UK experiment designed to study neutrinos from the sun and possibly other astrophysical sources using a 1000 ton heavy water (D20) Cerenkov detector. All four existing solar neutrino experiments, Homestake, Kamioka, Sage and Gallex, report a deficiency of electron neutrinos relative to the standard solar model (the solar neutrino problem). The distinct advantage of SNO is the use of D20 as the detecting medium, which makes the experiment sensitive both to nu(sub e), neutrinos (above approximately 6.5 MeV) and also to all types of neutrinos with an energy above 2.2 MeV.
Derived from text
Detection; Neutrinos; Sun; Gamma Rays; Cerenkov Radiation

19990045917 Birmingham Univ., UK
A Search for the H-Particle in Xi(-)d and K(-3)He Reactions
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 75-76; In English; See also 19990045908
Report No.(s): Proposal-277; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

This project comprises several related experiments on systems with multiple strangeness. Two of these (E813, E836) are searches for the S=-2, B=2 H-particle. The third, E886, is a search for other forms of strange matter. In addition, a subsidiary issue in the experiment has led to a theoretical study of oscillations in strange-particle decays.
Derived from text
Particle Decay; Strangeness; Quantum Mechanics; Hyperons

19990045918 Cagliari Univ., Italy
A Precision Measurement of Epsilon'/Epsilon in CP Violation K(sup 0) yields 2 Pi Decays
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 77-78; In English; See also 19990045908
Report No.(s): Proposal-283; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

NA48 is a fixed target experiment at the Conseil European Pour La Recherch? Nucleaire (CERN) Super Proton Synchrotron (SPS) primarily designed to measure the direct CP-violating parameter Re{e'/e} using simultaneous Kaon(sub L) and Kaon(sub S) beams. In 1997 the first significant data taking occurred using the full detector. Despite the delays caused by the SPS fire, 40 days running was possible during the August-October period.
Derived from text
Protons; Kaons; Pions; Particle Decay

19990045919 Athens Univ., Greece
Study of Lead Lead Interactions at 160 GeV/c per Nucleon
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 79-93; In English; See also 19990045908
Report No.(s): Proposal-285; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The study of strange baryon spectra in heavy ion collisions is a useful probe of hadronic matter under extreme conditions. The relative abundances for different baryon and antibaryon species can be studied in terms of thermal models, where they serve to assess the degree to which flavor equilibrium is reached, and allow thermodynamic parameters to be determined. The transverse mass spectra provide independent information on the temperatures achieved in the collision and also on transverse flow. Strangeness production is expected to increase for all species if a Quark-Gluon Plasma (QGP) is formed.
Derived from text
Baryons; Ionic Collisions; Plasmas (Physics); Strangeness; Thermodynamic Properties; Quantum Mechanics; Flavor (Particle Physics); Hadrons; Particle Interactions

19990045920 Glasgow Univ., UK
Angular and Polarization Correlation Coefficients in Neutron Decay
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 94-98; In English; See also 19990045908
Report No.(s): Proposal-286; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The standard model of electroweak interactions does not predict values for the elements of the CKM mixing matrix which relates the quark weak interaction eigenstates to the mss eigenstates and these quantities have to be determined from experiment. Although in recent years the main focus of attention has switched to the second and third fermion generations, the first generation element V(sub ud) is by far the largest element of the CKM matrix and to measure it precisely the study of the weak interactions of the first generation hadrons, in particular of the neutron, continues to be important. The decay of the free neutron is governed by two real coupling constants,G(sub V) (Polar vector) and G(sub A) (Axial vector).
Derived from text
Angular Correlation; Correlation Coefficients; Electroweak Interactions (Field Theory); Hadrons; Neutron Decay; Polarization Characteristics

19990045921 Bristol Univ., UK
Charmed Baryon Studies in the CERN Hyperon Beam
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 99; In English; See also 19990045908
Report No.(s): Proposal-287; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK); Abstract Only, Hardcopy, Microfiche

WA89 used the omega spectrometer in the CERN west Hall to study particle production (especially charmed baryons) in a beam of sigma- hyperons. Almost 500 million events were accumulated in the 1993 and 1994 runs. Analysis continues, with particular emphasis on unbiasses extraction of charm events and the evaluation of cross-sections. We are also studying the polarization of hyperons produced in the Sigma- -N collisions. Results on inclusive cros-sections for xi- production were published this year.
Author
Baryons; Charm (Particle Physics); Hyperons; Particle Production; Particle Interactions; Xi Hyperons; Sigma-Mesons

19990045922 Grenoble-1 Univ., Annecy, France
Central Production of Mesons Using the CERN Omega Spectrometer and the GAMS 4000 Electromagnetic Calorimeter
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 100-107; In English; See also 19990045908
Report No.(s): Proposal-291; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

Experiments WA91/WA120 search for non-q qbar mesons produced in the central region of the reaction pp yields pf(X(exp 0))p(sub s) at 450 GeV/c using the CERN omega spectrometer and GAMS-400. These experiments are a continuation of other experiments which performed a dedicated search for non-q qbar mesons in centrally produced exclusive events.
Derived from text
Mesons; Gluons; Quarks

19990045923 Argonne National Lab., IL USA
MINOS Experiment: Main Injector Neutrino Oscillation Search
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 108-112; In English; See also 19990045908
Report No.(s): Proposal-293; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The V-A structure of the Electroweak Theory requires only left handed neutrinos because neutrinos interact solely via the weak interaction. The only way ton ensure no right handed neutrinos exist is to make the neutrinos massless. An apparent inconsistency between data and theory in several arenas in which neutrinos are studied has lead to a recent surge of activity to try to resolve the issue of whether neutrinos have mass via the measurement of neutrino oscillations. An unambiguous measurement of neutrino oscillations would be the first real sign of physics beyond the standard model.
Author
Electroweak Model; Neutrinos; Oscillations

19990045924 Academia Sinica, Beijing, China
The BaBar Experiment: Physics at the SLAC B-Factory
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 113-120; In English; See also 19990045908
Report No.(s): Proposal-295; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The babar detector is an experiment which will run at the SLAC PEP-II collider. PEP-II is being built in the tunnel of the old PEP machine and will be an asymmetric e+e- collider with a centre of mass at the gamma(4s) energy. It is designed to have a high luminosity, 3X10(exp 33)cm(exp -2) s(exp -1), and so will be a copious source of B mesons; roughly 30 million will be produced each year. The high energy e- ring was successfully commissioned in the summer of 1997 and the low energy e+ ring is scheduled to be completed in 1998. The BaBar experiment will be at the sole interaction point of PEP-II and its design is optimized for B physics, in particular to observe and measure CP violation in the B system. The BaBar collaboration comprises approximately 450 people from 8 countries. The detector is currently under construction and is scheduled to take physics data early in 1999 and run for at least 5 years.
Author
Mesons; Experiment Design; High Energy Interactions

19990045926 Aarhus Univ., Denmark
The LHC-B Experiment
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 125-135; In English; See also 19990045908
Report No.(s): Proposal-298; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The primary goal of Large Hadron Collider-B (LHC-B) is to make precision measurement of CP violating decays in the B system and so to make detailed tests of the Standard Model explanation of CP violation or possible new physics. The LHC offers a unique opportunity for B meson physics studies to be made; the expected bbar cross section (about 500 micro-barns at 14TeV) means the LHC-B will be able to carry out high statistics studies of CP violation at the start of LHC running, and throughout its subsequent operation. At a nominal luminosity of 1.5 x 10(exp 32) cm(exp -2)s(exp -1) (which can be tuned at the LHC-B interaction region to optimize running conditions), approximately 10(exp 12) bb-bar pairs will be produced in a standard (10(exp 7)s) year.
Derived from text
Hadrons; Mesons; Experiment Design; Particle Accelerators

19990045927 Bari Univ., Italy
Study of Strange and Multi-Strange Particles in Ultrarelativistic Nucleus-Nucleus Collisions
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 138-140; In English; See also 19990045908
Report No.(s): Proposal-300; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxford-

shire, OX11, 0QX, UK), Hardcopy, Microfiche

The study of strange baryon spectra in heavy ion collisions is a useful probe of the dynamics of hadronic matter under extreme conditions. The relative abundances for different baryon and antibaryon species allow the degree and nature of flavor equilibration to be studied, while the transverse mass (m (sub T)) spectra provide independent information on the temperatures achieved in the collision. The onset of a Quark-Gluon Plasma (QGP) phase during the collisions is expected to enhance strangeness production and, in particular, the antihyperion yield with respect to normal hadronic interactions. The NA57 experiment is a continuation of the research program into strangeness production in heavy ion collisions initiated at the CERN Omega Spectrometer in experiments WA85, WA94 and wA97. The principal aim is to measure hyperon production and kaon production at mid-rapidities in central pb-pb collisions with high statistics.

Derived from text

Baryons; Hadrons; Hyperons; Ionic Collisions; Nuclear Interactions; Strangeness; Experiment Design

19990045928 Centre National de la Recherche Scientifique, Annecy-le-Vieux, France

Study of e+e- Annihilation Phenomena with the ALEPH Detector

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 141-158; In English; See also 19990045908

Report No.(s): Proposal-710; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

Large Electron Positron collider (LEP) has delivered a record integrated luminosity of 72.7pb(exp -1) to ALEPH this year. Running began at the Z peak for detector calibration on July 19th. The first high energy run at square root of s = 183 GeV went into the machine on July 311s using 90/60 optics with a total current of 5.2mA in each beam split into 4 bunches. by Nov. 10 at the end of running, the integrated luminosity delivered above 181GeV had been 63.5 pb(exp -1) of which ALEPH 4recorded ’on tape’ an overall efficiency of 93.9 %. This global efficiency is again an improvement on previous years reflecting the excellent low background conditions as well as the detector performance. The on-line run quality assessment of the data reported very few problems throughout the year. However, the off line reconstruction of the charged tracks has revealed unexpected time-dependent fluctuations in the TPC alignment constants which have been attributed to a large beam loss incident in August inside ALEPH. This years data includes 7.0 pb(exp -1) cp;;ected at 130/136 GeV repeating the experiment of two years ago when the 4 jet anomaly was observed. The anomaly did not reappear. The long standing commitments to the inner tracking chamber (ITC), the electro magnetic calorimeter endcaps (ECAL), the second level trigger, the TPC laser system and the microvertex detector (VDET2) electronics have been maintained. In addition, the UK groups continue to participate heavily in the running and coordination fo the experiment at Echenvex. ALEPH has published 23 papers since last years report, and submitted many contributed papers to the Jerusalem EPS conference. Also, UK physicist have given 12 talks at International Conferences. The UK W physics and gamma-gamma analysis groups have continued to meet fairly regularly throughout the year.

Derived from text

Anomalies; Luminosity; Positrons; Quarks; Quantum Chromodynamics; Higgs Bosons; Supersymmetry

19990045929 Technische Hochschule, Aachen, Germany

OPAL: An Omni-Purpose Apparatus for LEP with 4 Pi Coverage

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 159-178; In English; See also 19990045908

Report No.(s): Proposal-720; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

The past year has seen a record integrated luminosity of 73 pb(exp -1) delivered to OPAL with a Large Electron Positron (LEP) luminosities of 5X10(exp 31) cm(exp -2) s(exp -1) and 2 pb(exp -1) day (-1). During the 1996/97 Winter shutdown, the number of radio frequency cavities installed around LEP was increased from 172 to 240. After recommissioning the accelerator in JUly 197 and calibrating the four experiments with a short run on the Z(exp 0) peak, the Lep center-of-mass energy was increased to 183 GeV. During October, LEP spent one week at lower center-of-mass energies, 130 and 136 GeV. The data collected were sufficient to exclude definitively a possible new particle as explanation for the apparent excess of 4-jet events observed by ALEPH at these energies during 1995. by the LEP shutdown in early November, OPAL had accumulated 57pb(exp -1) of data around 183 GeV. Physics analysis is well underway, with a comprehensive set of preliminary results already shown at the LEPC meeting. OPAL operated with customary reliability and efficiency throughout 1997. Two upgrades were commissioned early in this year’s running, both with substantial UK contributions: an extension of the tile-scintillator system to low angles, and new online trigger software. Judicious colimator settings were required to reduce the otherwise intolerable background of off momentum particles which arose following the rupture of a LEP vacuum window.

Derived from text

Electrons; Positrons; Bosons; Quantum Chromodynamics; Higgs Bosons; Hadrons; Quarks

19990045930 Ames Lab., IA USA

DELPHI: A Detector with Lepton, Photon and Hadron Identification

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 178-194; In English; See also 19990045908
Report No.(s): Proposal-740; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

A total of 53.9 pb(exp -1) was recorded by DELPHI at energies around 193 GeV. In addition 6 pb(exp -1) were recorded at energies of 130 and 1236 GeV in an attempt to elucidate the threshold for ZZ pair production; the first such event was observed by DELPHI. The analysis of data taken at energies of 161 and 172 GeV in 1996 is now well advanced, many papers described analyses of data taken above Z(exp 0) energies. UK physicist are deeply involved in several aspects of LEP2 physics, as well as in ongoing high-precision analyses of z(exp)) production and decay properties. The UK physicist have been most active in studies summarized in the report.
Derived from text

Hadrons; Leptons; Pair Production; Photons; Higgs Bosons; Quantum Chromodynamics

19990045931 Birmingham Univ., UK

H1: A Detector for HERA Experiments

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 195-220; In English; See also 19990045908
Report No.(s): Proposal-750; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

The positron-proton collider, Hadron Elektron Ring Anlage (HERA) has recently completed its most successful year of running so far. The machine began operation in May and ran efficiently with very few breaks until October 1997. The amount of data delivered to the colliding beam experiments H1 and Zeus, surpasses that delivered in all previous years combined. Positron beams with high polarisation were provided as a standard for the HERMES experiment. In addition the HERA-B experiment took a large amount of test data. H1 achieved an overall data taking efficiency of 80%. New detector components took data for the first time including: (1) the central silicon tracking detector, (2) the backward silicon tracking detector, (3) a proton spectrometer, and (4) an additional electron tagger. In 1997 physics analyses were performed using the previous years' data and also using a substantial part of the data collected in the present year. Notable H1 results in 1997 include: (1) observation of an excess in the number of events observed at high Q(exp 2) above the standard model prediction; (2) observation of a number of events containing a high P(sub T) isolated lepton and large missing transverse momentum, (3) new measurements of the proton structure function F(sub 2) across the range Q(exp 2) greater than .35 and Q(exp 2) less than 5000 GeV(exp 2); (4) a determination of the gluon density in the proton from deep inelastic charm production; (5) a measurement of jet production at low Q(exp 2) enabling an examination of the structure of the virtual photon.
Author

Gluons; Leptons; Photons; Positrons; Protons; Quantum Chromodynamics; Charm (Particle Physics); High Energy Electrons; Hadrons; Vector Mesons

19990045932 Argonne National Lab., IL USA

ZEUS: A Detector for HERA

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 221-237; In English; See also 19990045908
Report No.(s): Proposal-760; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

In 1997 Hadron Electron Ring Anlage (HERA) again ran with 820 GeV protons and 27.5 GeV positrons. The expectation that a short shutdown in the winter of 1996/1997 would lead to a rapid startup and high efficiencies for both HERA and zEUS was fully met. A total of 36 pb(exp -1) was delivered of which almost 27 pb(exp -1) was collected by the zEus experiment for physics analysis. Thus HERA delivered more than twice as much luminosity in 1997 as in 1996, and the average efficiency of ZEUS was 75 % significantly higher than for any previous year. This was at least partly due to the fact that very few changes were made between the 1996 and 1997 run periods. Another benefit of this policy is that as triggers and detector configurations are practically identical for both years, the 1996 and 1997 data samples can easily be combined into a single sample. Analysis of the combined sample is already well advanced, and first results from the earlier part of the 197 data have already been presented at the Summer conference. The UK groups have continued to play a full part in the data taking,lk providing two of the four run coordinators in 1997 as well as several of the designated shift leaders and crew. We also supply the gas officer for the whole experiment.

Other roles played by UK physicist in 1997 include overall tracking coordinator, Monte Carlo code editor /manager, a coordinator of one of the four physics groups, and the physics chairperson.
Author
Hadrons; Photons; Photoproduction; Kaons; Quantum Chromodynamics; Charm (Particle Physics)

19990045933 Albany Univ., Albany, NY USA
The ATLAS Project
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 238-265; In English; See also 19990045908; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

1997 has been a year of both consolidation and further development for the A Toroidal LHC ApparatuS (ATLAS) experiment at Large Hadron Collider (LHC) scheduled to start data taking in the year 2005. A series of major Technical Design Reports (TDRs) were submitted for review by the LHCC on the following: (1) Calorimeter performance, (2) Liquid Argon Calorimetry, (3) Tile Calorimetry, (5) Inner detector (SCT and TRT), Muon Spectrometer, Magnet system. These TDRs have been favorably received by the LHCC and approved by the CERN research board and the Director-General. Specific milestones have been set for each part of the ATLAS detector for future monitoring by the LHCC. For other ATLAS detector systems, TDRs will be produced when required, in advance of the construction phase. The main areas of UK activity as detailed in this report are the semiconductor tracker (SCT), the level-1 calorimeter trigger, software development and physics studies.
Author
Actuators; Calorimeters; Spectrometers; Toroids; Design Analysis; Prototypes; Silicon Radiation Detectors; Electronic Equipment; Software Engineering

19990045934 Bristol Univ., UK
The Compact Muon Solenoid (CMS) Detector
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 266-285; In English; See also 19990045908
Report No.(s): Proposal-892; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

The Compact Muon Solenoid (CMS) experiment is a general purpose detector designed to run at the highest luminosity at LHC. It has been optimized for the search for the Standard Model Higgs Boson over a mass range from 90 GeV / C(exp 2), and it will also be sensitive to a wide range of possible signatures from alternative electro-weak symmetry breaking mechanisms. Muons, photons and electrons will be identified and measured with high precision. The project has made substantial progress during the year and there has been a further optimization of the overall design of the detector. Most notably, the radius of the Barrel Electromagnetic Calorimeter has been reduced from 1430 mm to 1290 mm. This, together with an increase in the cross section of the crystals, has reduced the number of channels in the barrel from 88 128 to 61 200, allowing a contingency to be created in the cost estimate. The size of the Endcap crystals has also been increased and the outer radius of the Dees decreased, thus reducing the channel count in this region by 9% to 21 500. The new layout has also improved the interface between the barrel and Endcap sections, allowing cables and services to be routed through the gap between the two, without causing a loss in acceptance. The space freed behind the ECAL will be used to increase the thickness of the Hadron Calorimeter (HCAL) by two more absorber layers. The Tracker system has been concentrating on re-optimizing the overall design, following a substantial reduction in the cost of silicon microstrip detectors. The lower cost is possible only by using p implanted diodes on n-type detector material and operating at high bias voltages, which has been demonstrated in detector tests from a range of manufacturers.The technical design reports (TDRs) for the HCAL and the magnet system were submitted this year and have been approved by the research board. Preparation of the ECAL TDR has been a major task during the latter part of the year with UK physicist making leading contributions. In particular, they have been responsible for undertaking the complete detector performance studies and writing the corresponding chapter, and for writing all the endcap specific sections. The Tracker TDR has been delayed to allow for the reoptimization of the design.
Author
Calorimeters; Crystals; High Voltages; Solenoids; Radiation Counters; Equipment Specifications; Experiment Design; Electromagnetic Measurement; Monte Carlo Method

19990045935 Alberta Univ., Edmonton, Alberta Canada
Measurements of the Spin Structure of the Nucleon at HERA
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 286-287; In English; See also 19990045908
Report No.(s): Proposal-780; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

The HERMES collaboration was set up to make measurements of the spin structure of the nucleon. It is now studying spin dependent deep inelastic scattering from the proton and neutron using the 27 GeV polarized positron beam at HERA in conjunction with internal polarize3d gas targets of hydrogen and deuterium. The HERMES spectrometer is being upgraded during the 1997-98 shutdown. The threshold Cerenkov counter is being changed to a RICH to allow improved particle identification, particularly the separation of kaons from pions. A muon detector is also being installed behind the spectrometer iron yoke to improve the efficiency for the detection of J/psi particles.
Author
Inelastic Scattering; Kaons; Nucleons; Pions; Particle Spin

19990045936 Birmingham Univ., School of Physics and Space Research, UK
Opto Electronic Modulator Readout for LHC Tracking Detectors
Charlton, D., Birmingham Univ., UK; Dawson, I., Birmingham Univ., UK; Dowell, J. D., Birmingham Univ., UK; Homer, R. J., Birmingham Univ., UK; Kenyon, I. R., Birmingham Univ., UK; Mahout, G., Birmingham Univ., UK; Oglesby, S. J., Birmingham Univ., UK; Shaylor, H. R., Birmingham Univ., UK; Wilson, J. A., Birmingham Univ., UK; Particle Physics Experiments Report, 1997; Feb. 1998, pp. 288-289; In English; See also 19990045908
Report No.(s): Proposal-803; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

Data transfer from the frontend via optical fiber links is highly attractive; it reduces the volume of material by a factor of ten compared to copper twisted pairs and the number of radiation lengths of material by a factor of one hundred. Ground loops, electronic pickup between channels and high power drivers are eliminated. Possible means of converting the electronic signals at the frontend to optical signals rely on either active elements (lasers or LEDs) or passive modulators. In the case of modulators the light source is a laser at the electronics barrack and the light is piped by fiber to the modulator. Electronic signals applied to the modulator affect the light level it transmits or reflects; and this modulated signal is returned o the electronics barrack via optical fibers.
Author
Modulators; Optical Communication; Optical Fibers; Silicon Radiation Detectors; Research and Development; Systems Engineering

19990045937 Bristol Univ., UK
Diamond Detectors
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 290-291; In English; See also 19990045908
Report No.(s): Proposal-812; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

The RD42 collaboration continues to explore the potential of diamond as the active medium in both microstrip and pixel devices for use in high radiation levels, such as those encountered by vertex detectors in LHC experiments.
Derived from text
Diamonds; Microstrip Devices; Pixels; Radiation Counters

19990045938 Brunel Univ., Uxbridge, UK
Dense, Fast, Radiation-Tolerant Fluoro-Hafnate Glass Scintillators for Electromagnetic Calorimeters in High Energy Physics
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 292-293; In English; See also 19990045908
Report No.(s): Proposal-883; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

Work has continued during the year on the development of large blocks of scintillating glass for use in electromagnetic calorimetry. The material is a cerium doped heavy-metal-fluoride-glass which has a radiation length of 16mm. The present goal is to produce 12 blocks of glass with dimensions 20 X 30 X 140 cubic millimeters, in order to test a prototype calorimeter module in a high energy electron beam at CERN. The Russian collaborators, are particularly interested in new methods of production applicable to a wider range of glasses, since traditional casting methods limit the choice of materials to stable glas forming mixtures. The Institute of General Physics Moscow has made a large block of fluoride glass by a novel casting technique and a large block of scintillating glass has now been produced by hot isostatic pressing. It is planned that blocks made by these institutions will form part of the calorimeter array to be tested at CERN.
Author
Calorimeters; Cerium; Glass; Hot Isostatic Pressing; Metal Fluorides; Scintillation Counters; Metallic Glasses; Transmission

19990045939 Ecole Polytechnique, Lab. pour l'Utilisation des Lasers Intenses, Palaiseau, France

Laser/Plasma Particle Acceleration Experiments

Particle Physics Experiments Report, 1997; Feb. 1998, pp. 294-295; In English; See also 19990045908

Report No.(s): Proposal-895; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11,0QX, UK), Hardcopy, Microfiche

Recent experiments around the world, including those performed at the Vulcan facility, have shown the possibility of using plasma waves as a medium for high gradient particle acceleration. In our experiments we have been able to demonstrate electrons, from the plasma itself, being self-trapped in the accelerating structure up to energies of 100 MeV. Copious numbers of electrons are produced by this self trapping. It is estimated that there are 10(exp 11) electrons with energy greater the 1 MeV produced in our experiment. With the current rate of advancement of the physics of the laser driver, it is imagined that this process will be a useful source of electrons in this energy range.

Derived from text

Electrons; High Acceleration; Laser Pumping; Particle Acceleration; Plasma Waves; Plasmas (Physics)

19990045967 National Inst. for Fusion Science, Toki, Japan

Molecular Dynamics Simulation of Structure Formation of Short Chain Molecules

Fujiwara, Susumu, National Inst. for Fusion Science, Japan; Sato, Tetsuya, National Inst. for Fusion Science, Japan; November 1998; ISSN 0915-633X; 20p; In English

Report No.(s): NIFS-577; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Molecular dynamics simulations are carried out to study the structure formation of 100 short chain molecules, each of which consists of 20 CH2 groups. Our simulations show that the orientationally ordered structure is formed from a random configuration by quenching. The global orientational order starts to increase suddenly after a certain duration and grow in a stepwise fashion afterwards. This behavior is also found in the growth process of the local orientationally-ordered regions. It is found from the microscopic analysis of the structure formation process that parallel ordering of chain molecules starts to occur after the rigidity of chain molecules grows to some extent. From the analysis of the obtained orientationally ordered structure and the molecular mobility, we also find the following characteristic features: (1) The chain molecules are packed hexagonally at 400 K and the transition from the hexagonal phase toward the orthorhombic phase takes place as the temperature decreases. (2) The gauche bonds in the same chain molecule tend to form gauche pairs. The gauche pairs with the same sign form the double gauche defects and those with the opposite sign form the kink defects. (3) In the hexagonal phase, the chain molecules become longitudinally mobile. This result, which is obtained by the microscopic analysis of the chain motion, is the microscopic evidence to confirm the existence of the chain sliding diffusion in the hexagonal phase which underlies the sliding diffusion theory of polymer crystallization proposed by Hikosaka.

Author

Molecular Dynamics; Simulation; Research; Microstructure

19990046039 Los Alamos National Lab., NM USA

Feasibility of using boron-loaded plastic fibers for neutron detection

Grazioso, R. F.; Heger, A. S.; Ensslin, N.; Mayo, D. R.; Mercer, D. J.; Dec. 31, 1998; 7p; In English; Symposium on radiation measurements and applications

Report No.(s): DE99-000667; LA-UR-98-1891; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The results from simulations and laboratory experiments with boron-loaded plastic scintillating fibers as a nondestructive assay tool are presented. Single and multiclad fibers in three diameters of 0.25, 0.5, and 1 mm were examined for their application in neutron coincident counting. For this application, the simulation results show that various configurations of boro-loaded plastic scintillating fibers have a die-away time ((tau)) of 12 (micro)s with an efficiency ((var-epsilon)) of 50%. For a comparable efficiency He-3 proportional tubes have a typical die-away time of 50 (micro)s. The shortened die-away time can reduce the relative error for measurement of similar samples by up to 50%. Plastic scintillating fibers also offer flexible configurations with the potential to discriminate between signals from gamma- ray and neutron events. to date, the emphasis of the investigation has been the detection capability of plastic scintillating fibers for neutrons and gamma rays and evaluation of their ability to discriminate between the two events. Quantitative calculations and experiments have also been conducted to determine the light output, evaluate the noise,quantify light attenuation, and determine neutron detection efficiency. Current experimental data support the analytical results that boron-loaded plastic fibers can detect thermal neutrons with performance metrics that are comparable or better than those of He-3 proportional tubes.

NTIS

Boron; Detection; Thermal Neutrons

19990046268 NASA, Washington, DC USA

Centrality and collision system dependence of antiproton production from p+A to Au+Au collisions at AGS energies

Sako, H., Tsukuba Univ., Japan; Ahle, L., Massachusetts Inst. of Tech., USA; Akiba, Y., High Energy Accelerator Research Organization, Japan; Ashktorab, K., Brookhaven National Lab., USA; Baker, M. D., Massachusetts Inst. of Tech., USA; Beavis, D., Brookhaven National Lab., USA; Britt, H. C., Lawrence Livermore National Lab., USA; Chang, J., California Univ., USA; Chasman, C., Brookhaven National Lab., USA; Chen, Z., Brookhaven National Lab., USA; Chu, Y. Y., Brookhaven National Lab., USA; Cianciolo, V., Oak Ridge National Lab., USA; Cole, B. A., Columbia Univ., USA; Crawford, H. J., California Univ., USA; Cumming, J. B., Brookhaven National Lab., USA; Debbe, R., Brookhaven National Lab., USA; Dunlop, J. C., Massachusetts Inst. of Tech., USA; Eldredge, W., California Univ., USA; Engelage, J., California Univ., USA; Fung, S.-Y., California Univ., USA; Dec. 31, 1997; 6p; In English

Contract(s)/Grant(s): DE-AC02-98CH-10886; DE-FG02-86ER-40281; W-7045-eng-48; DE-AC02-76ER-03069; DE-FG03-86ER-40271; NGR-05-003-513; KOSEF-951-0202-032-2

Report No.(s): DE98-004992; BNL-65375; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Antiproton production in heavy ion collisions reflects subtle interplay between initial production and absorption by nucleons. Because the AGS energies (10--20 A(center-dot)GeV/c) are close to the antiproton production threshold, antiproton may be sensitive to cooperative processes such as QGP and hadronic multi-step processes. On the other hand, antiproton has been proposed as a probe of baryon density due to large N(anti N) annihilation cross sections. Cascade models predict the maximum baryon density reaches about 10 times the normal nucleus density in central Au+Au collisions, where the strong antiproton absorption is expected. In this paper, the authors show systematic studies of antiproton production from p+A to Au+Au collisions.

NTIS

Annihilation Reactions; Antiprotons; Particle Production; Baryons; Gold Isotopes; Ionic Collisions

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NUCLEAR AND HIGH-ENERGY PHYSICS

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

19990043986 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA

Progress Report: SNS Neutronics Studies

Charlton, L. A.; Barnes, J. M.; Johnson, J. O.; Gabriel, T. A.; Dec. 31, 1998; 8p; In English; ICANS: 14. conference on the international collaboration on advanced neutron sources

Report No.(s): DE99-000238; ORNL/CP-99605; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The proposed Spallation Neutron Source (SNS) facility will consist of two parts: (1) a high-energy (1-GeV) and high-powered (1-MW) proton accelerator (linac) and accumulator ring, and (2) a target station that produces low-energy (is less than 2-eV) neutrons and delivers them to the neutron scattering instruments. It will be a 60-Hz facility, delivering 6 x 10(exp 15) protons each second in 60 1-micros pulses with a linac length of 490 m and an accumulator ring circumference of 220 m. This paper deals with the second part of the facility: the design and development of the SNS target station proposed for Oak Ridge National Laboratory (ORNL). Some of the more recent work will be presented, including a premoderator study, validation comparisons with experiment, sensitivity studies of cryogenic H2 moderator output to assumed ortho/para admixtures, and the construction of a more detailed model geometry.

NTIS

Spallation; Neutron Sources; Linear Accelerators; Storage Rings (Particle Accelerators); Protons

19990043987 Department of Energy, Office of Energy Research, Washington, DC USA

Radioactive Foil Analysis of 1.5 GeV Proton Bombardment of a Hg Target

Charlton, L. A.; Gabriel, T. A.; Jerde, E.; Glasgow, D. C.; Dec. 31, 1998; 4p; In English

Report No.(s): DE99-000239; ORNL/CP-99623; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The number of reactant nuclei in a series of foils surrounding a container of Hg that has been bombarded by 1.5 GeV protons is calculated and compared to experimental measurements. This is done to aid in the validation of the Hg cross sections used in the design studies of the Spallation Neutron Source (SNS). It was found that the calculations match the measurements to within the uncertainties inherent in the analysis.

NTIS

Mercury (Metal); Protons; Nuclear Reactions

19990043992 Department of Energy, Washington, DC USA

Uniformity model for energetic ion processes using a Kaufman ion source

Smith, D. J.; Warner, J. A.; LeBarron, N.; Dec. 31, 1998; 3p; In English

Report No.(s): DE99-001030; DOE/SF/19460-269; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Processes that use energetic ions for large substrates require that the time-averaged erosion effects from the ion flux be uniform across the surface. A numerical model has been developed to determine this flux and its effects on surface etching of a silica/photoresist combination. The geometry of the source and substrate is very similar to a typical deposition geometry with single or planetary substrate rotation. The model was used to tune an inert ion-etching process that used single or multiple Kaufman sources to less than 3% uniformity over a 30 cm aperture after etching 8 (micro)m of material. The same model can be used to predict uniformity for ion-assisted deposition (IAD).

NTIS

Ion Sources; Ions; Mathematical Models

19990044015 Department of Energy, Office of Energy Research, Washington, DC USA

Measurement of the E1 Strength Function of Be-11

Varner, R. L.; Gan, N.; Beene, J. R.; Dec. 31, 1998; 7p; In English; ENAM '98: 2. international conference on exotic nuclei and atomic masses

Report No.(s): DE99-000208; ORNL/CP-99406; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have investigated the E1 strength function of Be-11 by Coulomb excitation and measurement of the subsequent projectile photon decay. The photons were measured in a wall of BaF2 detectors. The authors have used the virtual photon method to extract the photoabsorption cross section and hence the dipole strength function. They compare the findings with sum rule predictions. This is a first example of techniques they will extend to heavier mass nuclei.

NTIS

Electron Transitions; Atomic Theory; Excitation; Beryllium Isotopes

19990044061 Maryland Univ., Dept. of Physics, College Park, MD USA

Search for the B(sub c) meson in hadronic Z(0) decays using the OPAL detector at LEP

Herndon, M. F.; Dec. 31, 1999; 145p; In English

Report No.(s): DE99-001320; DOE/ER/41015-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A search for decays of the B(sub c) meson was performed using data collected from 1990--1995 with the OPAL detector on or near the Z(0) peak at LEP. The decay channels B(sub c)(+) yields J/(psi)(pi)(+), B(sub c)(+) yields J/(psi)a(sub 1)(+) and B(sub c)(+) yields J/(psi) (ell)(+)(nu) were investigated, where (ell) denotes an electron or a muon. Two candidates are observed in the mode B(sub c)(+) yields J/(psi)(pi)(+), with an estimated background of (0.63 +/- 0.20) events. The weighted mean of the masses of the two candidates is (6.32 +/- 0.06) GeV/sq c, which is consistent with the predicted mass of the B(sub c) meson. One candidate event is observed in the mode B(sub c)(+) yields J/(psi)(ell)(+)(nu), with an estimated background of (0.82 +/- 0.19) events. No candidate events are observed in the B(sub c)(+) yields J/(psi)a(sub 1)(+) decay mode, with an estimated background of (1.10 +/- 0.22) events. Upper bounds at the 90% confidence level are set on the production rates for these processes.

NTIS

Bosons; Particle Decay; Mesons; Hadrons

19990044073 Oak Ridge National Lab., TN USA

Efficient use of Bayes' equations for fitting neutron-induced cross section and integral data

Larson, N. M.; Leal, L. C.; Derrien, H.; Dec. 31, 1998; 6p; In English; International conference on the physics of nuclear science and technology

Report No.(s): DE99-001342; ORNL/CP-96092; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Analysis of differential and integral neutron data requires the use of a fitting procedure such as Bayes' method, used in the analysis code SAMMY. In this paper, techniques for more efficient use of Bayes' method are described. A reformulation of Bayes' equations permits truly simultaneous fitting to multiple measurements without overhead costs required for calculating theoretical values simultaneously. Several techniques for properly including data covariances are also described.

NTIS

Neutron Cross Sections; Bayes Theorem; Neutrons

19990044085 Department of Energy, Office of Energy Research, Washington, DC USA
Nuclear interactions of high energy heavy ions and applications in astrophysics ***Final Report***
Wefel, J. P.; Guzik, T. G.; Jun. 25, 1998; 97p; In English
Report No.(s): DE99-001164; DOE/ER/40147-12; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Projectile fragmentation experiments have been conducted at the LBL Bevalac accelerator, utilizing both the B40 and the HISS facilities, to produce a dataset of 36 beam/energy combinations covering projectiles from He-4 to Ni-58 and various energies from 170--2100 MeV/nucleon. While some runs were subject to beam instabilities, magnet problems or low statistics, there remains a large dataset which is still being analyzed. The results will be used to investigate the physics of the intermediate energy fragmentation process and will find application in the astrophysics of cosmic ray propagation in the galaxy. An overview of the science goals and rationale is followed by presentation of the experimental techniques and apparatus that has been employed. Data analysis, including both detector subsystem and accelerator calibration, is discussed with emphasis on the unique features of the dataset and the analysis problems being addressed. Results from the experiments are presented throughout to illustrate the status of the analysis, e.g., momentum distribution widths. Total, Elemental and Isotopic cross sections from various beam/energy combinations are presented, including the first data on S-32 fragmentation and the complete isotopic fragmentation cross sections for Si-28 interacting in both Carbon and Hydrogen targets. The new results are compared to any existing data and to formulae used to predict unmeasured cross sections. The size and complexity of the dataset and the required detail of the analysis precluded finishing the full analysis under the subject grant. Plans for additional analysis are presented, and these will be carried out in coming years as time and resources permit.
NTIS
Nuclear Interactions; Heavy Ions; Astrophysics

19990045628 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Synchrotron Radiation: Why Does New Radiation Open New Fields?
Matoba, Masaru, Kyushu Univ., Japan; Jul. 1998; 7p; In Japanese; See also 19990045622; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Synchrotron radiation is discussed on subjects from the principle of the generation to effects on the interdisciplinary basic and applied researches and the potentiality for the regional industrial basis.
Author
Synchrotron Radiation; Radiation Protection; Synchrotrons

19990045662 Department of Energy, Assistant Secretary for Human Resources and Administration, Washington, DC USA
Three-dimensional computational fluid dynamics for the Spallation Neutron Source liquid mercury target
Wendel, M. W.; Siman-Tov, M.; Dec. 31, 1998; 8p; In English; Nuclear applications of accelerator technology, USA
Report No.(s): DE99-000388; ORNL/CP-98989; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Spallation Neutron Source (SNS) is a high-power accelerator-based pulsed spallation source being designed by a multilaboratory team led by Oak Ridge National Laboratory (ORNL) to achieve high fluxes of neutrons for scientific experiments. Computational fluid dynamics (CFD) is being used to analyze the SNS design. The liquid-mercury target is subjected to the neutronic (internal) heat generation that results from the proton collisions with the mercury nuclei. The liquid mercury simultaneously serves as the neutronic target medium, transports away the heat generated within itself, and cools the metallic target structure. Recirculation and stagnation zones within the target are of particular concern because of the likelihood that they will result in local hot spots. These zones exist because the most feasible target designs include a complete U-turn flow redirection. Although the primary concern is that the target is adequately cooled, the pressure drop from inlet to outlet must also be considered because pressure drop directly affects structural loading and required pumping power. Based on the current design, a three-dimensional CFD model has been developed that includes the stainless steel target structure, the liquid-mercury target flow, and the liquid-mercury cooling jacket that wraps around the nose of the target.
NTIS
Spallation; Neutron Sources; Mercury (Metal); Targets; Computer Aided Design; Design Analysis

19990045665 Department of Energy, Office of Energy Research, Washington, DC USA
High density matter in AGS, SPS and RHIC collisions, Volume 9
Dec. 31, 1998; 82p; In English; Conference on high density matter in AGS, SPS and RHIC collisions
Report No.(s): DE99-000789; BNL-65762; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This 1-day workshop focused on phenomenological models regarding the specific question of the maximum energy density achievable in collisions at AGS, SPS and RHIC. The idea was to have 30-minute (or less) presentations of each model--but not

the model as a whole, rather then that strongly narrowed to the above physics question. The key topics addressed were: (1) to estimate the energy density in heavy-ion collisions within a model, and to discuss its physical implications; (2) to suggest experimental observables that may confirm the correctness of a model approach--with respect to the energy density estimate; (3) to compare with existing data from AGS and SPS heavy-ion collisions, and to give predictions for the future RHIC experiments. G. Ogilvie started up the workshop with a critical summary of experimental manifestations of high-density matter at the AGS, and gave a personal outlook on RHIC physics. R. Mattiello talked about his newly developed hadron cascade model for applications to AGS and SPS collisions. Next, D. Kharzeev gave a nice introduction of the Glauber approach to high-energy collisions and illustrated the predictive power of this approach in nucleus-nucleus collisions at the SPS. It followed S. Vance with a presentation of the baryon-junction model to explain the observed baryon stopping phenomenon in collisions of heavy nuclei. S. Bass continued with a broad perspective of the UrQMD model, and provided insight into the details of the microscopic dynamical features of nuclear collisions at high energy. J. Sandweiss and J. Kapusta addressed the interesting aspect of photon production in peripherical nuclear collisions due to intense electromagnetic bremstrahlung by the highly charged, fast moving ions. Finally, H. Sorge closed up the one-day workshop with a presentation of his recent work with the RQMD model. This report consists of a summary and vugraphs of the presentations.
NTIS
Ionic Collisions; Conferences; Flux Density

19990045667 Department of Energy, Office of Energy Research, Washington, DC USA
Fermion frontiers in vector lattice gauge theories, Volume 8
Dec. 31, 1998; 172p; In English; Conference on fermion frontiers in vector lattice gauge theories
Report No.(s): DE99-000783; BNL-65634; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The inclusion of fermions into simulations of lattice gauge theories is very difficult both theoretically and numerically. With the presence of Teraflops-scale computers for lattice gauge theory, the authors wanted a forum to discuss new approaches to lattice fermions. The workshop concentrated on approaches which are ripe for study on such large machines. Although lattice chiral fermions are vitally important to understand, there is not technique at hand which is viable on these Teraflops-scale machines for real-world problems. The discussion was therefore focused on recent developments and future prospects for Quantum Chromodynamics (QCD)-like theories. For the well-known fermion formulations, the Aoki phase in Wilson fermions, novelties of U(sub A)(1) symmetry and the (eta) (prime) for staggered fermions and new approaches for simulating the determinant for Wilson fermions were discussed. The newer domain-wall fermion formulation was reviewed, with numerical results given by many speakers. The fermion proposal of Friedberg, Lee and Pang was introduced. They also were able to compare and contrast the dependence of QCD and QCD-like SUSY theories on the number of quark flavors. These proceedings consist of several transparencies and a summary page from each speaker. This should serve to outline the major points made in each talk.
NTIS
Conferences; Fermions; Gauge Theory

19990045756 Department of Energy, Office of Energy Research, Washington, DC USA
RHIC spin physics, Volume 7
Dec. 31, 1998; 411p; In English; RIKEN-BNL workshop on RHIC spin physics
Report No.(s): DE99-000790; BNL-65615; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This proceedings compiles one-page summaries and five transparencies for each talk, with the intention that the speaker should include a web location for additional information in the summary. Also, email addresses are given with the participant list. The order follows the agenda: gluon, polarimetry, accelerator, W production and quark/antiquark polarization, parity violation searches, transversity, single transverse spin, small angle elastic scattering, and the final talk on ep collisions at RHIC. The authors begin the Proceedings with the full set of transparencies from Bob Jaffe's colloquium on spin, by popular request.
NTIS
Conferences; Particle Production; Particle Spin

19990045762 Department of Energy, Washington, DC USA
Accident analysis for aircraft crash into hazardous facilities: A statistical primer
Rock, J. C.; Dec. 31, 1998; 26p; In English
Report No.(s): DE99-000456; ANRCP-1998-20; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The DOE Standard 3014-96, Accident Analysis for Aircraft Crash into Hazardous Facilities provides a robust statistical framework useful for assessing the release frequency for hazardous materials used in many industrial operations. The formulae and the verbal instructions for calculating screening quantities and frequencies in the DOE Standard are consistent with an

unstated underlying six-term expression for estimating the annual number of aircraft- impact-related releases. The six-term formula is here shown to result from iterated application of Bayes' rule. The statistical concepts underlying this formula are explained; the six-term model is then developed and its components related to the corresponding elements of the four-factor model presented in the Standard. The six-term model is shown to be consistent with the instructions given in the Standard for calculating the screening and evaluation quantities using the four-factor model. The difference between screening and evaluation of release frequencies is clarified. Discussion of the six-term model shows clearly how conservative approximations to its conditional probability terms lead to simple and efficient screening formulae. A numerical example is provided to demonstrate a screening calculation.
NTIS
Aircraft Accidents; Hazardous Materials; Probability Theory; Aircraft Accident Investigation

19990045763 Department of Energy, Office of Energy Research, Washington, DC USA
Hadron mass scaling in Regge phenomenology
Burakovsky, L.; Dec. 31, 1998; 6p; In English; International conference on parameterized relativistic quantum theory (PROT '98)
Report No.(s): DE99-000434; LA-UR-98-1843; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The authors show that Regge phenomenology is consistent with the only scaling law for the hadron masses, M(sup star)/M = (alpha)(prime)/(alpha)(prime) (sup star)(sup 1/2), where asterisk indicates a finite-temperature quantity. Phenomenological models further suggest the following expression of the above scaling in terms of the temperature-dependent gluon condensate: M(sup star)/M = (alpha)(prime)/(alpha)(prime)(sup *)(sup 1/2) = <G(sub mu)(nu)(sup alpha)>(sup *)/<G(sup alpha)(mu)(nu)>(sup 1/4).
NTIS
Scaling Laws; Hadrons; Particle Mass

19990046318 Los Alamos National Lab., NM USA
Time-grated energy-selected cold neutron radiography
McDonald, T. E.; Brun, T. O.; Claytor, T. N.; Farnum, E. H.; Greene, G. L.; Dec. 31, 1998; 20p; In English; International topical meeting on neutron radiography
Report No.(s): DE99-001123; LA-UR-98-833; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
A technique is under development at the Los Alamos Neutron Science Center (LANSCE), Manuel Lujan Jr. Neutron Scattering Center (Lujan Center) for producing neutron radiography using only a narrow energy range of cold neutrons. The technique, referred to as Time-Gated Energy-Selected (TGES) neutron radiography, employs the pulsed neutron source at the Lujan Center with time of flight to obtain a neutron pulse having an energy distribution that is a function of the arrival time at the imager. The radiograph is formed on a short persistence scintillator and a gated, intensified, cooled CCD camera is employed to record the images, which are produced at the specific neutron energy range determined by the camera gate. The technique has been used to achieve a degree of material discrimination in radiographic images. For some materials, such as beryllium and carbon, at energies above the Bragg cutoff the neutron scattering cross section is relatively high while at energies below the Bragg cutoff the scattering cross section drops significantly. This difference in scattering characteristics can be recorded in the TGES radiography and, because the Bragg cutoff occurs at different energy levels for various materials, the approach can be used to differentiate among these materials. This paper outlines the TGES radiography technique and shows an example of radiography using the approach.
NTIS
Time Dependence; Energy Levels; Cold Neutrons; Neutron Radiography

19990046335 Department of Energy, Office of Energy Research, Washington, DC USA
High Energy Physics Group at the University of South Alabama ***Final Report, 15 Apr. 1990 - 14 Apr. 1997***
Jenkins, C. M., Department of Energy, USA; Clark, R. K., Department of Energy, USA; Aug. 15, 1998; 17p; In English
Report No.(s): DE99-000511; DOE/ER/40564-T1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The experimental high energy physics group at the University of South Alabama worked on three experiments conducted at the Fermi National Accelerator Laboratory. These experiments were E-705, E-771, and E-871. The group helped in taking data, analysis of data, and for one experiment in the construction of a new spectrometer. Experiment E-705 used 300 GeV/c p, pi(-), anti-p, and pi(+) on Li to study hadronic production of charmonium and direct photon production. The authors participated in the E-705 data analysis. They helped in the assembly of the E-771 spectrometer. E-771 used 800 GeV/c p-Si interactions to study hadronic beauty production and charmonium production. The groups task was to bring up the electromagnetic calorimeter and interface it into the data acquisition system. Off-line work done for the analysis of E-771 concentrated on the electromagnetic reconstruction package. Other work done in conjunction with E-771 included the development of a tracking program that used

the Hough Transformation. In March of 1994, the group joined Experiment E-871. This experiment is a search for CP violation. The group took responsibility for the scintillation trigger hodoscopes to be used by the experiment.
NTIS
High Energy Interactions; Radiation Detectors; Particle Production; Research

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OPTICS

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

19990043991 Department of Energy, Washington, DC USA
Wideband optical monitor for a planetary-rotation coating-system
Campanelli, M. B.; Smith, D. J.; Dec. 31, 1998; 3p; In English
Report No.(s): DE99-001029; DOE/SF/19460-268; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A substrate-specific, through-planet, wideband optical coating monitor is being developed to increase production yield and the understanding of physical vapor deposition (PVD) coatings fabricated in the Optical Manufacturing Laboratory at the University of Rochester's Laboratory for Laser Energetics. In-situ wideband optical monitoring of planetary rotation systems allows direct monitoring of large, expensive substrates with complex layering schemes. The optical monitor discussed here is under development for coating several large (e.g., 80.7 x 41.7 x 9.0 cm) polarizers for the National Ignition Facility. Wideband optical monitoring of the production substrates is used in concert with an array of crystal monitors for process control, film parameter evaluation, and error detection with associated design reoptimization. The geometry of a planetary rotation system, which produces good uniformity across large substrates, makes optical monitoring more difficult. Triggering and timing techniques for data acquisition become key to the process because the optical coating is available only intermittently for monitoring. Failure to properly consider the effects of the system dynamics during data retrieval and processing may result in significant decreases in the spectral data's reliability. Improved data accuracy allows better determination of film thicknesses, indices, and inhomogeneities and enables in-situ error detection for design reoptimization.
NTIS
Broadband; Optical Materials; Monitors; Planetary Rotation; Coating

19990044017 Department of Energy, Office of Energy Research, Washington, DC USA
Progress Towards Sub-Micron Hard X-Ray Imaging Using Elliptically Bent Mirrors and its Applications
MacDowell, A. A.; Lamble, G. M.; Celestre, R. S.; Padmore, H. A.; Chang, C. H.; Jun. 30, 1998; 9p; In English; International symposium on optical science, engineering, and instrumentation
Report No.(s): DE98-059379; LBNL-42032; LSBL-478; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors have developed an x-ray micro-probe facility utilizing mirror bending techniques that allow white light x-rays (4-12keV) from the Advanced light Source Synchrotron to be focused down to spot sizes of micron spatial dimensions. They have installed a 4 crystal monochromator prior to the micro-focusing mirrors. The monochromator is designed such that it can move out of the way of the input beam, and allows the same micron sized sample to be illuminated with either white or monochromatic radiation. Illumination of the sample with white light allows for elemental mapping and Laue x-ray diffraction, while illumination of the sample with monochromatic light allows for elemental mapping (with reduced background), micro-X-ray absorption spectroscopy and micro-diffraction. The performance of the system will be described as will some of the initial experiments that cover the various disciplines of Earth, Material and Life Sciences.
NTIS
X Ray Diffraction; X Ray Optics; X Ray Sources; Mirrors

19990045700 Department of Energy, Office of Financial Management and Controller, Washington, DC USA
Instrumentation of LOTIS: Livermore Optical Transient Imaging System; a fully automated wide field of view telescope system searching for simultaneous optical counterparts of gamma ray bursts
Park, H. S.; Ables, E.; Barthelmy, S. D.; Bionta, R. M.; Ott, L. L.; Mar. 06, 1998; 10p; In English; SPIE international symposium on astronomical telescopes and instrumentation
Report No.(s): DE98-054337; UCRL-JC-130017; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

LOTIS is a rapidly slewing wide-field-of-view telescope which was designed and constructed to search for simultaneous gamma-ray burst (GRB) optical counterparts. This experiment requires a rapidly slewing (is less than 10 sec), wide-field-of-view

(> 15 deg), automatic and dedicated telescope. LOTIS utilizes commercial tele-photo lenses and custom 2048 x 2048 CCD cameras to view a 17.6 x 17.6 deg field of view. It can point to any part of the sky within 5 sec and is fully automated. It is connected via Internet socket to the GRB coordinate distribution network which analyzes telemetry from the satellite and delivers GRB coordinate information in real-time. LOTIS started routine operation in Oct. 1996. In the idle time between GRB triggers, LOTIS systematically surveys the entire available sky every night for new optical transients. This paper describes the system design and performance.
NTIS
Telescopes; Gamma Ray Bursts; Gamma Ray Astronomy; Gamma Ray Sources (Astronomy)

19990045851 Helsinki Univ. of Technology, Dept. of Engineering Physics and Mathematics, Espoo Finland
Effects of Partial Spatial Coherence with Uniform-Intensity Diffractive Axicons
Friberg, A. T.; Popov, S. Y.; 1998; 38p; In English
Report No.(s): PB99-135907; TKK-F-A786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Apodized annular-aperture logarithmic axicons that form uniform-intensity axial line images with coherent light are studied in Gaussian-correlated illumination. Diffractive assessment of the line-image distributions and spatial coherence properties involves a highly oscillating double 2D integral. The on-axis behavior depends only on radial integrals that can be computed with special-purpose routines. The authors show that at all correlation levels the images at off-axis points can be evaluated using a technique based on spline approximations. The authors also demonstrate that the method of stationary phase an be sequentially applied to the 4D diffraction integral yielding accurate 3D closed-form results. The stationary-phase formulas find applications in fast image evaluation, in intensity balancing by varying the irradiance, and in designing axicon phase profiles. This paper complements the authors' earlier study of partially coherent axicon images by radiometric transport techniques.
NTIS
Coherent Light; Diffractive Optics

19990046071 NASA Johnson Space Center, Houston, TX USA
Method and Apparatus for Improved Spatial Light Modulation
Colin, Soutar, Inventor, NASA Johnson Space Center, USA; Juday, Richard D., Inventor, NASA Johnson Space Center, USA; Jan. 12, 1999; 28p; In English
Patent Info.: Filed 24 Oct. 1994; NASA-Case-MSC-22378-2; US-Patent-5,859,728; US-Patent-Appl-SN-327762; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

A method and apparatus for modulating a light beam in an optical processing system is described. Preferably, an electrically-controlled polarizer unit and/or an analyzer unit are utilized in combination with a spatial light modulator and a controller. Preferably, the spatial light modulator comprises a pixelated birefringent medium such as a liquid crystal video display. The combination of the electrically controlled polarizer unit and analyzer unit make it simple and fast to reconfigure the modulation described by the Jones matrix of the spatial light modulator. A particular optical processing objective is provided to the controller. The controller performs calculations and supplies control signals to the polarizer unit, the analyzer unit, and the spatial light modulator in order to obtain die optical processing objective.
Official Gazette of the U.S. Patent and Trademark Office
Liquid Crystals; Light Modulation; Light Beams; Polarizers; Light Modulators

19990046074 National Optical Astronomy Observatories, Tucson, AZ USA
What is Better Than an 8192 x 8192 CCD Mosaic Imager? Two Mosaic Wide Field Imagers, One for KPNO and One for CTIO
Muller, Gary P., National Optical Astronomy Observatories, USA; Reed, Rich, National Optical Astronomy Observatories, USA; Armandroff, Taft, National Optical Astronomy Observatories, USA; Boroson, Todd, National Optical Astronomy Observatories, USA; Jacoby, George, National Optical Astronomy Observatories, USA; Mar. 1998; 10p; In English
Report No.(s): NOAO-Preprint-785; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A new generation wide-field imager is being developed and will be put into service at sites in North and South America. Driven by the requirement for larger imaging areas and more pixels but limited by manufacturing process constraints, manufacturers are developing 2, 3, and 4-side buttable CCDs(Charge Coupled Devices) that can be tiled to achieve large imaging areas as opposed to developing a single large CCD. NOAO has designed, fabricated, and tested a wide-field imager called Mosaic that tiles 8 CCDs to produce an imaging area slightly greater than 123 mm x 123 mm. Several successful science observation runs have been completed using Mosaic at the KPNO(Kitt Peak National Observatory) Mayall 4 m and .9 m telescopes. A second Mosaic Wide-Field Imager is presently being manufactured and will be deployed at the CTIO(Cerro Tololo Inter-American Observatory)

Blanco 4 m telescope early next year. This report will focus on the mechanical design aspects of the Mosaic Imager and the upgrade path to achieve the scientific requirements will be discussed.
Author
Charge Coupled Devices; Imaging Techniques; Mosaics

19990046296 National Inst. of Standards and Technology, Information Technology Lab., Gaithersburg, MD USA
Performance Enhancement of a Joint Transform Correlator Using the Directionality of a Spatial Light Modulator
Hsieh, M. L.; Paek, E. G.; Wilson, C. L.; Hsu, K. Y.; Dec. 1998; 24p; In English
Report No.(s): PB99-117962; NISTIR-6272; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have observed that conventional electrically addressable spatial light modulators have different transfer functions along the fast (horizontal) and the slow (vertical) directions. We then propose to use the directionality of a spatial light modulator to increase the performance of a joint transform correlator. Our experimental results show that input space-bandwidth product of a joint transform correlator can be significantly increased by recording a hologram so that interference fringes run along the fast (horizontal) direction of a spatial light modulator.
NTIS
Optical Correlators; Augmentation; Light Modulators; Performance Tests

19990046782 NASA Stennis Space Center, Bay Saint Louis, MS USA
Multi Spectral Imaging System
Spiering, Bruce A., Inventor, NASA Stennis Space Center, USA; May 04, 1999; In English
Patent Info.: Filed 26 Sep. 1997; NASA-Case-SSC-00048; US-Patent-5,900,942; US-Patent-Appl-SN-938300; No Copyright; Avail: US Patent and Trademark Office, Hardcopy, Microfiche

An optical imaging system provides automatic co-registration of a plurality of multi spectral images of an object which are generated by a plurality of video cameras or other optical detectors. The imaging system includes a modular assembly of beam splitters, lens tubes, camera lenses and wavelength selective filters which facilitate easy reconfiguration and adjustment of the system for various applications. A primary lens assembly generates a real image of an object to be imaged on a reticle which is positioned at a fixed length from a beam splitter assembly. The beam splitter assembly separates a collimated image beam received from the reticle into multiple image beams, each of which is projected onto a corresponding one of a plurality of video cameras. The lens tubes which connect the beam splitter assembly to the cameras are adjustable in length to provide automatic co-registration of the images generated by each camera.
Official Gazette of the U.S. Patent and Trademark Office
Imaging Techniques; Optical Measuring Instruments; Cameras

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990043945 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Characteristics of Discharge in Plasma Jet Emitter
Inoue, Takayuki, Kyushu Univ., Japan; Ueno, Ryuichi, Kyushu Univ., Japan; Sakae, Takeji, Kyushu Univ., Japan; Yamamoto, Takanori, Kyushu Univ., Japan; Technology Reports of Kyushu University; Mar. 1998; Volume 71, No. 2, pp. 69-72; In Japanese; See also 19990043944; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In order to investigate characteristics of discharge in plasma jet emitter, hydrogen ion source including the emitter is developed. A method to generate the pulsed plasma with reliability is suggested. The influences of magnetic field, the pressure and the timing of the pulse power supplies on the discharge are studied.
Author
Plasmas (Physics); Emitters; Dischargers; Jet Flow

19990043993 Department of Energy, Office of Energy Research, Washington, DC USA
Confinement in the RFP: Lundquist number scaling, plasma flow, and reduced transport
Fiksel, G.; Almagri, A. F.; Anderson, J. K.; Oct. 31, 1998; 8p; In English; IAEA fusion energy conference
Report No.(s): DE99-001039; DOE/ER/54345-309; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Global heat and particle transport in the reversed field pinch (RFP) result primarily from large-scale, resistive MHD fluctuations which cause the magnetic field in the core of the plasma to become stochastic. Achieving a better understanding of this turbulent transport and identifying ways to reduce it are critical RFP development issues. The authors report measurements of the Lundquist number (S-scaling) of magnetic and ion flow velocity fluctuations in the Madison Symmetric Torus (MST) RFP. The S-scaling of magnetic fluctuations in MST is weaker than previous measurements (tilde b)/B (approximately) S(sup -1/2) in smaller (lower S) RFP plasmas. Impurity ion flow velocity fluctuations (measured with fast Doppler spectroscopy) have a scaling similar to the magnetic fluctuations, falling in the range (tilde V)/V(sub A) (approximately) S(sup -(0.08-0.10)). The MHD dynamo ((tilde V) x (tilde b)) up to 15 V/cm was measured in the plasma core. Interestingly, the scaling of the MHD dynamo ((tilde V) x (tilde b)) (approximately) S(sup -(0.64-0.88)) is stronger than for its constituents, a result of decreased coherency between (tilde V) and (tilde b) with increasing S. A weak S-scaling of magnetic fluctuations implies fluctuation suppression measures (e.g., current profile control) may be required in higher-S RFP plasmas. Two types of current profile modifications have been examined--inductive and electrostatic. The inductive control halves the amplitude of global magnetic fluctuations and improves the confinement by a factor of 5. The electrostatic current injection, localized in the edge plasma, reduces edge resonant fluctuations and improves the energy confinement. In addition, regimes with confinement improvement associated with the plasma flow profile are attained.
NTIS
Plasmas (Physics); Flow Velocity; Scaling Laws; Radiation Transport

19990043994 Department of Energy, Washington, DC USA
Ultrasonically determined fill pressure and density in closed spherical shells
Asaki, T. J.; Dec. 31, 1998; 16p; In English; Target fabrication meeting
Report No.(s): DE99-001073; LA-UR-98-2111; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Experiments have been conducted in which the D2 fill pressure has been determined for several closed millimeter-size aluminum and beryllium shells. The vibrational resonance frequency spectrum of the shells was used to calculate the sound velocity of the interior gas. This velocity, along with the equation-of-state, determined the gas pressure and density. The accuracy in determining the fill conditions is within 0.5% in both pressure and density for near critical density ((rho) (approximately-gt) 9 mol/L) gas over a wide range of temperatures (190 K to 300 K). Reduced accuracy was apparent at low density. An attempt was made to determine the fill density of one shell by acoustic observation of the dew point temperature. While this temperature was recorded very accurately, the uncertainty in the saturated vapor density curve near the critical point yielded inaccurate results. These methods were shown to be unaffected by small deviations in the sphericity of the gas-filled cavity.
NTIS
Gas Pressure; Density (Mass/Volume); Spherical Shells

19990044000 Electrotechnical Lab., Ibaraki, Japan
Pulsed High Power Source for Screw Pinch Device
Sato, Yasuhiro, Electrotechnical Lab., Japan; 1998; ISSN 0366-9106; 104p; In Japanese; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Design and construction of a pulsed high power capacitor bank system for a thermonuclear fusion plasma experimental machine are described. According to the fundamental program of the second stage thermonuclear fusion research and development determined by the Japan Fusion Council, the Electrotechnical Laboratory decided to construct a medium-sized high-beta screw pinch machine TPE-2. The mission of TPE-2 is to produce a plasma of more than 100 eV in temperature and 10% in beta value, and to confine it for several hundreds microsec. The designed coil current is 1-5 MA in peak value, a few microsec in rising time and I ms in pulse length. In order to satisfy the above requirement, the energy of the capacitor bank exceeds 1 MJ and the inductance for bank system must be minimized. For this purpose, a high voltage capacitor bank of low inductance and a new idea of power crowbar system must be developed. The research and development of main components such as a capacitor unit and a switching device for high voltage (80kV) use are carried out to a great extent to construct the capacitor bank system. A low inductance (40 nH) and high energy density (70 J/1) capacitor unit, and a start gap switch with low jitter time (less than 20 ns) were successfully developed after some trial manufacturing procedures. While, to maintain the reliability and reproducibility in operating the bank system, a monitoring system was newly developed, which monitors the parallel operation of 312 gap switches. After the installation of switch monitoring system, the ratio of abnormally operated switches decreased to 1/5 owing to the effect of fast detection of miss operated switches. Also a new protection system against an accidental short-circuiting of bank system was developed. These two systems enabled to operate the bank system very stably and safely. The capacitor bank system based on the above research and development was constructed and connected to load assembly of TPE-2. TPE-2 has been operated stably for over ten years and for more than 18,000 shots, which is the designed life time of the bank system. A plasma of 400 eV in maximum

temperature and 14% in maximum beta value are produced and sustained for 800 microsec. These values, which satisfy well the designed ones, are mainly due to the successful development of the pulsed high power capacitor bank system.
Author
Capacitors; Screw Pinch; High Voltages; Plasmas (Physics); Inductance

19990044012 National Inst. for Fusion Science, Toki, Japan
An Overview of the Large Helical Device Project
Iiyoshi, A., National Inst. for Fusion Science, Japan; Komori, A., National Inst. for Fusion Science, Japan; Ejiri, A., National Inst. for Fusion Science, Japan; Emoto, M., National Inst. for Fusion Science, Japan; Funaba, H., National Inst. for Fusion Science, Japan; Goto, M., National Inst. for Fusion Science, Japan; Ida, K., National Inst. for Fusion Science, Japan; Idei, H., National Inst. for Fusion Science, Japan; Inagaki, S., National Inst. for Fusion Science, Japan; Kado, S., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Kawahata, K., National Inst. for Fusion Science, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Kumazawa, R., National Inst. for Fusion Science, Japan; Masuzaki, S., National Inst. for Fusion Science, Japan; Minami, T., National Inst. for Fusion Science, Japan; Miyazawa, J., National Inst. for Fusion Science, Japan; Morisaki, T., National Inst. for Fusion Science, Japan; Morita, S., National Inst. for Fusion Science, Japan; Murakami, S., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 22p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/OV1/4; NIFS-571; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Large Helical Device (LHD) has successfully started running plasma confinement experiments after a long construction period of eight years. During the construction and machine commissioning phases, a variety of milestones have been attained in fusion engineering, which successfully led to the first operation, and the first plasma was ignited on March 31, 1998. Two experimental campaigns are planned in 1998. In the first campaign, the magnetic flux mapping clearly demonstrated a nested structure of magnetic surfaces. The first plasma experiments were conducted with second harmonic 84-GHz and 82.6-GHz ECH at a heating power input of 0.35 MW. The magnetic field was set at 1.5 T in the first year so as to accumulate operational experience of the superconducting coils. In the second campaign, auxiliary heating with NBI at 3 MW has been carried out. The averaged electron densities up to 6 x 10(exp 19)/m, central temperatures ranging 1.4 to 1.5 keV and stored energies up to 220 kJ have been attained despite the fact that impurity level is not yet minimized. The obtained scaling of energy confinement time has been found to be consistent with the ISS95 scaling law with some enhancement.
Author
Plasmas (Physics); Magnetic Flux; Magnetic Fields; Flux Density; Augmentation; Helical Windings

19990044013 National Inst. for Fusion Science, Toki, Japan
Plasma Confinement Studies in LHD
Fujiwara, M., National Inst. for Fusion Science, Japan; Yamada, H., National Inst. for Fusion Science, Japan; Ejiri, A., National Inst. for Fusion Science, Japan; Emoto, M., National Inst. for Fusion Science, Japan; Funaba, H., National Inst. for Fusion Science, Japan; Goto, M., National Inst. for Fusion Science, Japan; Ida, K., National Inst. for Fusion Science, Japan; Idei, H., National Inst. for Fusion Science, Japan; Inagaki, S., National Inst. for Fusion Science, Japan; Kao, S., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Kawahata, K., National Inst. for Fusion Science, Japan; Komori, A., National Inst. for Fusion Science, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Kumazawa, R., National Inst. for Fusion Science, Japan; Masuzaki, S., National Inst. for Fusion Science, Japan; Minami, T., National Inst. for Fusion Science, Japan; Miyazawa, J., National Inst. for Fusion Science, Japan; Morisaki, T., National Inst. for Fusion Science, Japan; Morita, S., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 14p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/EX2/3; NIFS-572; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The initial experiments of the Large Helical Device (LHD) have extended confinement studies on currentless plasmas to a large scale (R=3.9 m, a = 0.6 m). Heating by NBI of 3 MW has produced plasmas with a fusion triple product of 8 x 10(exp 18) keV/cu m/ s at a magnetic field of 1.5T. An electron temperature of 1.5 keV and an ion temperature of 1.1 keV have been achieved simultaneously at the line- averaged electron density of 1.5 x 10(exp 19)/cu m. The maximum stored energy has reached 0.22 MJ with neither unexpected confinement deterioration nor visible MHD instabilities, which corresponds to is less than beta> = 0.7%. Energy confinement times, reaching 0. 17 s at the maximum, have shown a manner similar to the present scaling law derived from the existing medium sized helical devices, but improve on it by 50%. A distinguishing feature of a favorable dependence of energy confinement time on density remains in the present power density (-40 kW/cu m) and the electron density (3 x 10(exp 19)/cu m) regimes unlike L-mode in tokamaks. Temperatures of both electrons and ions as high as 200 eV have been observed at the outermost flux surface, which indicates a qualitative jump in performance from the helical devices to date. Spontaneously generated

toroidal currents agree with the physical picture of neoclassical bootstrap currents. Change of magnetic configuration due to finite-P effect has been well described by the 3-D MHD equilibrium analysis. An escape of particles from the core region leading to a hollow density profile has been observed in hydrogen plasmas, which is mitigated through core fueling with a pellet injection or in helium discharges.
Author
Research; Confinement; Electron Density (Concentration); Electron Energy; Heliotrons; Hydrogen Plasma

19990044051 National Inst. for Fusion Science, Toki, Japan
5D Simulation Study of Suprathermal Electron Transport in Non-Axisymmetric Plasmas
Murakami, S., National Inst. for Fusion Science, Japan; Gasparino, U., Max-Planck-Inst. fuer Plasmaphysik, Germany; Idei, H., National Inst. for Fusion Science, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Maassberg, H., Max-Planck-Inst. fuer Plasmaphysik, Germany; Marushchenko, N., National Science Center, Ukraine; Nakajima, N., National Inst. for Fusion Science, Japan; Rome, M., Max-Planck-Inst. fuer Plasmaphysik, Germany; Okamoto, M., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 16p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/TH2/1; NIFS-576; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

ECRH-driven transport of suprathermal electrons is studied in non-axisymmetric plasmas using a new Monte Carlo simulation technique in 5D phase space. Two different phases of the ECRH-driven transport of suprathermal electrons can be seen; the first one is a rapid convective phase due to the direct radial motion of trapped electrons and the second one is a slower phase due to the collisional transport. The important role of the radial transport of suprathermal electrons in the broadening of the ECRH deposition profile in W7-AS is clarified. The ECRH driven flux is also evaluated and put in relation with the ”electron root” feature recently observed in W7-AS. It is found that, at low collisionalities, the ECRH driven flux due to the suprathemial electrons can play a dominant role in the condition of ambipolarity and, thus, the observed ”electron root” feature in W7-AS is thought to be driven by the radial (convective) flux of ECRH generated suprathermal electrons. The possible scenario of this ”ECRH-driven electron root” is considered in the LHD plasma.
Author
Electron Transfer; Transport Properties; Plasmas (Physics); Simulation

19990044052 National Inst. for Fusion Science, Toki, Japan
Eigenfunctions for Vlasov Equation in Multi-species Plasmas
Yamagishi, T., Tokyo Metropolitan Univ., Japan; November 1998; ISSN 0915-633X; 12p; In English
Report No.(s): NIFS-578; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The normal mode expansion method for the Vlasov equation has been developed to multi-species plasmas in an infinite system. The perturbed charge density for the Vlasov-Poisson system in multi-species plasmas is found be the same form as the perturbed distribution function in a single species plasma. The eigenfunctions and adjoint eigenfunctions, and the orthogonality relations between them have been derived. The complete set of eigenfunctions for the charge density is constructed, which has been applied for the initial value problems. The continuum contribution consists of the ballistic mode and pure continuum contribution. Scalar potential and each species distribution function are also solved making use of the complete set of eigenfunctions.
Author
Vlasov Equations; Distribution Functions; Plasmas (Physics); Eigenvectors

19990044066 Princeton Univ., Plasma Physics Lab., NJ USA
Heating and current drive on NSTX and HHFW experiments on CDX-U
Wilson, J. R.; Hosea, J.; Grisham, L.; Dec. 31, 1998; 4p; In English; Europhysics topical conference on RF heating and current drive of fusion devices
Report No.(s): DE98-057590; PPPL-CFP-3871; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The NSTX (National Spherical Torus Experiment) device to be built at Princeton is a low-aspect-ratio toroidal device that has the achievement of high toroidal beta (approximately 45%) and noninductive operation as two of its main research goals. to achieve these goals, significant auxiliary-heating and current-drive systems are required. Present plans include ECH (electron cyclotron heating) for preionized and start-up assist, HHFW (high harmonic fast wave) for heating and current drive, and, eventually, NBI (neutral-beam injection) for heating, current drive and plasma rotation. In support of the NSTX program, experimental tests of HHFW physics have been performed on the Current Drive Experiment-Upgrade (CDX-U).
NTIS
Electron Cyclotron Heating; Beam Injection; Neutral Beams; Plasmas (Physics)

19990044068 Michigan Univ., Ann Arbor, MI USA
Laser scattering from long scalelength plasmas on Omega ***Final Report***
Drake, R. P.; Seka, W.; Craxton, R. S.; Bauer, B. S.; Dec. 31, 1998; 29p; In English
Report No.(s): DE99-001428; DOE/SF/21273-T2; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this project, the authors accomplished the tasks called for in the revised statement of work associated with this grant. Specifically, they accomplished: (1) active participation in the design of long-scalelength plasmas for Omega and in experiments to characterize these plasmas; (2) development of software that permits the rapid evaluation of laser-scattering diagnostic possibilities involving the standard parametric instabilities. It must be able to account for all 60 beams in Omega in addition to a probe beam and variable detector locations; and (3) design, purchase of components for, and assembly of instrumentation to make such measurements, providing for long- term versatility in the type of measurement. The project background and these accomplishments are discussed.
NTIS
Plasma Diagnostics; Light Scattering; Plasmas (Physics); Laser Plasmas

19990044110 Naval Research Lab., Fundamental Plasma Processes, Washington, DC USA
Parameter Space for Collisionless RF Sheaths ***Interim Report***
Manheimer, Wallace M.; Apr. 08, 1999; 18p; In English
Report No.(s): AD-A361681; NRL/MR/6707--99-8348; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As plasma processing reactors approach higher ion density, the sheath models which neglect the rf response of the ions become invalid. This work shows that at arbitrary ion density, the nature of the collisionless rf ion sheath can be described in a number of different regimes of parameter space. These regimes can all be visualized on a single two dimensional plot where the horizontal axis is the ion plasma frequency divided by the frequency, and the vertical axis is the electron oscillating velocity divided by the ion sound speed.
DTIC
Plasma Sheaths; Plasmas (Physics); Plasma Frequencies

19990045657 Department of Energy, Office of Energy Research, Washington, DC USA
Expectations for the National Spherical Torus Experiment's high harmonic fast wave system
Carter, M. D.; Ryan, P. M.; Swain, D. W.; Dec. 31, 1998; 5p; In English; Annual meeting of the American Nuclear Society
Report No.(s): DE99-000397; ORNL/CP-99321; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High harmonic fast waves (HHFW) have been chosen as the primary method to drive steady state currents in the National Spherical Torus Experiment (NSTX). The somewhat limited experience with this frequency range in conventional tokamak plasma indicates that the coupling to electrons should be successful; however, there is no experimental data base for HHFWs in the unique and rapidly varying plasma regimes expected for NSTX. In this paper, the authors describe how the HHFW antenna was designed for NSTX using the computer codes to help make decisions that might affect the system's performance and operation. The antenna geometry has been optimized to maintain the power handling and phase control requirements within engineering constraints. The physics issues that lead to the choice of poloidal current strap orientation are discussed. Expectations for current profile control using the antenna's phase control system are also discussed.
NTIS
Antennas; Spherical Waves

19990045658 Department of Energy, Office of Energy Research, Washington, DC USA
Survey of electric field shear driven by radio frequency waves in tokamak plasmas
Jaeger, E. F.; Berry, L. A.; Batchelor, D. B.; Dec. 31, 1998; 4p; In English; European Physical Society conference on controlled fusion and plasma physics
Report No.(s): DE99-000396; ORNL/CP-99315; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The stabilization of plasma turbulence by sheared poloidal rotation is thought to explain enhanced confinement in tokamak plasmas. One method proposed for controlling sheared flow is the use of externally driven radio-frequency (RF) waves. A number of calculations and some experiments have suggested that a modest amount of power in the ion cyclotron range of frequencies (ICRF) can drive the needed flows. Previous calculations have relied on incompressible fluid models which balance RF forces in the poloidal direction against neoclassical viscosity. But the incompressible assumption is not always valid, particularly for ion

Bernstein waves (IBW). Also, since the IBW is a kinetic wave by nature, a fully consistent model should include kinetic effects. In this paper, RF driven flows are calculated from both compressible fluid and kinetic points of view.
NTIS
Electric Fields; Shear Flow; Radio Frequencies; Tokamak Devices

19990045743 National Inst. for Fusion Science, Toki, Japan
Spectral Line Intensities of NeVII for Non-equilibrium Ionization Plasma Including Dielectronic Recombination Processes
Murakami, Izumi, National Inst. for Fusion Science, Japan; Kato, Takako, National Inst. for Fusion Science, Japan; Safronova, Ulyana, Notre Dame Univ., USA; January 1999; ISSN 0915-6364; 80p; In English
Report No.(s): NIFS-DATA-50; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
We have calculated the dielectronic recombination rate coefficients from Li-like Ne (Ne(7+)) ions to Be-like Ne (Ne(6+)) ions for selected excited states of Ne(6+) ions. A collisional-radiative model (CRM) for Ne(6+) ions is constructed to calculate the population density of each excited state in non-equilibrium ionization plasmas, including recombining processes. NeVII spectral line intensities and the radiative power loss are calculated with the CRM. A density effect caused by collisional excitation from the metastable state 2s2p(3)P is found at an electron density of 10(exp 5) - 10(exp 17)/cc. The collisional excitations between excited states become important at high electron temperature T(sub e) approx. greater than 100 eV.
Author
Neon Isotopes; Ionization; Plasmas (Physics); Recombination Coefficient; Electron-Ion Recombination; Line Spectra; Level (Quantity)

19990045767 Department of Energy, Office of Energy Research, Washington, DC USA
Wall-confined high beta spheromak
Fowler, T. K.; Hopper, E. B.; Moir, R. W.; Pearlstein, L. D.; Mar. 16, 1998; 8p; In English; US-Japan workshop physics base on DHe3 fusion
Report No.(s): DE98-057458; UCRL-JC-130151; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The spheromak could be extended into the high beta regime by supporting the pressure on flux-conserving walls, allowing the plasma to be in a Taylor state with zero pressure gradient and thus stable to ideal and resistive MHD (Magnetohydrodynamics). The concept yields a potentially attractive, pulsed reactor which would require no external magnets. The flux conserver would be shaped to be stable to the tilt and shift instabilities. We envision a plasma which is ohmically ignited at low beta, with the kinetic pressure growing to beta is greater than 1 by fueling from the edge. The flux conserver would be designed such that the magnetic decay time = the fusion burn time. The thermal capacity of the flux conserver and blanket would exceed the fusion yield per discharge, so that they can be cooled steadily. Ignition is estimated to require minimum technology: 30-100 MJ of pulsed power applied at a 0.5 GW rate generates an estimated bum yield is greater than 1 GJ. The concept thus provides an alternate route to a fusion plasma that is MHD stable at high beta, yielding a reactor that is simple and cheap. The major confinement issue is transport due to grad(T), e.g. driven by high beta modes related to the ITG instability.
NTIS
Spheromaks; Plasmas (Physics); Plasma Control; Plasma Physics; Magnetohydrodynamics

19990045882 National Inst. for Fusion Science, Toki, Japan
Transition from L Mode to High Ion Temperature Mode in CHS Heliotron/Torsatron Plasmas
Ida, K., National Inst. for Fusion Science, Japan; Osakabe, M., National Inst. for Fusion Science, Japan; Tanaka, K., National Inst. for Fusion Science, Japan; Minami, T., National Inst. for Fusion Science, Japan; Nishimura, S., National Inst. for Fusion Science, Japan; Okamura, S., National Inst. for Fusion Science, Japan; Fujisawa, A., National Inst. for Fusion Science, Japan; Yoshimura, Y., National Inst. for Fusion Science, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Darrow, D. S., Princeton Plasma Physics Lab., USA; Idei, H., National Inst. for Fusion Science, Japan; Iguchi, H., National Inst. for Fusion Science, Japan; Isobe, M., National Inst. for Fusion Science, Japan; Kado, S., National Inst. for Fusion Science, Japan; Kondo, T., Graduate Univ. for Advanced Studies, Japan; Lee, S., National Inst. for Fusion Science, Japan; Matsuoka, K., National Inst. for Fusion Science, Japan; Morita, S., National Inst. for Fusion Science, Japan; Nomura, I., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 12p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/EX2/2; NIFS-567; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A high ion temperature mode (high T(sub i) mode) is observed for neutral beam heated plasmas in the Compact Helical System (CHS) Heliotron/torsatron. The high T(sub i) mode plasma is characterized by a high central ion temperature, T(sub i)(O),

and is associated with a peaked electron density profile produced by neutral beam fueling with low wall recycling. Transition from L mode to high T(sub i) mode has been studied in CHS. The central ion temperature in the high Ti mode discharges reaches to 1 keV which is 2.5 times higher than that in the L mode discharges. The ion thermal diffusivity is significantly reduced by a factor of more than 2 - 3 in the high T(sub i) mode plasma. The ion loss cone is observed in neutral particle flux in the energy range of 1 - 6 keV with a narrow range of pitch angle (90 +/- 10 degree) in the high T(sub i) mode. However, the degradation of ion energy confinement due to this loss cone is negligible.
Author
Ion Temperature; High Temperature; Plasmas (Physics); Ionic Diffusion; Heliotrons; Electron Density Profiles

19990045883 National Inst. for Fusion Science, Toki, Japan
Global Mode Analysis of Ideal MHD Modes in L equals 2 Heliotron/Torsatron Systems
Nakajima, N., National Inst. for Fusion Science, Japan; Chen, J., Graduate Univ. for Advanced Studies, Japan; Ichiguchi, K., National Inst. for Fusion Science, Japan; Okamoto, M., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 10p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/THP1/08; NIFS-566; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

By means of a global mode analysis of ideal MHD modes for Mercier-unstable equilibria in a planar axis L = 2/M = 10 heliotron/torsatron system with an inherently large Shafranov shift, the conjecture from local mode analysis for Mercier-unstable equilibria has been confirmed and the properties of pressure-driven modes have been clarified. According to the degree of the decrease in the local magnetic shear by the Shafranov shift, the Mercier-unstable equilibria are categorized into toroidicity-dominant (strong reduction) and helicity-dominant (weak reduction) equilibria. In both types of equilibria, interchange modes are destabilized for low toroidal mode numbers n less than M, where M is the toroidal field period of the equilibria, and both poloidally and toroidally localized ballooning modes purely inherent to three-dimensional systems are destabilized for fairly high toroidal mode numbers n much greater than M, For moderate toroidal mode numbers n approx. M, tokamak-like poloidally localized ballooning modes with a weak toroidal mode coupling are destabilized in toroidicity-dominant equilibria, and in contrast, in the helicity-dominant equilibria, interchange modes are destabilized. The interchange modes are localized on the inner side of the torus, because the Shafranov shift enhances the unfavorable magnetic curvature there rather than on the outer side of the torus. A continuous or quasi-point unstable spectrum is briefly discussed.
Author
Toroidal Plasmas; Tokamak Devices; Magnetohydrodynamic Stability

19990045940 Commonwealth Scientific and Industrial Research Organization, Collingwood, Australia
Australian Journal of Physics, Volume 51
Robertson, R. P., Editor, Commonwealth Scientific and Industrial Research Organization, Australia; 1998; ISSN 0004-9506; In English; See also 19990045941 through 19990045946; Copyright; Avail: Issuing Activity (Australian Journal of Physics, P.O. Box 1139 (150 Oxford St.), Collingwood, Victoria 3066, Australia), Hardcopy, Microfiche

This issue contains a featured review entitled: ”One-dimensional self-organised structures in dusty plasms”. Other articles which are included are titled: (1) ”Wigners variant of Bell’s inequality”, (2) ”Weak plasma turbulence theory and some other items of plasma kinetics”, (3) ”Effect of the motion of ions on the penetration of a rotating magnetic field into a plasma cylinder”, (4) ”Planetary-scale coherent structures of tropical moist convection”, and (5) ”Deep convection in the interior of major planets : a review”.
CASI
Plasma Physics; Plasmas (Physics); Dust; Physics; Geophysics; Astrophysics

19990045941 Academy of Sciences (USSR), General Physics Inst., Moscow, USSR
One-Dimensional Self-Organized Structures in Dusty Plasmas
Tsytovich, V. N., Academy of Sciences (USSR), USSR; Australian Journal of Physics; 1998; Volume 51, No. 5, pp. 764-834; In English; See also 19990045940; Copyright; Avail: Issuing Activity (Australian Journal of Physics, P.O. Box 1139 (150 Oxford St.), Collingwood, Victoria 3066, Australia), Hardcopy, Microfiche

A dusty plasma is an open system in which the formation of structures is a natural phenomenon. The first part of the present review is devoted to an introduction to dusty plasma physics and a formulation of the new theoretical kinetic and new hydrodynamic approaches used in subsequent parts. In the new hydrodynamic approach only dust-plasma particle collisions are taken into account and the usual binary plasma collisions are neglected. This description takes into account the possibility of plasma absorption on dust particles and is appropriate for open systems. The second part of the review contains a description of one-dimensional

plasma-dust self-organized structures where the energy source corresponds to the plasma fluxes towards the dust regions from the plasma regions where the dust is absent. The fluxes are created by the structures in a self-consistent manner to increase the ion density and decrease the electron density, drift velocity and electrostatic potential inside the structure. The third part contains the theory of shock waves in dusty plasmas, modification of the Gugoniot relation and analyses of the possibility of an increase of dust density behind the shock front. All parts are based on the modern point of view of the physics of dusty plasmas and mainly new material is presented. The review is written in the form of lectures and therefore the references to the existing literature are given in the text, with more details in the last section devoted to some historical comment.
Author
Particle Collisions; Plasma Physics; Plasmas (Physics); Dust; Plasma Clouds; Attraction; Force

19990045943 Academy of Sciences (USSR), Inst. of Automation and Electrometry, Novosibirsk, USSR
Weak Plasma Turbulence Theory and Some Other Items of Plasma Kinetics
Erofeev, V. I., Academy of Sciences (USSR), USSR; Australian Journal of Physics; 1998; Volume 51, No. 5, pp. 843-857; In English; See also 19990045940; Copyright; Avail: Issuing Activity (Australian Journal of Physics, P.O. Box 1139 (150 Oxford St.), Collingwood, Victoria 3066, Australia), Hardcopy, Microfiche

A new approach to a plasma kinetic description is discussed, the beginnings of which were published recently. It is shown that calculations of the three-wave collision integral following this approach confirm the intensity and structure of the three-wave collision integral obtained in the traditional theory. The reported kinetics extend the area of applicability for weak plasma turbulence theory: apart from waves it properly accounts for the effect of various other plasma nonlinear structures of the type of solitons, drift vortices collapsing cavities and so on. Some directions for further studies are also discussed.
Author
Kinetics; Plasma Turbulence; Plasmas (Physics)

19990045944 New England Univ., School of Physical Sciences, Armidale, Australia
Effect of the Motion of Ions on the Penetration of a Rotating Magnetic Field Into a Plasma Cylinder
Hugrass, W. N., New England Univ., Australia; Australian Journal of Physics; 1998; Volume 51, No. 5, pp. 859-864; In English; See also 19990045940; Copyright; Avail: Issuing Activity (Australian Journal of Physics, P.O. Box 1139 (150 Oxford St.), Collingwood, Victoria 3066, Australia), Hardcopy, Microfiche

A simplified for the rotating magnetic field (RMF) current in an indefinitely long cylindrical is considered. The model allows for motion of both the electron and ion fluids in the zeta and theta directions. It is assumed that equilibrium is satisfied on the average and hence the tau components of the equations of motion are not considered. It is shown that the motion of the ion fluid does not introduce any significant modifications to the nonlinear mechanism for the penetration of the RMF into the plasma.
Author
Equations of Motion; Ions; Magnetic Fields; Nonlinearity; Penetration; Plasma Cylinders; Plasmas (Physics); Rotation

19990045964 National Inst. for Fusion Science, Toki, Japan
Progress Summary of LHD Engineering Design and Construction
Motojima, O., National Inst. for Fusion Science, Japan; Akaishi, K., National Inst. for Fusion Science, Japan; Chikaraishi, H., National Inst. for Fusion Science, Japan; Funaba, H., National Inst. for Fusion Science, Japan; Hamaguchi, S., National Inst. for Fusion Science, Japan; Imagawa, S., National Inst. for Fusion Science, Japan; Inagaki, S., National Inst. for Fusion Science, Japan; Inoue, N., National Inst. for Fusion Science, Japan; Iwamoto, A., National Inst. for Fusion Science, Japan; Kitagawa, S., National Inst. for Fusion Science, Japan; Komori, A., National Inst. for Fusion Science, Japan; Kubota, Y., National Inst. for Fusion Science, Japan; Maekawa, R., National Inst. for Fusion Science, Japan; Masuzaki, S., National Inst. for Fusion Science, Japan; Mito, T., National Inst. for Fusion Science, Japan; Miyazawa, J., National Inst. for Fusion Science, Japan; Morisaki, T., National Inst. for Fusion Science, Japan; Murai, K., National Inst. for Fusion Science, Japan; Muroga, T., National Inst. for Fusion Science, Japan; Nagasaka, T., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 14p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/FT2/1; NIFS-573; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In March 1998, the large helical device (LHD) project finally completed its 8 years construction schedule. LHD is a superconducting (SC) heliotron type device with R = 3.9 m, a(sub p) = 0.6 m, and B = 3 T, which has simplex and continuous large helical coils. The major mission of LHD is to demonstrate the high potential of currentless helical-toroidal plasmas, which are free from current disruption and have an intrinsic potential for steady state operation. After the intensive physics design studies in the 1980's, the necessary programs of SC engineering R&D were made and carried out, and as a result, LHD fabrication technologies were successfully developed. In this process, a significant database on fusion engineering has been established. These achievements

have been made in various areas, such as the technologies of SC conductor development, SC coil fabrication, liquid helium (LHe) and supercritical helium (SHe) cryogenics, development of low temperature structural materials and welding, operation and control, and power supply systems and related SC coil protection schemes. They are integrated, and nowadays comprise a major part of the LHD relevant fusion technology area. These issues correspond to a necessary technological data base for the next step of future reactor designs. In addition, we could increase this with successful commissioning tests just after the completion of LHD machine assembly phase, which consisted of vacuum leak test, LHe cooldown test, and coil current excitation test. We recapitulate and highlight these LHD relevant engineering developments in this paper. to summarize our construction of LHD as an SC device, the critical design with NbTi SC material has been successfully accomplished by our R&D activities, which enables us to move into a new regime of fusion experiments.
Author
Heliotrons; Design Analysis; Fabrication; Superconducting Devices; Vacuum Tests; Toroidal Plasmas; Reactor Design; Product Development; Construction

19990045965 National Inst. for Fusion Science, Toki, Japan
Global MHD Modes Excited by Energetic Ions in Heliotron/Torsatron Plasmas
Toi, K., National Inst. for Fusion Science, Japan; Takechi, M., Nagoya Univ., Japan; Takagi, S., Nagoya Univ., Japan; Matsunaga, G., Nagoya Univ., Japan; Isobe, M., National Inst. for Fusion Science, Japan; Kondo, T., Graduate Univ. for Advanced Studies, Japan; Sasao, M., National Inst. for Fusion Science, Japan; Darrow, D. S., Princeton Plasma Physics Lab., USA; Ohkuni, K., National Inst. for Fusion Science, Japan; Ohdachi, S., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Fujisawa, A., National Inst. for Fusion Science, Japan; Gotoh, M., National Inst. for Fusion Science, Japan; Idei, H., National Inst. for Fusion Science, Japan; Ida, K., National Inst. for Fusion Science, Japan; Iguchi, H., National Inst. for Fusion Science, Japan; Kado, S., National Inst. for Fusion Science, Japan; Kojima, M., National Inst. for Fusion Science, Japan; Kubo, S., National Inst. for Fusion Science, Japan; Lee, S., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 12p; In English; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-F1-CN-69/EXP1/19; NIFS-574; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In NBI heated plasmas of the CHS heliotron/torsatron where the beam driven current with a peaked profile is induced, m = 2/n = 1 and m = 3/n = 2 (m, n : poloidal and toroidal mode numbers) fishbone instabilities are observed for the first time. Pulsed increase in energetic ion loss flux is detected by an escaping ion probe during the m = 3/n = 2 mode. The sawtooth crash is often induced by the m = 2/n = l mode. The current driven internal kink mode is thought to be destabilized by the presence of energetic ions, having a character of pressure driven interchange mode. Toroidal Alfven eigenmodes(TAEs) with n = 1 and n = 2 are also identified for the first time in NBI heated plasmas. TAEs localize near the plasma core region with fairly low magnetic shear realized by the small net plasma current, and do not lead to enhanced loss of energetic ions because of low fluctuation level.
Author
Magnetohydrodynamics; Plasma Currents; Magnetohydrodynamic Waves; Ion Probes

19990045966 National Inst. for Fusion Science, Toki, Japan
Potential Turbulence in Tokamak Plasmas
Hamada, Y., National Inst. for Fusion Science, Japan; Nishizawa, A., National Inst. for Fusion Science, Japan; Kawasumi, Y., National Inst. for Fusion Science, Japan; Fujisawa, A., National Inst. for Fusion Science, Japan; Kojima, M., National Inst. for Fusion Science, Japan; Narihara, K., National Inst. for Fusion Science, Japan; Ida, K., National Inst. for Fusion Science, Japan; Ejiri, A., National Inst. for Fusion Science, Japan; Ohdachi, S., National Inst. for Fusion Science, Japan; Kawahata, K., National Inst. for Fusion Science, Japan; Toi, K., National Inst. for Fusion Science, Japan; Sato, K., National Inst. for Fusion Science, Japan; Seki, T., National Inst. for Fusion Science, Japan; Iguchi, H., National Inst. for Fusion Science, Japan; Adati, K., National Inst. for Fusion Science, Japan; Hidekuma, S., National Inst. for Fusion Science, Japan; Hirokura, S., National Inst. for Fusion Science, Japan; Iwasaki, K., National Inst. for Fusion Science, Japan; Ido, T., National Inst. for Fusion Science, Japan; Kumazawa, R., National Inst. for Fusion Science, Japan; Kuramoto, H., National Inst. for Fusion Science, Japan; Minami, T., National Inst. for Fusion Science, Japan; October 1998; ISSN 0915-633X; 10p; In English; Fusion Energy Conference, 19-24 Oct. 1998, Yokohama, Japan; Sponsored by International Atomic Energy Agency, Austria
Report No.(s): IAEA-CN-69/EXP2/14; NIFS-575; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Microscopic potential turbulence in tokamak plasmas are investigated by a multi-sample-volume heavy ion beam probe. The wavenumber/frequency spectra S(k, omega) of the plasmas potential fluctuation as well as density fluctuation are obtained for the first time. The instantaneous turbulence-driven particle flux, calculated from potential and density turbulence has oscillations

of which amplitude is about 100 times larger than the steady-state outwards flux, showing sporadic behaviours. We also observed large-scale coherent potential oscillations with the frequency around 10-40 kHz.
Author
Tokamak Devices; Turbulence; Plasmas (Physics); Research; Ion Beams

19990045990 Princeton Univ., Plasma Physics Lab., NJ USA
Collisional (delta)f method
Chen, Y.; White, R. B.; Dec. 31, 1997; 29p; In English
Report No.(s): DE98-050124; PPPL-3257; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A general method for including various collisional effects, such as the drag and diffusion of test particles due to background plasmas, the effect of particle source and sink, and the like-particle Coulomb collisions, is presented. The marker density g is generally unknown along the particle trajectory, and its evaluation depends on the way particles are initially loaded and new particles are injected into the simulation. The method is demonstrated for the problem of the nonlinear evolution of the Toroidicity Induced Alfven eigenmode, driven by energetic (alpha) particles. The saturation amplitude is found to scale with the collision rate in a way as predicted by theory.
NTIS
Collision Rates; Particle Collisions; Plasmas (Physics); Particle Diffusion

19990046032 General Atomics Co., San Diego, CA USA
Stabilization of the external kink and control of the resistive wall mode in tokamaks
Garofalo, A. M.; Turnbull, A. D.; Strait, E. J.; Jan. 31, 1999; 18p; In English; Annual physics of plasmas meeting, APS Division of Plasma Physics
Report No.(s): DE99-001451; GA-A23023; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

One promising approach to maintaining stability of high beta tokamak plasmas is the use of a conducting wall near the plasma to stabilize low-n ideal MHD instabilities. However, with a resistive wall, either plasma rotation or active feedback control is required to stabilize the more slowly growing resistive wall modes (RWMs). Experiments in the DIII-D, PBHX-M, and HBT-EP tokamaks have demonstrated that plasmas with a nearby conducting wall can remain stable to the n = 1 ideal external kink above the beta limit predicted with the wall at infinity, with durations in DIII-D up to 30 times (tau)(sub w), the resistive wall time constant. More recently, detailed, reproducible observation of the n = 1 RWM has been possible in DIII-D plasmas above the no-wall beta limit. The DIII-D measurements confirm characteristics common to several RWM theories. The mode is destabilized as the plasma rotation at the q = 3 surface decreases below a critical frequency of 1 to 7 kHz. The measured mode growth times of 2 to 8 ms agree with measurements and numerical calculations of the dominant DIII-D vessel eigenmode time constants, (tau)(sub w). From its onset, the RWM has little or no toroidal rotation and rapidly reduces the plasma rotation to zero. Both DIII-D and HBT-EP have adopted the smart shell concept as an initial approach to control of these slowly growing RWMs; external coils are controlled by a feedback loop designed to make the resistive wall appear perfectly conducting by maintaining a net zero radial field at the wall. Initial experiment results from DIII-D have yielded encouraging results.
NTIS
Stabilization; Walls; Tokamak Devices; Control

19990046034 General Atomics Co., San Diego, CA USA
Results from the DIII-D scientific research program
Taylor, T. S.; Burrell, K. H.; Baker, D. R.; Nov. 30, 1998; 38p; In English; IAEA fusion energy conference
Report No.(s): DE99-001443; GA-A23007; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The DIII-D research program is aimed at developing the scientific basis for advanced modes of operation which can enhance the commercial attractiveness of the tokamak as an energy producing system. Features that improve the attractiveness of the tokamak as a fusion power plant include: high power density (which demands high (beta)), high ignition margin (high energy confinement time), and steady state operation with low recirculating power (high bootstrap fraction), as well as adequate divertor heat removal, particle and impurity control. This set of requirements emphasizes that the approach to improved performance must be an integrated approach, optimizing the plasma from the core, through the plasma edge and into the divertor. The authors have produced high performance ELMing H-mode plasmas with (beta)(sub N) H(sub 98y) (approximately) 6 for 5 (tau)(sub E) (approximately 1 s) and demonstrated that core transport barriers can be sustained for the length of the 5-s neutral beam pulse in L-mode plasmas. They have demonstrated off-axis electron cyclotron current drive for the first time in a tokamak, discovering an efficiency above theoretical expectations. Edge stability studies have shown that the H-mode edge pressure gradient is not limited by ballooning modes; the self-consistent bootstrap provides second stable regime access. Divertor experiments have provided

a new understanding of convection and recombination in radiative divertors and have produced enhanced divertor radiation with scrape off layer plasma flows and impurity enrichment.
NTIS
Tokamak Devices; Research Projects

19990046036 Los Alamos National Lab., NM USA
Time to pause before the next step
Siemon, R. E.; Dec. 31, 1998; 10p; In English; Forum for major next-step fusion experiments
Report No.(s): DE99-000687; LA-UR-98-1798; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Many scientists, who have staunchly supported ITER for years, are coming to realize it is time to further rethink fusion energy's development strategy. Specifically, as was suggested by Grant Logan and Dale Meade, and in keeping with the restructuring of 1996, a theme of better, cheaper, faster fusion would serve the program more effectively than 'demonstrating controlled ignition...and integrated testing of the high-heat-flux and nuclear components required to utilize fusion energy...' which are the important ingredients of ITER's objectives. The author has personally shifted his view for a mixture of technical and political reasons. On the technical side, he senses that through advanced tokamak research, spherical tokamak research, and advanced stellarator work, scientists are coming to a new understanding that might make a burning-plasma device significantly smaller and less expensive. Thus waiting for a few years, even ten years, seems prudent. Scientifically, there is fascinating physics to be learned through studies of burning plasma on a tokamak. And clearly if one wishes to study burning plasma physics in a sustained plasma, there is no other configuration with an adequate database on which to proceed. But what is the urgency of moving towards an ITER-like step focused on burning plasma. Some of the arguments put forward and the counter arguments are discussed here.
NTIS
Fusion Reactors; Thermonuclear Reactions

19990046037 Los Alamos National Lab., Engineering Sciences and Applications Div., NM USA
Numerical thermal stability studies of the National Ignition Facility final optics assembly
Parietti, L.; Martin, R. A.; Dec. 31, 1998; 26p; In English; 1998 ASME International Fluids Engineering Division summer meeting
Report No.(s): DE99-000680; LA-UR-98-1203; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The National Ignition Facility (NIF), the world's most powerful laser system, is being built at Lawrence Livermore National Laboratory (LLNL) to study inertial fusion and high-energy-density science. This billion-dollar facility consists of 192 beams focusing 1.8 MJ on a fusion target. The Final Optics Assembly (FOA), the last mechanical apparatus before the target chamber, converts the light from an incoming frequency of 1 (omega) to a target-ready 3 (omega), and focuses the laser beam. The performance of the frequency conversion crystals is very sensitive to temperature changes; crystal temperature must be maintained within a 0.1 C of a nominal temperature prior to a laser shot. To ensure system availability, it is important to have an estimate of the thermal recovery time to operating temperature of the FOA after thermal disturbances caused by normal and maintenance operations. This paper presents Computational fluids Dynamics (CFD) fluid and thermal design calculations for both normal and maintenance operations of the NIF FOA.
NTIS
Numerical Stability; Thermal Stability; Ignition

19990046174 National Inst. for Fusion Science, Toki, Japan
On Kinetic Complexity in a Three-Wave Interaction
Skoric, M. M., Belgrade Univ., Yugoslavia; Sato, T., National Inst. for Fusion Science, Japan; Maluckov, A. M., National Inst. for Fusion Science, Japan; Jonvanovic, M. S., National Inst. for Fusion Science, Japan; Jun. 1998; ISSN 0915-633X; 17p; In English
Contract(s)/Grant(s): Proj. 01E11
Report No.(s): NIFS-549; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A stimulated Raman scattering in a plasma represents a resonant three-wave interaction which involves the nonlinear coupling of an electromagnetic pump into a scattered electromagnetic wave plus an electron plasma wave. In this paper, we concentrate on a nonlinear evolution of stimulated Raman backscattering in an open convective weakly confined model. In recent fluid simulations, rich spatio-temporal complexity that exhibits a transition to intermittency and chaos was revealed. However, this model has failed to account for a realistic entropy balance due to an anomalous dissipation. We introduce a hybrid-three-wave interaction model to include a phenomenological kinetic dissipation due to particle trapping and plasma wave breaking. Furthermore, we propose an open plasma model with realistic current-free boundaries to compare with a closed- isolated case. Under a continual free energy supply we vary a transport parameter to study a kinetic self-organization. In simulations, macro and micro

scale complexities develop, which saturate and get attracted to definite dynamical states, such as: quasi- steady, quasi-periodic and intermittent ones. At this point, an important consistency of above findings with a general scenario of a self-organization in plasmas can be claimed.
Author
Backscattering; Raman Spectra; Plasmas (Physics); Kinetic Theory; Three Dimensional Motion; Wave Interaction

19990046175 National Inst. for Fusion Science, Toki, Japan
Computational Study of Three Dimensional Equilibria with the Bootstrap Current
Kanno, R., National Inst. for Fusion Science, Japan; Nakajima, N, National Inst. for Fusion Science, Japan; Hayashi, T., National Inst. for Fusion Science, Japan; Okamoto, M., National Inst. for Fusion Science, Japan; Mar. 1998; ISSN 0915-633X; 10p; In English
Report No.(s): NIFS-546; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The three dimensional currentless equilibrium code, HINT, is revised so that it can handle equilibria with a net toroidal current, e.g. the bootstrap current. The revised HINT code is applied to equilibria of the Large Helical Device with good nested flux surfaces.
Author
Computation; Three Dimensional Models; Equilibrium Methods

19990046177 Princeton Univ., Plasma Physics Lab., NJ USA
Deuterium-Tritium Simulations of the Enhanced Reversed Shear Mode in the Tokamak Fusion Test Reactor
Mikkelsen, D. R.; Manickam, J.; Scott, S. D.; Zarnstorff,; Dec. 31, 1997; 21p; In English
Report No.(s): DE97-052063; PPPL-3240; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The potential performance, in deuterium-tritium plasmas, of a new enhanced con nement regime with reversed magnetic shear (ERS mode) is assessed. The equilibrium conditions for an ERS mode plasma are estimated by solving the plasma transport equations using the thermal and particle diffusivities measured in a short duration ERS mode discharge in the Tokamak Fusion Test Reactor (F. M. Levinton, et al., Phys. Rev. Letters, 75, 4417, (1995)). The plasma performance depends strongly on Zeff and neutral beam penetration to the core. The steady state projections typically have a central electron density of (approx)2:5 x 10 20 m(exp -3) and nearly equal central electron and ion temperatures of (approx)10 keV. In time dependent simulations the peak fusion power, (approx) 25 MW, is twice the steady state level. Peak performance occurs during the density rise when the central ion temperature is close to the optimal value of (approx) 15 keV. The simulated pressure profiles can be stable to ideal MHD instabilities with toroidal mode number n = 1, 2, 3, 4 and (infinity) for (beta)(sub norm) up to 2.5; the simulations have (beta)(sub norm) (le) 2.1. The enhanced reversed shear mode may thus provide an opportunity to conduct alpha physics experiments in conditions similar to those proposed for advanced tokamak reactors.
NTIS
Deuterium; Tritium; Tokamak Devices; Fusion Reactors; Advanced Test Reactors; Deuterium Plasma; Simulation

19990046178 Princeton Univ., Plasma Physics Lab., NJ USA
Testing the (rho)* scaling of thermal transport models: predicted and measured temperatures in the Tokamak Fusion Test Reactor dimensionless scaling experiments
Mikkelsen, D. R.; Scott, S. D.; Dorland, W.; Dec. 31, 1997; 18p; In English
Report No.(s): DE97-052062; PPPL-3241; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Theoretical predictions of ion and electron thermal diffusivities are tested by comparing calculated and measured temperatures in low (L) mode plasmas from the Tokamak Fusion Test Reactor (D. J. Grove and D. M. Meade, Nucl. Fusion 25 , 1167 (1985)) nondimensional scaling experiments. The DIII-D (J. L. Luxon and L. G. Davis, Fusion Technol. 8 , 441 (1985)) L-mode (rho)* scalings, the transport models of Rebut-Lallia-Watkins (RLW), Boucher's modification of RLW, and the Institute for Fusion Studies-Princeton Plasma Physics Laboratory (IFS-PPPL) model for transport due to ion temperature gradient modes are tested. The predictions use the measured densities in order to include the effects of density profile shape variations on the transport models. The uncertainties in the measured and predicted temperatures are discussed. The predictions based on the DIII-D scalings are within the measurement uncertainties. All the theoretical models predict a more favorable (rho)* dependence for the ion temperatures than is seen. Preliminary estimates indicate that sheared ow stabilization is important for some discharges, and that inclusion of its effects may bring the predictions of the IFS-PPPL model into agreement with the experiments.
NTIS
Thermal Diffusivity; Mathematical Models; Tokamak Devices; Dimensionless Numbers; Fusion Reactors; Transport Theory; Scaling Laws; Electron Energy

19990046196 Rutherford Appleton Lab., Chilton, UK

Optimisation of Narrow Band Extreme UV Conversion Efficiency of Picosecond Laser Plasma Sources

Bijkerk, F.; Stuik, R.; Shmaenok, L. A.; Sorokin, A. A.; Turcu, I. C. E.; Feb. 26, 1999; ISSN 1358-6254; 18p; In English

Report No.(s): PB99-139347; RAL-TR-1999-002; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Extreme Ultra Voilet lithography is considered a likely successor of the current deep-UV lithographic techniques in semiconductor industry. For this application a bright source of monochromatic light with a wavelength in the range between 10 and 20 nm is needed. An appropriate candidate is the laser plasma; a very bright point source, also in this wavelength range. Optimization of yield of a laser plasma is needed in order to use this source as efficient as possible.

NTIS

Optimization; Narrowband; Energy Conversion Efficiency; Laser Plasmas; Laser Outputs; Point Sources; Picosecond Pulses; Ultraviolet Radiation

19990046225 Oak Ridge National Lab., TN USA

Fusion materials *Semiannual Report, period ending 30 Jun. 1998*

Burn, G.; Sep. 30, 1998; 314p; In English

Report No.(s): DE98-007433; DOE/ER-0313/24; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is the twenty-fourth in a series of semiannual technical progress reports on fusion materials. This report combines the full spectrum of research and development activities on both metallic and non-metallic materials with primary emphasis on the effects of the neutronic and chemical environment on the properties and performance of materials for in-vessel components. This effort forms one element of the materials program being conducted in support of the Fusion Energy Sciences Program of the US Department of Energy.

NTIS

Reactor Materials; Research and Development

19990046312 General Atomics Co., San Diego, CA USA

Comparison of L-H transition measurements with physics models

Carlstrom, T. N.; Burrell, K. H.; Groebner, R. J.; Leonard, A. W.; Osborne, T. H.; Dec. 31, 1998; 24p; In English; IAEA fusion energy conference

Report No.(s): DE99-001353; GA-A22989; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A technique of fitting a modified hyperbolic tangent to the edge profiles has improved the localization of plasma edge parameters. Non-dimensional edge parameters are broadly consistent with several theories of the L-H transition that use edge gradients in their formulation of a critical threshold parameter. The ion (del)B drift direction has only a small effect on the edge plasma conditions measured near the plasma midplane but a large effect on the divertor plasma. The dramatic change of power threshold with the direction of the ion (del)B drift implies that phenomena in the divertor region may be critical for the L-H transition.

NTIS

Plasmas (Physics); Plasma Control

19990046313 General Atomics Co., San Diego, CA USA

Progress towards sustainment of advanced tokamak modes in DIII-D

Rice, B. W.; Burrell, K. H.; Ferron, J. R.; Dec. 31, 1998; 24p; In English; IAEA fusion energy conference

Report No.(s): DE99-001352; GA-A22999; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Improving confinement and beta limits simultaneously in long-pulse ELMy H-mode discharges is investigated. The product (beta)(sub N)H(sub 98y) serves as a useful figure-of-merit for performance, where (beta)(sub N) (triple-bond) (beta)/(I/aB) and H(sub 98y) is the ratio of the thermal confinement time relative to the most recent ELMy H-mode confinement scaling established by the ITER confinement database working group. In discharges with q(0) (approximately) 1 (no sawteeth) and discharges with q(sub min) > 1.5 and negative central magnetic shear, (beta)(sub N) (approximately) 2.9 and H(sub 98y) (approximately) 1.4 are sustained for up to 2 s. Although peaked profiles are observed, steep internal transport barriers are not present. Further increases in (beta)(sub N) in these discharges is limited by neoclassical tearing modes (NTM) in the positive shear region. In another recently developed regime, (beta)(sub N) (approximately) 3.8 and H(sub 98y) (approximately) 1.8 has been sustained during large infrequent ELMs in non-sawtoothing discharges with 1(0) (approximately) 1. This level of performance is similar to that obtained in ELM-free regimes such as VH-mode. The limitation on (beta)(sub N) and pulse length in these discharges is also the onset of NTMs.

NTIS

Tokamak Devices; Fusion Reactors

19990046314 General Atomics Co., San Diego, CA USA

Radiative and SOL experiments in open and baffled divertors on DIII-D

Allen, S. L.; Brooks, N. H.; Bastasz, R.; Nov. 30, 1998; 28p; In English; IAEA fusion energy conference

Report No.(s): DE99-001350; GA-A23004; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The authors present recent progress towards an understanding of the physical processes in the divertor and scrape-off-layer (SOL) plasmas in DIII-D. This has been made possible by a combination of new diagnostics, improved computational models, and changes in divertor geometry. They have focused primarily on ELMing H-mode discharges. The physics of Partially Detached Divertor (PDD) plasmas, with divertor heat flux reduction by divertor radiation enhancement using D(2) puffing, has been studied in 2-D, and a model of the heat and particle transport has been developed that includes conduction, convection, ionization, recombination, and flows. Plasma and impurity particle flows have been measured with Mach probes and spectroscopy and these flows have been compared with the UEDGE model. The model now includes self-consistent calculations of carbon impurities. Impurity radiation has been increased in the divertor and SOL with puff and pump techniques using SOL D(2) puffing, divertor cryopumping, and argon puffing. The important physical processes in plasma-wall interactions have been examined with a DiMES probe, plasma characterization near the divertor plate, and the REDEP code. Experiments comparing single-null (SN) plasma operation in baffled and open divertors have demonstrated a change in the edge plasma profiles. These results are consistent with a reduction in the core ionization source calculated with UEDGE. Divertor particle control in ELMing H-mode with pumping and baffling has resulted in reduction in H-mode core densities to n(sub e)/n(sub gw) (approx) 0.25. Divertor particle exhaust and heat flux has been studied as the plasma shape was varied from a lower SN, to a balanced double null (DN), and finally to an upper SN.

NTIS

Tokamak Devices; Divertors (Fusion Reactors)

19990046315 General Atomics Co., San Diego, CA USA

Effects of plasma shape and profiles on edge stability in DIII-D

Lao, L. L.; Chan, V. S.; Chen, L.; Dec. 31, 1998; 20p; In English; IAEA fusion energy conference

Report No.(s): DE99-001349; GA-A22993; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The results of recent experimental and theoretical studies concerning the effects of plasma shape and current and pressure profiles on edge instabilities in DIII-D are presented. Magnetic oscillations with toroidal mode number n (approximately) 2--9 and a fast growth time (gamma)(sup -1) = 20--150 (micro)s are often observed prior to the first giant type 1 ELM in discharges with moderate squareness. High n ideal ballooning second stability access encourages edge instabilities by facilitating the buildup of the edge pressure gradient and bootstrap current density which destabilize the intermediate to low n modes. Analysis suggests that discharges with large edge pressure gradient and bootstrap current density are more unstable to n > 1 modes. Calculations and experimental results show that ELM amplitude and frequency can be varied by controlling access to the second ballooning stability regime at the edge through variation of the squareness of the discharge shape. A new method is proposed to control edge instabilities by reducing access to the second ballooning stability regime at the edge using high order local perturbation of the plasma shape in the outboard bad curvature region.

NTIS

Plasmas (Physics); Shapes; Stability; Tokamak Devices; Pressure Distribution; Plasma Currents; Edges

19990046316 Wisconsin Univ., Dept. of Physics, Madison, WI USA

Measurement of core velocity fluctuations and the dynamo in a reversed- field pinch

Den Hartog, D. J.; Craig, D.; Fiksel, G.; Fontana, P. W.; Prager, S. C.; Dec. 31, 1998; 24p; In English; Annual physics of plasmas meeting, APS Division of Plasma Physics

Report No.(s): DE99-001348; DOE/ER/54345-311; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Plasma flow velocity fluctuations have been directly measured in the high temperature magnetically confined plasma in the Madison Symmetric Torus (MST) Reversed-Field Pinch (RFP). These measurements show that the flow velocity fluctuations are correlated with magnetic field fluctuations. This initial measurement is subject to limitations of spatial localization and other uncertainties, but is evidence for sustainment of the RFP magnetic field configuration by the magnetohydrodynamic (MHD) dynamo. Both the flow velocity and magnetic field fluctuations are the result of global resistive MHD modes of helicity m = 1, n = 5--10 in the core of MST. Chord-averaged flow velocity fluctuations are measured in the core of MST by recording the Doppler shift of impurity line emission with a specialized high resolution and throughput grating spectrometer. Magnetic field fluctuations

are recorded with a large array of small edge pickup coils, which allows spectral decomposition into discrete modes and subsequent correlation with the velocity fluctuation data.
NTIS
Velocity Measurement; Velocity Distribution; Flow Velocity; Reverse Field Pinch; Variations; Plasma Diagnostics; High Temperature Plasmas; Magnetohydrodynamics

19990046333 Department of Energy, Office of Energy Research, Washington, DC USA
Design of the HHFW heating and current drive system for NSTX
Ryan, P. M., Department of Energy, USA; Carter, M. D., Department of Energy, USA; Swain, D. W., Department of Energy, USA; Dec. 31, 1998; 4p; In English; 2nd; RF Heating and Current Drive of Fusion Devices, USA
Report No.(s): DE99-000473; ORNL/CP-96471; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
The National Spherical Tokamak Experiment (NSTX) is a low aspect ratio (A = 1.25) tokamak being built at Princeton Plasma Physics Laboratory (PPPL), with major radius = 0.8 m, B(sub T) = 0.32 T and I(sub p) up to 1 MA. The machine requires on the order of 6 MW of auxiliary heating in order to test (beta) limits and it needs electron heating/current drive in order to extend the pulse length and demonstrate non-inductive startup. The high harmonic fast wave (HHFW) system, operating at 30 MHz, is being designed to meet these objectives.
NTIS
Tokamak Devices; Design Analysis; Radio Frequency Heating

19990046341 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Generation and compression of a target plasma for magnetized target fusion
Kirkpatrick, R. C., Department of Energy, USA; Lindemuth, I. R., Department of Energy, USA; Sheehey, P. T., Department of Energy, USA; Dec. 31, 1998; 43p; In English
Report No.(s): DE99-000557; LA-UR-98-1861; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
This is the final report of a three-year, Laboratory Directed Research and Development (LDRD) project at the Los Alamos National Laboratory (LANL). Magnetized target fusion (MTF) is intermediate between the two very different approaches to fusion: inertial and magnetic confinement fusion (ICF and MCF). Results from collaboration with a Russian MTF team on their MAGO experiments suggest they have a target plasma suitable for compression to provide an MTF proof of principle. This LDRD project had tow main objectives: first, to provide a computational basis for experimental investigation of an alternative MTF plasma, and second to explore the physics and computational needs for a continuing program. Secondary objectives included analytic and computational support for MTF experiments. The first objective was fulfilled. The second main objective has several facets to be described in the body of this report. Finally, the authors have developed tools for analyzing data collected on the MAGO and LDRD experiments, and have tested them on limited MAGO data.
NTIS
Inertial Confinement Fusion; Plasma Compression; Plasma Control; Plasmas (Physics); Controlled Fusion

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SOLID-STATE PHYSICS

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

19990043983 Department of Energy, Office of Energy Research, Washington, DC USA
Helical Spin-Density Wave in Fe/Cr Trilayers with Perfect Interfaces
Fishman, R. S.; Jul. 31, 1998; 12p; In English; International conference on magnetism and magnetic materials
Report No.(s): DE99-000221; ORNL/CP-99130; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
Despite the presence of only collinear, commensurate (C) and incommensurate (I) spin-density waves (SDW's) in bulk Cr, the interfacial steps in Fe/Cr multilayers are now believed to stabilize a helical (H) SDW within the Cr spacer. Yet H SDW's were first predicted in an Fe/Cr trilayer with perfect interfaces when the orientation of the Fe moments does not favor C ordering: if the number of Cr monolayers is even (odd) and the Fe moments are pointing in the same (opposite) direction, then a C SDW does not gain any coupling energy. Under these circumstances, a simple model verifies that H ordering is indeed favored over 1 ordering provided that the Fermi surface mismatch is sufficiently small or the temperature sufficiently high.
NTIS
Magnons; Interlayers; Iron

19990045626 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Electrohydrodynamics of Liquid Crystal in Dielectric Regime: Variety of Chevron Patterns

Mori, Nobuaki, Kyushu Univ., Japan; Hidaka, Yoshiki, Kyushu Univ., Japan; Kai, Shoichi, Kyushu Univ., Japan; Technology Reports of Kyushu University; Jul. 1998; Volume 71, No. 4, pp. 297-302; In Japanese; See also 19990045622; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

When an ac voltage beyond the threshold at higher frequency (dielectric regime) is applied to a planarly oriented nematic layer, a herringbone pattern called the ”chevron pattern” appears. Though it its known that there are few types of chevron patterns, their details are not clear yet. In order to clarify the variety of chevron patterns, therefore, we prepared two types of cell. One cell was filled with the nematics MBBA with higher electric conductivity by doping TBAB. The other one was filled with pure MBBA of lower electric conductivity. We found two types of chevron patterns. That is the chevron A observed in the higher conductivity cell had larger period (approx. 10 microns) with no defects and the chevron B observed in the lower conductivity cell had smaller period (approx. 1 micron) consisting of periodic alignments of defects.

Author

Electrohydrodynamics; Liquid Crystals; Dielectrics

19990045663 Department of Energy, Washington, DC USA

Equation of state of warm condensed matter

Barbee, T. W.; Young, D. A.; Rogers, F. J.; Mar. 01, 1998; 10p; In English; 1997 fall meeting of the Materials Research Society Report No.(s): DE98-057717; UCRL-JC-130201; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent advances in computational condensed matter theory have yielded accurate calculations of properties of materials. These calculations have, for the most part, focused on the low temperature (T=0) limit. An accurate determination of the equation of state (EOS) at finite temperature also requires knowledge of the behavior of the electron and ion thermal pressure as a function of T. Current approaches often interpolate between calculated T=0 results and approximations valid in the high T limit. Plasma physics-based approaches are accurate in the high temperature limit, but lose accuracy below T approximately T(sub Fermi). We seek to ”connect up” these two regimes by using ab initio finite temperature methods (including linear-response(1) based phonon calculations) to derive an equation of state of condensed matter for T is less than or equal to T(sub Fermi). We will present theoretical results for the principal Hugoniot of shocked materials, including carbon and aluminum, up to pressures P is less than 100 GPa and temperatures T is less than 10(exp 4)K, and compare our results with available experimental data.

NTIS

Equations of State; Matter (Physics); Condensed Matter Physics

19990045894 NASA Marshall Space Flight Center, Huntsville, AL USA

Crystallization of Chicken Egg White Lysozyme from Assorted Sulfate Salts

Forsythe, Elizabeth L., Universities Space Research Association, USA; Snell, Edward H., National Academy of Sciences - National Research Council, USA; Malone, Christine C., Universities Space Research Association, USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; Journal of Crystal Growth; 1999; ISSN 0022-0248; Volume 196, pp. 332-343; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Chicken egg white lysozyme has been found to crystallize from ammonium, sodium, potassium, rubidium, magnesium, and manganese sulfates at acidic and basic pH, with protein concentrations from 60 to 190 mg/ml. Crystals have also been grown at 4 C in the absence of any other added salts using isoionic lysozyme which was titrated to pH 4.6 with dilute sulfuric acid. Four different crystal forms have been obtained, depending upon the temperature, protein concentration, and precipitating salt employed. Crystals grown at 15 C were generally tetragonal, with space group P4(sub 3)2(sub 1)2. Crystallization at 20 C typically resulted in the formation of orthorhombic crystals, space group P2(sub 1)2(sub 1)2(sub 1). The tetragonal reversible reaction orthorhombic transition appeared to be a function of both the temperature and protein concentration, occurring between 15 and 20 C and between 100 and 125 mg/ml protein concentration. Crystallization from 1.2 M magnesium sulfate at pH 7.8 gave a trigonal crystal, space group P3(sub 1)2(sub 1), a = b = 87.4, c = 73.7, gamma = 120 deg, which diffracted to 2.8 A. Crystallization from ammonium sulfate at pH 4.6, generally at lower temperatures, was also found to result in a monoclinic form. space group C2, a = 65.6, b = 95.0, c = 41.2, beta = 119.2 deg. A crystal of approximately 0.2 x 0.2 x 0.5 mm grown from bulk solution diffracted to approximately 3.5 A.

Author

Chickens; Eggs; Lysozyme; Crystallization; Crystal Growth

19990046016 National Inst. of Standards and Technology, Technology Administration, Gaithersburg, MD USA

Anisotropy of Interfaces in an Ordered HCP Binary Alloy

Cahn, J. W., National Inst. of Standards and Technology, USA; McFadden, G. B., National Inst. of Standards and Technology, USA; Han, S. C.; Sep. 1998; 36p; In English

Report No.(s): PB98-158405; NISTIR-6217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multiple-order-parameter mean field theory of ordering on a bindary hexagonal-close-packed (HCP) crystal structure is developed, and adapted to provide a continuum formulation that incorporates the underlying symmetries of the HCP crystal in both the bulk and gradient energy terms of the free energy. The work is an extension of the previous treatment of order-disorder transitions on a face-centered-cubic crystal (FCC) lattice. The theory is used to compute the orientation dependence of the structure and energy of interphase and antiphase boundaries in ordering to the Cd3Mg and CdMg structures, which are the HCP analogs of Cu3Au and CuAu structures in FCC. As in the corresponding FCC case, the multiple order parameters do not form a vector. Anisotropy is a natural consequence of the underlying crystal symmetrics and the multiple-order-parameter continuum formation presented here. The isotropy transverse to the six-fold axis expected for a scalar order parameter is not found.

NTIS

Anisotropy; Binary Alloys; Hexagons; Close Packed Lattices

19990046291 NASA Marshall Space Flight Center, Huntsville, AL USA

Application of Rotating Magnetic Fields to THM Growth Process: Te-CdTe

LeClair, Mark, Cape Simulations, Inc., USA; Worlikar, Ani, Cape Simulations, Inc., USA; Motakef, Shariar, Cape Simulations, Inc., USA; Gillies, Donald C., NASA Marshall Space Flight Center, USA; 1998; In English; Crystal Growth, 26-31 Jul. 1998, Jerusalem, Israel; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The numerical simulation of ongoing traveling heater method (THM) solution growth experiments of CdTe from Te solvent and the influence of a Rotating Magnetic Field (RMF) on control of convection in the solution zone is presented. The application of RMF is pursued as a means to actively control thermo-solutal convection in the solution zone which otherwise would be dominated by buoyancy forces. Numerical simulation and scaling analysis are used to generate a flow-regime map demarcating the boundary separating the buoyancy- and RMF-driven convection in the solution zone. Results indicate that whereas at low gravity levels the application of RMF can completely overwhelm buoyancy-induced convection, at normal gravity levels the successful control of convection by RMF requires use of fairly thin solvent zones. Simulation results also indicate that field strengths required to dominate natural convection on earth may lead to instabilities and transition to turbulence, and an associated deleterious effect on the quality of grown crystals. These and other simulations results are discussed in reference to experimental evidence.

Author

Rotation; Magnetic Fields; Cadmium Tellurides; Solvents; Heating Equipment

19990046323 Northrop Grumman Corp., Electronic Sensors and System Sector Advanced Technology Center, Linthicum, MD USA

Multispectral Superconducting Quantum Detectors ***Final Report, Sep. 1995 - Dec. 1998***

Bluzer, Nathan; Forrester, Martin G.; Jan. 1999; 77p; In English

Contract(s)/Grant(s): F49620-95-C-0074

Report No.(s): AD-A361795; AFRL-SR-BL-TR-99-0103; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Superconducting quantum detector structures were formulated, designed, fabricated and tested. As designed, the expected photoresponse depends on the superconducting current's kinetic inductance. The kinetic inductance, inversely proportional to the Cooper pair density, changes with photoabsorption. Photons with sufficient energy to breaks Cooper pairs, modulate the superconducting current's kinetic inductance. The modulation depends on the photoabsorbed photon flux density and the quasiparticle excitation lifetime. Such a photoresponse is consistent with a quantum detector. For maximum response, we have fabricated photodetector structures with significantly reduced geometrical inductance and maximum kinetic inductance. These quantum detectors were monolithic with Josephson-junction readout circuits. A multi-level YBa2Cu3O(7-delta) processes was used for fabrication. These devices were tested at cryogenic temperatures in a specially designed and fabricated facility. Electrically, the SQUID read out performed well. Modulation of the SQUID critical current was successful, revealing that we successfully fabricated these detector structures. This modulation was achieved by injecting a dc current into one half of the quantum photodetector, thereby changing the average phase across Josephson junctions from pi/2. This phase change reduced the SQUID's critical current. The quasiparticle lifetime was too short to measure a quantum response at low frequencies. The experimentally observed short quasiparticle lifetime may be due to intrinsic or extrinsic effects. Given the relative immaturity of high temperature superconducting fabrication technology, it is not unreasonable to expect material defects to severely reduce the quasiparticle lifetime and hence

mask any low frequency quantum responses. A second possibility is that unlike the BCS superconductors, the quasiparticle lifetimes in high temperature superconductors do not exponentially increase with lower temperatures.
DTIC
Superconductivity; Quantum Electronics; Photometers; Detectors

19990046581 Arizona State Univ., Dept. of Electrical Engineering, Tempe, AZ USA
Semiconductor Science and Technology, Volume 12 ***Final Report, Oct. 1997 - Sep. 1998***
Bird, J. P.; Aug. 1998; 195p; In English; Surfaces and Interfaces of Mesoscopic Devices, 7-12 Dec. 1997, HI, USA
Contract(s)/Grant(s): N00014-98-1-0042
Report No.(s): AD-A361848; ISSN 0268-1242; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The Second International Workshop on Surfaces and Interfaces of Mesoscopic Devices (SIMD'97) was held among the luxurious surroundings of the Hyatt Regency Hotel, on the Hawaiian island of Maui, from 7-12 December 1997. Some seventy researchers from around the world gathered in this idyllic setting to report key advances in the physics of mesoscopic devices and their future technological applications. The atmosphere of the workshop was highly stimulating, with all contributions presented in oral format and sufficient time allocated for lively question and answer sessions. The scope of the workshop was also ambitious, although without being over-diluted. Major topics covered included: fundamentals of electron transport in quantum dots and quantum dot arrays, organics on semiconductors, impurities in heterostructures, fabrication of nanostructures, single electron devices, quantum wells and nanodevices. As Guest Editor of this special issue of Semiconductor Science and Technology, I would like to take this opportunity to thank all of the workshop committee members for their hard work and to gratefully acknowledge the financial support for SIMD'97 from the Arizona State University and the Office of Naval Research. Here's looking forward to doing it all again.
DTIC
Nanostructures (Devices); Semiconductor Devices; Fabrication; Research and Development; Conferences; Electronic Equipment; Microelectronics

19990046585 Missouri Univ., Dept. of Physics and Astronomy, Rolla, MO USA
Doctoral Research in Wavelet NDE and Novel Dielectrics ***Final Report, 15 May 1995 - 23 Mar. 1999***
DeFacio, Brian; Mar. 19, 1999; 17p; In English
Contract(s)/Grant(s): F49620-95-1-0380; AF Proj. 3484
Report No.(s): AD-A361860; AFRL-SR-BL-TR-99-0109; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goals of this project were to perform and publish mathematical research on wavelet signal processing, periodic composite dielectrics, and complete some work on the dispersion of water from a previous AFOSR grant. The wavelet studies were directed toward nondestructive evaluation using ultrasonic waves. The novel dielectrics were mainly the PBGS, photonic band structures-periodic arrays of a dielectric with permittivity e(a) embedded in a background dielectric with permittivity e(b). Several types of disorder of these periodic objects were also studied.
DTIC
Wavelet Analysis; Energy Gaps (Solid State); Nondestructive Tests; Signal Processing

19990046755 La Trobe Univ., School of Chemistry, Bundoora, Australia
A/C-Ring Colchicine Analogues: A Comparison of Molecular Conformations of the Minimized and Crystal Structures
Ang, Kiah H., La Trobe Univ., Australia; Greenwood, Richard J., La Trobe Univ., Australia; Mackay, Maureen F., La Trobe Univ., Australia; Wong, Margaret G., Swinburne Univ. of Technology, Australia; Australian Journal of Chemistry; 1997; ISSN 0004-9425; Volume 50, No. 2, pp. 115-122; In English; Copyright; Avail: Issuing Activity (CSIRO Publishing, P.O. Box 1139, 150 Oxford St., Collingwood, Vic. 3066, Australia), Hardcopy, Microfiche

Molecular mechanics and molecular orbital calculations have been used to determine the low-energy conformations of six biaryl analogues of colchicine lacking the seven-membered B-ring. A comparison of the conformations resulting from the different minimizations has been made, and these conformations were also compared with those found in the solid state for the respective biaryl analogues and the A/c-ring systems of colchicine and isocolchicine. The barriers to rotation about the A/c-linkage of the analogues were estimated from rotational plots. The mm+ calculations were not satisfactory for estimating the barriers, whilst the mmx, MAXIMIN2 and AM1 values, although agreeing on average only to within 16 kJ mol-1, exhibited the expected trend in magnitude. This trend, however, did not correlate with the inhibition of tubulin polymerization to microtubules.
Author
Colchicine; Crystal Structure; Molecular Orbitals; Polymerization; Molecular Structure; Biochemistry

19990046765 Polish Academy of Sciences, Warsaw, Poland

Some Aspects of PVT Low Supersaturation Nucleation and Contactless Crystal Growth

Grasza, K., Polish Academy of Sciences, Poland; Palosz, W., Universities Space Research Association, USA; Crystal Research and Technology; 1996; 5p; In English

Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The basic principles of the contactless growth of crystals from the vapor in combination with the process of low-supersaturation nucleation are discussed. The mathematical formulation of the morphological stability criterion in vapor growth systems is given and its implications for contactless growth technique are analyzed. A diagram for selection of proper temperature conditions for growth of CdTe crystals is presented.

Author

Crystal Growth; Crystallization; Vapor Deposition; Nucleation; Supersaturation

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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.

19990045741 Rutherford Appleton Lab., Chilton, UK

The Dualized Standard Model and its Applications ***Interim Report***

Hong-Mo, Chan, Rutherford Appleton Lab., UK; Tsou, Sheung Tsun, Oxford Univ., UK; Feb. 11, 1999; ISSN 1358-6254; In English

Report No.(s): RAL-TR-1999-015; Copyright; Avail: Issuing Activity (CLRD, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire)X11 0QX, UK), Hardcopy, Microfiche

Based on a nonabelian generalization of electric-magnetic duality, the Dualized Standard Model (DSM) suggests a natural explanation for exactly 3 generations of fermions as the 'dual color' SU(3) symmetry broken in a particular manner. The resulting scheme then offers on the one hand a fermion mass hierarchy and a perturbative method for calculating the mass and mixing parameters of the Standard Model fermions, and on the other testable predictions for new phenomena ranging from rare meson decays to ultra-high energy cosmic rays. Calculations to 1-loop order gives, at the cost of adjusting only 3 real parameters, values for the following quantities all (except one) in very good agreement with experiment: the quark CKM matrix elements absolute value of V(sub rs), the lepton CKM matrix elements absolute value of U(sub rs), and the second generation masses m(sub c),m(sub s), m(sub mu). This means, in particular, that it gives near maximal mixing U(sub mu.3) between nu(sub mu) and nu(sub tau) as observed by SuperKamiokande, Kamiokande and Soudan, while keeping small the corresponding quark angles V(sub cb), V(sub ts). In addition, the scheme gives (i) rough order-of-magnitude estimates for the masses of the lowest generation, (ii) predictions for low energy FCNC effects such as K(sub L) approaches e.mu, (iii) a possible explanation for the long-standing puzzle of air showers beyond the GZK cut-off. All these together, however, still represent but a portion of the possible physical consequences derivable from the DSM scheme the majority of which are yet to be explored.

Author

Electroweak Interactions (Field Theory); Standard Model (Particle Physics); Quark Models; Fermions; Particle Decay

19990045942 Geurdes (Johannes F.), The Hague, Netherlands

Wigner's Variant of Bell's Inequality

Geurdes, Johannes F., Geurdes (Johannes F.), Netherlands; Australian Journal of Physics; 1998; Volume 51, No. 5, pp. 835-842; In English; See also 19990045940; Copyright; Avail: Issuing Activity (Australian Journal of Physics, P.O. Box 1139 (150 Oxford St.), Collingwood, Victoria 3066, Australia), Hardcopy, Microfiche

It is shown that Wigner's variant of Bell's inequality does not exclude all local hidden variable explanations of the Einstein-Podolsky-Rosen problem.

Author

Inequalities; Quantum Mechanics; Einstein Equations; Particle Spin; Wigner Coefficient

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990044039 Norwegian Defence Research Establishment, Kjeller, Norway
Proposed Industrial Policy for Defence Procurement ***Final Report Forslag Til Gjennomforing av Naeringspolitisk Strategi for Materiellprosjekter***
Johansen, Henry Kjell, Norwegian Defence Research Establishment, Norway; Warberg, Erik, Norwegian Defence Research Establishment, Norway; Huseby, Dag Elvind, Norwegian Defence Research Establishment, Norway; Mar. 02, 1999; 80p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): FFIE Proj. 706/732
Report No.(s): FFI/Rapport/99/01050; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report summarizes the work carried out by the Norwegian Defence Research Establishment on industrial policy issues in conjunction with the defence procurements planned for the next 20 years. The work has been requested by the Ministry of Defence to advise them on possible measures to increase the Norwegian defence industry involvement in defence acquisitions. One major task has been to categorize the larger procurement projects in; possible procurement contracts for Norwegian industry, international co-operation likely and procurement abroad with offset agreement. Around 50% of the procurements fall in the last category, while the rest divides between national supplies and international co-operation if the industry is given necessary support to become competitive. Such measures could be; participation in international armament co-operation, strategic use of offset to strengthen the industry, early integrated teaming arrangements and partnering, new contract strategies, revision of the defence acquisition act, simplification of the procurement decision structure, and improved financing of technology development and competence building.
Author
Defense Industry; Procurement; Government/Industry Relations; Contracts

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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.

19990046038 Los Alamos National Lab., NM USA
Internet information infrastructure: Terrorist tool or architecture for information defense
Kadner, S.; Turpen, E.; Rees, B.; Dec. 31, 1998; 17p; In English; Annual international arms control conference
Report No.(s): DE99-000670; LA-UR-98-1348; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Internet is a culmination of information age technologies and an agent of change. As with any infrastructure, dependency upon the so-called global information infrastructure creates vulnerabilities. Moreover, unlike physical infrastructures, the Internet is a multi-use technology. While information technologies, such as the Internet, can be utilized as a tool of terror, these same technologies can facilitate the implementation of solutions to mitigate the threat. In this vein, this paper analyzes the multifaceted nature of the Internet information infrastructure and argues that policymakers should concentrate on the solutions it provides rather than the vulnerabilities it creates. Minimizing risks and realizing possibilities in the information age will require institutional activities that translate, exploit and convert information technologies into positive solutions. What follows is a discussion of the Internet information infrastructure as it relates to increasing vulnerabilities and positive potential. The following four applications of the Internet will be addressed: as the infrastructure for information competence; as a terrorist tool; as the terrorist's target; and as an architecture for rapid response.
NTIS
Internets; Architecture (Computers)

19990046190 Patent and Trademark Office, Washington, DC USA
Strategic Information Technology Plan for Fiscal Years 1999-2004 (Patent and Trademark Office). Executive Overview
Dec. 1998; 622p; In English
Report No.(s): PB99-137200; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

In PTO's Corporate Plan, the Commissioner of Patents and Trademarks outlines a vision and establishes goals which recognizes the importance of intellectual property protection in a global and technology-based economy. In concert with the Corporate Plan, the Strategic Information Technology Plan documents the role that information technology plays in achieving the PTO's mission, vision, and goals. The plan also defines a vision for PTO's information technology environment that will greatly enhance the quality of the PTO's service to its customers and guide the PTO Information Technology Program during the FY1999 to FY2004 period. to meet the challenges of the future, the PTO has developed an ambitious strategic agenda to help position the agency to operate more successfully and efficiently in the 21st century. An important component of the PTO's agenda is 'leveraging information technology.' This corporate strategic response enables PTO to maintain current business production, improve and enhance the current business through electronic commerce, and add new capability by migrating automated information systems to operate on an 'open system' information technology infrastructure.
NTIS
Data Management; Information Theory; Organizations

19990046290 Oklahoma Univ., Oklahoma Geological Survey, Norman, OK USA
Identification and evaluation of fluvial-dominated deltaic (Class I oil) reservoirs in Oklahoma ***Final Report, August 1998***
Banken, M. K.; Nov. 30, 1998; 74p; In English
Report No.(s): DE98-000547; DOE/BC/14956-16; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Oklahoma Geological Survey (OGS), the Geo Information Systems department, and the School of Petroleum and Geological Engineering at the University of Oklahoma have engaged in a five-year program to identify and address Oklahoma's oil recovery opportunities in fluvial-dominated deltaic (FDD) reservoirs. This program included a systematic and comprehensive collection and evaluation of information on all FDD oil reservoirs in Oklahoma and the recovery technologies that have been (or could be) applied to those reservoirs with commercial success. The execution of this project was approached in phases. The first phase began in January, 1993 and consisted of planning, play identification and analysis, data acquisition, database development, and computer systems design. by the middle of 1994, many of these tasks were completed or nearly finished including the identification of all FDD reservoirs in Oklahoma, data collection, and defining play boundaries. by early 1995, a preliminary workshop schedule had been developed for project implementation and technology transfer activities. Later in 1995, the play workshop and publication series was initiated with the Morrow and the Booch plays. Concurrent with the initiation of the workshop series was the opening of a computer user lab that was developed for use by the petroleum industry. Industry response to the facility initially was slow, but after the first year lab usage began to increase and is sustaining. The remaining six play workshops were completed through 1996 and 1997, with the project ending on December 31, 1997.
NTIS
Reservoirs; Oil Recovery; Oils; Geological Surveys; Geology; Oil Fields

19990046350 Celeris Aerospace Canada, Inc., Ottawa, Ontario Canada
Technical Data Management: An Essential Tool for Effective Life Cycle Management
Hall, Stephen R., Celeris Aerospace Canada, Inc., Canada; Miner, John W. R., Celeris Aerospace Canada, Inc., Canada; Exploitation of Structural Loads/Health Data for Reduced Life Cycle Costs; November 1998; 20p; In English; See also 19990046347; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Contents include the following: economic realities; tool of exploration; the neglected partners; technical data management; the solution; an integrate approach; causes of failure; the cost of data acquisition; reason for monitoring; data-modeling techniques; sources of data error; and conclusions.
CASI
Data Management; Life (Durability); Failure

19990046482 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
End-to-End, Phase 2 ***Interim Report***
Hovey, Paul; Feb. 1999; 90p; In English
Report No.(s): AD-A361799; JADS/JT&E-TR-99-005; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This summary serves as a stand-alone document, as well as part of this report. For that reason, the reader will find some duplication of verbiage and figures between the summary and the full report. The Joint Advanced Distributed Simulation (JADS) Joint Test and Evaluation (JT&E) was chartered by the deputy director, Test, Systems Engineering and Evaluation (Test and Evaluation), Office of the Under Secretary of Defense (Acquisition and Technology) in October 1994 to investigate the utility of advanced distributed simulation (ADS) technologies for support of developmental test and evaluation (DT&E) and operational test and evaluation (OT&E). The program is Air Force led with Army and Navy participation. JADS Joint Test Force (JTF) man-

ning currently includes 18 Air Force, 4 Air Force civilians, 12 Army, and 1 Navy civilian. Science Applications International Corporation and the Georgia Tech Research Institute provide contracted technical support. The program is currently scheduled to end in March 2000. The JADS JTF is directly investigating ADS applications in three slices of the test and evaluation (T&E) spectrum: the System Integration Test (SIT) which explored ADS support of air-to-air missile testing; the End-to-End (ETE) Test which is investigating ADS support for command, control, communications, computers, intelligence, surveiliance, and reconnaissance (C4ISR) testing; and the Electronic Warfare (EW) Test which is exploring ADS support for EW testing. The JTF is also chartered to observe or participate at a modest level in ADS activities sponsored and conducted by other agencies in an effort to broaden conclusions developed in the three dedicated test areas.
DTIC
Electronic Warfare; Systems Engineering; Systems Integration

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LAW, POLITICAL SCIENCE AND SPACE POLICY

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

19990045742 Norwegian Defence Research Establishment, Kjeller, Norway
The Role of International Security Assistance in Support of Peace Agreements in War-Torn Societies
Hansen, Annika S., Norwegian Defence Research Establishment, Norway; Lia, Brynjar, Norwegian Defence Research Establishment, Norway; Dec. 11, 1998; 47p; In English
Contract(s)/Grant(s): Proj. FFISYS/715/161.1
Report No.(s): FFI/RAPPORT-98/05291; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Based on an analytical framework and two separate case studies, analysing the peace processes in Bosnia/Herzegovina (the Dayton peace process) and in the West Bank/Gaza (the Oslo peace process), the report summarizes previous findings and attempts to draw a number of general conclusions about the role and importance of security assistance in support of peace agreements in war-torn societies. The report highlights the security gaps in a post settlement society, in particular prevailing threats to civilian security, and argues that these are the most powerful impediment to a successful outcome of the peace process, because they inhibit confidence building and reconciliation. The report underlines that a broad, sustained and longterm international involvement in peace implementation is the most important determinant for a successful outcome of a peace process. ne security aspect of the implementation process itself is analysed by dividing the process into a demilitarization process, a long term military reform process, as well as a process of building civilian security, and the report addresses the scope and limitations of international security assistance in supporting and facilitating these three processes. In conclusion, the report develops and discusses a set of criteria for effectiveness of security assistance in promoting peace processes.
Author
Security; Peacetime; International Relations

88
SPACE SCIENCES (GENERAL)

19990046604 NASA Goddard Space Flight Center, Greenbelt, MD USA
Temperature and Gravity Dependence of Trace Element Abundances in Hot DA White Dwarfs (94-EUVE-094) ***Final Report***
Finley, David S., NASA Goddard Space Flight Center, USA; September 1998; 8p; In English
Contract(s)/Grant(s): NASA Order S-57780-F
Report No.(s): NASA/CR-1998-208619; NAS 1.26:208619; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

EUV spectroscopy has shown that DA white dwarfs hotter than about 45,000 K may contain trace heavy elements, while those hotter than about 50,000 K almost always have significant abundances of trace heavy elements. One of our continuing challenges is to identify and determine the abundances of these trace constituents, and then to relate the observed abundance patterns to the present conditions and previous evolutionary histories of the hot DA white dwarfs.
Author
Extreme Ultraviolet Explorer Satellite; Extreme Ultraviolet Radiation; Ultraviolet Astronomy; Beams (Radiation); Stellar Radiation; White Dwarf Stars

89
ASTRONOMY

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

19990045698 Department of Energy, Washington, DC USA
Pulsating variable stars in the MACHO bulge database: the semiregular variables
Minniti, D.; Alcock, C.; Allsman, R. A.; Nov. 01, 1997; 15p; In English
Report No.(s): DE98-054671; UCRL-JC-129160; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We review the pulsating stars contained in the top 24 fields of the MACHO bulge database, with special emphasis on the red semiregular stars. Based on period, amplitude and color cuts, we have selected a sample of 2000 semiregular variables with 15 is less than P is less than 100 days. Their period-luminosity relation is studied, as well as their spatial distribution. We find that they follow the bar, unlike the RR Lyrae, in these fields.
NTIS
Semiregular Variable Stars; Periodic Variations; Stellar Luminosity; Spatial Distribution

19990045709 NASA Marshall Space Flight Center, Huntsville, AL USA
Hard X-Ray Variability of the Black Hole Candidate GRO J0422+32 During its 1992 Outburst
vanderHooft, F., Amsterdam Univ., Netherlands; Kouveliotou, C., Universities Space Research Association, USA; vanParadijs, J., Astronomical Inst., Netherlands; Paciesas, W. S., Amsterdam Univ., Netherlands; Lewin, W. H. G., Massachusetts Inst. of Tech., USA; Crary, D. J., NASA Marshall Space Flight Center, USA; Finger, M. H., Universities Space Research Association, USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Zhang, S. N., Universities Space Research Association, USA; vanderKlis, M., Amsterdam Univ., Netherlands; Astrophysical Journal; Mar. 01, 1999; Volume 513, pp. 477-490; In English
Contract(s)/Grant(s): NWO-782-376-011; NAS2-560; NAG5-3674; NWO-PGS-78-277; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have studied the hard X-ray variability of the soft X-ray transient GRO J0422+32 with BATSE (Burst and Transient Source Experiment) in the 20-100 keV energy band. Our analysis covers 180 days following the first X-ray detection of the source on August 5, 1992, fully covering its primary and secondary X-ray outbursts. We compute power density spectra (PDSs) in the 20-50, 50-100, and 20-100 keV energy bands, in the frequency interval 0.002-0.488 Hz. The PDSs of GRO J0422+32 are approximately flat up to a break frequency, and decay as a power law above it, with index approximately 1. During the first 70 days of the X-ray outburst, the PDSs of GRO J0422+32 show a significant quasi-periodic oscillation (QPO) peak near approximately 0.2 Hz, superposed on the power-law tail. The break frequency of the PDSs obtained during the primary X-ray outburst of GRO J0422+32 occurs at 0.041 +/- 0.006 Hz; during the secondary outburst, the break is at 0.081 +/- 0.015 Hz. The power density at the break ranged between 44% and 89% / square root of Hz (20-100 keV). The canonical anticorrelation between the break frequency and the power density at the break, observed in Cyg X-1 and other BHCs in the low state, is not observed in the PDSs of GRO J0422+32. We compare our results with those of similar variability studies of Cyg X-1. The relation between the spectral slope and the amplitude of the X-ray variations of GRO J0422+32 is similar to that of Cyg X-1; however, the relation between the hard X-ray flux and the amplitude of its variation is opposite to what has been found in Cyg X-1. Phase lags between the X-ray flux variations of GRO J0422+32 at high and low photon energies could only be derived during the first 30 days of its outburst. During this period, the variations in the 50-100 keV band lag those in the 20-50 keV energy band by an approximately constant phase difference of 0.039(3) rad in the frequency interval 0.02-0.20 Hz. The time lags of GRO J0422+32 during the first 30 days of the outburst decrease with frequency as a power law with index 0.9 for v is greater than 0.01 Hz.
Author
Accretion Disks; X Ray Binaries; Black Holes (Astronomy); Emission Spectra; Gamma Ray Bursts

19990045714 NASA Marshall Space Flight Center, Huntsville, AL USA
Bright Points and Subflares in Ultraviolet Lines and X-Rays
Rovira, M., Instituto de Astronomia y Fisica del Espacio, Argentina; Schmieder, B., Observatoire de Paris-Meudon, France; Demoulin, P., Observatoire de Paris-Meudon, France; Simnett, G. M., Birmingham Univ., UK; Hagyard, M. J., NASA Marshall Space Flight Center, USA; Reichmann, E., NASA Marshall Space Flight Center, USA; Reichmann, E., NASA Marshall Space Flight Center, USA; Tandberg-Hanssen, E., NASA Marshall Space Flight Center, USA; Astrophysical Journal; Jan. 01, 1999; Volume 510, pp. 474-484; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have analyzed an active region which was observed in H.alpha (Multichannel Subtractive Double Pass Spectrograph), in UV lines (SMM/UVSP), and in X-rays (SMM/HXIS). In this active region there were only a few subflares and many small bright points visible in UV and in X-rays. Using an extrapolation based on the Fourier transform, we have computed magnetic

field lines connecting different photospheric magnetic polarities from ground-based magnetograms. Along the magnetic inversion lines we find two different zones: (1) a high-shear region (> 70 deg) where subflares occur, and (2) a low-shear region along the magnetic inversion line where UV bright points are observed. In these latter regions the magnetic topology is complex with a mixture of polarities. According to the velocity field observed in the Si IV lamda.1402 line and the extrapolation of the magnetic field, we notice that each UV bright point is consistent with emission from low-rising loops with downflows at both ends. We notice some hard X-ray emissions above the bright-point regions with temperatures up to 8 x 10(exp 6) K, which suggests some induced reconnection due to continuous emergence of new flux. This reconnection is also enhanced by neighboring subflares.
Author
Ultraviolet Radiation; Ultraviolet Spectra; Solar Prominences; X Ray Spectra; Gamma Ray Bursts

19990045895 NASA Marshall Space Flight Center, Huntsville, AL USA
Rossi X-Ray Timing Explorer Observations of the Anomalous Pulsar 4U 0142+61
Wilson, Colleen A., NASA Marshall Space Flight Center, USA; Dieters, Stefan, Alabama Univ., USA; Finger, Mark H., Universities Space Research Association, USA; Scott, D. Matthew, Universities Space Research Association, USA; vanParadijs, Jan, Alabama Univ., USA; Astrophysical Journal; Mar. 01, 1999; Volume 513, pp. 464-470; In English
Contract(s)/Grant(s): NAG5-3672; NAG5-7105; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We observed the anomalous X-ray pulsar 4U 0142+61 using the Proportional Counter Array on board the Rossi X-Ray Timing Explorer in 1996 March. The pulse frequency was measured as v = 0.11510039(3) Hz, with an upper limit of absolute value of the first derivative of v is less than or equal to 4 x 10(exp -13) Hz/s on the short-term change in frequency over the 4.6 day span of the observations. A compilation of all historical measurements showed an overall spin-down trend with slope first derivative of v = -3.0 +/- 0.1 x 10(exp -14) Hz/s. Searches for orbital modulations in pulse arrival times yielded an upper limit of a(sub x) sin i approximately is less than 0.26 lt-s (99% confidence) for the period range 70 s to 2.5 days. These limits combined with previous optical limits and evolutionary arguments suggest that 4U 0142+61 is probably not a member of a binary system.
Author
Main Sequence Stars; Stellar Evolution; X Ray Binaries; Pulsars

19990045903 NASA Goddard Space Flight Center, Greenbelt, MD USA
Adjustable Synchronization: A Proposal for Next Generation Space Telescope Operations
Welter, Gary, Computer Sciences Corp., USA; Cammarata, Glenn, NASA Goddard Space Flight Center, USA; Legg, Jim, Raytheon Co., USA; American Association for Artificial Intelligence; 1999; 8p; In English
Contract(s)/Grant(s): NAS5-32350; GS-35F-4381G; NASA Order S-2331-G; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Next Generation Space Telescope (NGST), planned for launch in 2007, poses a number of interesting engineering challenges. This article addresses one such challenge, specifically that of maximizing observatory efficiency through an appropriate balance between non-real-time construction of the near-term observing schedule and onboard adaptation to real-time conditions during actual observation execution. The appeal of onboard ”adaptive scheduling” is particularly strong for NGST because of its expected placement near the second Earth/Sun Lagrange point, a comparatively benign location vis-a-vis scheduling constraints. This is expected to make event-driven, in contrast to time-tagged, execution the norm for most observations. However, experience with previous missions has demonstrated to science operations teams that it is very useful for the team to be able to have substantial control of schedule construction, particularly when the mission is yet young and the team is first learning how to effectively use the satellite and science instruments. In this article. we explore a hybrid scheme designed to provide the advantages of real-time adaptive response under most circumstances, while at the same time giving the operations team the level of control perceived as appropriate for current mission conditions.
Author
Synchronism; Scheduling; Spaceborne Telescopes; Spaceborne Astronomy; Mission Planning

19990045955 National Optical Astronomy Observatories, Tucson, AZ USA
Combining Undersampled Dithered Images
Lauer, Tod R., National Optical Astronomy Observatories, USA; December 1998; 26p; In English
Report No.(s): NOAO-Preprint-822; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Undersampled images, such as those produced by the HST WFPC-2, misrepresent fine-scale structure intrinsic to the astronomical sources being imaged. Analyzing such images is difficult on scales close to their resolution limits and may produce erroneous results. A set of ”dithered” images of an astronomical source generally contains more information about its structure than any single undersampled image, however, and may permit reconstruction of a ”superimage” with Nyquist sampling. I present

a tutorial on a method of image reconstruction that builds a Nyquist superimage from a complex linear combination of the Fourier transforms of a set of undersampled dithered images. This method works by algebraically eliminating the high order satellites in the periodic transforms of the aliased images. The reconstructed image is an exact representation of the data-set with no loss of resolution at the Nyquist scale. The algorithm is directly derived from the theoretical properties of aliased images and involves no arbitrary parameters, requiring only that the dithers are purely translational and constant in pixel-space over the domain of the object of interest. I show examples of its application to WFC and PC images. I argue for its use when the best recovery of point sources or morphological information at the HST diffraction limit is of interest.
Author
Image Processing; Image Analysis; Imaging Techniques; Image Reconstruction; Scene Generation; Pixels; Optical Flow (Image Analysis); Computer Vision

19990045956 National Optical Astronomy Observatories, Tucson, AZ USA
A Survey for Low Surface Brightness Dwarf Galaxies around M31
Armandroff, Taft E., Kitt Peak National Observatory, USA; Davies, James E., Wisconsin Univ., USA; Jacoby, George H., Kitt Peak National Observatory, USA; October 1998; 20p; In English
Report No.(s): NOAO-Preprint-820; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

By applying a digital filtering technique to 1550 sq deg of the POSS-II in the vicinity of M31, we found two previously unidentified very low surface brightness dwarf galaxies which we designate and V and VI. Follow-up imaging with the KPNO 4-m telescope resolved these into stars easily. The V- and I- band images of and V indicate a distance similar to that of M31, and is less than [Fe/H]> approximately -1.5. All evidence strongly supports its classification as a dwarf spheroidal companion to M31. Data for and VI are being analyzed, but preliminary indications support a similar conclusion. Our search for more dwarfs, including follow-up observations of numerous candidates found via digital filtering, is incomplete; thus, further identifications may be forthcoming.
Author
Andromeda Galaxy; Andromeda Constellation; Local Group (Astronomy); Dwarf Galaxies; Astrophysics

19990045957 National Optical Astronomy Observatories, Tucson, AZ USA
Bernard's Merope Nebula (IC 349): An Interstellar Interloper
Barentine, John C., National Optical Astronomy Observatories, USA; Esquerdo, Gilbert A., Planetary Science Inst., USA; October 1998; 32p; In English
Report No.(s): NOAO-Preprint-819; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Barnard's Merope Nebula (IC 349) is the optically brightest portion of the diffuse nebulosity that envelops the Pleaides but is not morphologically similar to those nebulae. Knowledge of its true space motion can help clarify whether the object has a kinematic association and possibly a common origin with the Pleiades. Here we report a mean radial velocity result obtained in 1996 from spectra where bar-v(sub H el) = -44.4 km/s and sigma(sub v) = 5.42 km/s (N=5). The radial velocity result is presented along with recent values for the object's proper motion, yielding its space motion vector. Galactic space velocity components (U, V, W) = (50.6 +/- 5.3, -10.3 +/- 6.7, 11.3 +/- 6.4) km/s, referred to the LSR, were calculated for the object. In addition, the region was observed in the near-infrared to determine if a protostellar object is present within the dusty envelope of the nebula, to an equivalent luminosity upper limit of L/sola luminosity = 0.23 +/- 0.05, none was observed. These results suggest that IC 349 is kinematically unrelated to the Pleiades and that it does not harbor a protostellar object in its dusty interior.
Author
Nebulae; Pleiades Cluster; Interstellar Matter; Stellar Envelopes; Taurus Constellation; Dust

19990045959 National Optical Astronomy Observatories, Tucson, AZ USA
Future Prospects for Spectroscopy with Large and Small Telescopes
Pilachowski, C. A., National Optical Astronomy Observatories, USA; Barden, S. C., National Optical Astronomy Observatories, USA; January 1999; 18p; In English
Report No.(s): NOAO-Preprint-829; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the coming few years, more new telescopes with large aperture will become available for observations of stars in the Milky Way and in Local Group galaxies, and, increasingly, of stars in more distant galaxies. A wide range of new targets will come within reach not only from the increase of telescope aperture, but also from new technology which improves the performance goals of

modern instrumentation. New technologies on the horizon will be explored to evaluate their impact on scientific programs in the future.
Author
Milky Way Galaxy; Local Group (Astronomy); Stars; Telescopes

19990045961 National Optical Astronomy Observatories, Tucson, AZ USA
An Advanced Solar Telescope: I. Science Goals, 1, Science Goals
Keller, C. U., National Solar Observatory, USA; December 1998; 18p; In English; ASP High Resolution Physics: Theory, Observations, and Techniques, 28 Sep. - 2 Oct. 1998, Sunspot, NM, USA
Report No.(s): NOAO-Preprint-826; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many of the limitations of current ground-based observations of the sun are due to the restricted diameter of existing solar telescopes. The limited diameter leads to limited spatial resolution due to diffraction and limited photon flux. Here I present a few of the science goals requiring a large-aperture, ground-based telescope with adaptive optics: the interaction of convection and magnetic fields as a basic astrophysical process, observations of motions of magnetic flux tubes to understand the heating of chromospheres and coronae in late-type stars, and observations of the weak, mixed-polarity turbulent magnetic field to understand its origin and interaction with strong fields.
Author
Telescopes; Astrophysics; Chromosphere; Solar Corona; Late Stars; Diffraction

19990045962 National Optical Astronomy Observatories, Tucson, AZ USA
Optimum Apodization for Speckle Imaging of Extended Sources
Keller, C. U., National Solar Observatory, USA; December 1998; 16p; In English; ASP High Resolution Solar Physics: Theory, Observations, and Techniques, 28 Sep. - 2 Oct. 1998, Sunspot, NM, USA
Report No.(s): NOAO-Preprint-825; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Speckle imaging of extended sources such as the Sun has to be performed on small segments to reduce the impact of anisoplanatism. Since speckle techniques typically work in the Fourier domain, these segments are apodized to minimize the influence of edges on the Fourier transformed quantities. While apodization functions have been studied to optimally estimate the amplitudes of the Fourier transform of the true object, the influence of apodization on the Fourier phase estimates has not been studied. Indeed, commonly used apodization functions distort the phase estimates considerably. Here I show how apodization distorts the phase estimates and present a new type of apodization functions that leaves Knox-Thompson phase estimates unaffected. This leads to a substantial improvement of the quality of speckle reconstructions of the solar surface, in particular under mediocre seeing conditions.
Author
Speckle Holography; Speckle Interferometry; Speckle Patterns; X Ray Sources; X Ray Astronomy

19990046077 National Optical Astronomy Observatories, Tucson, AZ USA
Phoenix: A Cryogenic High-Resolution 1-5 Micron Infrared Spectrograph
Hinkle, Kenneth H., National Optical Astronomy Observatories, USA; Cuberly, Randy, National Optical Astronomy Observatories, USA; Gaughan, Neil, National Optical Astronomy Observatories, USA; Heynssens, Julie, National Optical Astronomy Observatories, USA; Joyce, Richard, National Optical Astronomy Observatories, USA; Ridgway, Stephen, National Optical Astronomy Observatories, USA; Schmitt, Paul, National Optical Astronomy Observatories, USA; Simmons, Jorge E., National Optical Astronomy Observatories, USA; Apr. 1998; 13p; In English
Report No.(s): NOAO-Preprint-793; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe a cryogenic, high-resolution spectrograph (Phoenix) for the 1-5 micrometer region. Phoenix is an echelle spectrograph of the near-Littrow over-under configuration without cross dispersion. The foreoptics include Lyot reimaging, discrete and circular variable order sorting filters, a selection of slits, and optics for post-slit and Lyot imaging. The entire instrument is cooled to 50 K using two closed cycle coolers. The detector is a Hughes-Santa Barbara 512 x lO24 InSb array. Resolution of 65,000 has been obtained. Throughput without slit losses (but including telescope losses) is 13% at 2.3 micrometers. Recent results are discussed. Phoenix is a facility instrument of the National Optical Astronomy Observatories and will be available at CTIO(Cerro Tololo Inter-American Observatory), KPNO(Kitt Peak National Observatory), and Gemini.
Author
Cryogenics; Spectrographs; Infrared Radiation; Imaging Techniques; Spectroscopy; Infrared Detectors; Construction; Structural Design

19990046294 NASA Marshall Space Flight Center, Huntsville, AL USA

On the Use of Monochromators for the Calibration of AXAF

Swartz, Douglas A., NASA Marshall Space Flight Center, USA; Elsner, Ronald F., NASA Marshall Space Flight Center, USA; Kolodzejczak, J. J., NASA Marshall Space Flight Center, USA; ODell, Stephen L., NASA Marshall Space Flight Center, USA; Tennant, Allyn F., NASA Marshall Space Flight Center, USA; Sulkanen, Martin E., NASA Marshall Space Flight Center, USA; Weisskopf, Martin E., NASA Marshall Space Flight Center, USA; Edgar, R., NASA Marshall Space Flight Center, USA; 1998; In English, Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Data acquired, during the AXAF calibration at MSFC's X-Ray Calibration Facility (XRCF), using monochromators requires special analysis owing to potentially large spatial variations in the monochromators' beams and to higher-order contributions to the spectral content. A description of the monochromators -- the Double-Crystal Monochromator (DCM) and the HIgh-Resolution Erect-Field Spectrometer (HIREFS\TM) reflection-grating monochromator --- is given, followed by a discussion of the spectral and spatial content as monitored by Beam-Normalization Detector (BND) flow proportional counters (FPCs). Emphasis is given to the methodology employed in determining the spatial content through fits to Beam Uniformity (BU) measurements made nonsimultaneously, either during calibration or during pre-calibration source characterization. We present an interpolation scheme which adequately represents the beam properties over a wide range of source conditions.

Author

Monochromators; Calibrating; X Ray Astronomy; Detectors

19990046388 Arizona Univ., Steward Observatory, Tucson, AZ USA

A 2 THz Heterodyne Array Receiver for SOFIA: Summary of Research ***Final Report, 1 May 1996 - 31 Jan. 1998***

Walker, Christopher K., Arizona Univ., USA; 1998; 4p; In English

Contract(s)/Grant(s): NAG2 -1057; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We proposed to perform a comprehensive design study of a 16-element heterodyne array receiver for SOFIA. The array was designed to utilize hot-electron bolometers in an efficient, low-cost waveguide mount to achieve low noise performance between approximately 1500 and 2400 GHz. Due to the prevailing physical conditions in the interstellar medium, this frequency range is one of the richest in the Far-Infra Red (FIR) portion of the spectrum. An array designed for this wavelength range will make excellent use of the telescope and the available atmospheric transmission, and will provide a new perspective on stellar, chemical, and galactic evolution in the present as well as past epochs. A few of the most important molecular and atomic species which the instrument will sample are CII, OI, CO, OH, NII, and CH. The system used the most sensitive detectors available in an efficient optical system. The local oscillator was a compact CO2 pumped far-infrared laser currently under development for SOFIA. The backend spectrometer was an array acousto-optic spectrometer (aAOS). The spectrometer utilizes proven hardware and technologies to provide broadband performance (> 1 GHz per AOS channel) and high spectral resolution (1 MHz) with the maximum sensitivity and minimum complexity and cost. The proposed instrument would be the fastest and most sensitive heterodyne receiver ever to operate in the 1.5 - 2.4 THz band. One of the key technologies developed for the proposed instrument is the laser micromachining of waveguide structures. These structures provide both the optical link between the instrument and the telescope (via an array of efficient feedhorns) and the impedance transformation between the detectors and free space. With the assistance of funds provided from this grant, we were able to fabricate and test the world's first laser micromachined feedhorns. The quality of the waveguide structure is far better than that obtainable using any other fabrication technique. The beam parameters are an excellent match to what is expected from theory. The success of this experiment demonstrates the viability of using laser micromachined components in the development of high performance, large format array receivers. We have continued our development efforts and will propose to build a 2nd generation instrument based on the same design concepts.

Author

Bolometers; Frequency Ranges; Laser Machining; Receivers; Sofia (Airborne Observatory); Spectral Resolution; Spectrometers; Stellar Evolution; Multispectral Linear Arrays; Waveguides

19990046557 National Optical Astronomy Observatories, Tucson, AZ USA

WFPC2 Observations of the URSA Minor Dwarf Spheroidal Galaxy

Mighell, Kenneth J., Herzberg Inst. of Astrophysics, Canada; Burke, Christopher J., National Optical Astronomy Observatories, USA; March 1999; 44p; In English

Contract(s)/Grant(s): NAS5-26555

Report No.(s): NOAO-Preprint-834; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present our analysis of archival Hubble Space Telescope Wide Field Planetary Camera 2 (WFPC2) observations in F555W (approximately V) and F814W (approximately I) of the central region of the Ursa Minor dwarf spheroidal galaxy. The

V versus V - I color-magnitude diagram features a sparsely populated blue horizontal branch, a steep thin red giant branch, and a narrow subgiant branch. The main sequence reaches approximately 2 magnitudes below the main-sequence turnoff (V(sup UMi, sub TO) approximately equals 23.27 +/- 0.11 mag) of the median stellar population. We compare the fiducial sequence of the Galactic globular cluster M92 (NGC 6341). The excellent match between Ursa Minor and M92 confirms that the median stellar population of the UMi dSph galaxy is metal poor ([Fe/H](sub UMi) approximately equals [Fe/H](sub M92) approximately equals -2.2 dex) and ancient (age(sub UMi)approximately equalsage(sub M92) approximately equals 14 Gyr). The B - V reddening and the absorption in V are estimated to be E(B - V) = 0.03 +/- 0.01 mag and A(sup UMi, sub V) = 0.09 +/- 0.03 mag. A new estimate of the distance modulus of Ursa Minor, (m - M)(sup UMi, sub 0) = 19.18 +/- 0.12 mag, has been derived based on fiducial-sequence fitting M92 [DELTA.V(sub UMi - M92) = 4.60 +/- 0.03 mag and DELTA(V - I)(sub UMi - M92) = 0.010 +/- 0.005 mag] and the adoption of the apparent V distance modulus for M92 of (m - M)(sup M92, sub V) = 14.67 +/- 0.08 mag (Pont et al. 1998, A&A, 329, 87). The Ursa Minor dwarf spheroidal galaxy is then at a distance of 69 +/- 4 kpc from the Sun. These HST observations indicate that Ursa Minor has had a very simple star formation history consisting mainly of a single major burst of star formation about 14 Gyr ago which lasted approximately is less than 2 Gyr. While we may have missed minor younger stellar populations due to the small field-of-view of the WFPC2 instrument, these observations clearly show that most of the stars in the central region Ursa Minor dwarf spheroidal galaxy are ancient. If the ancient Galactic globular clusters, like M92, formed concurrently with the early formation of the Milky Way galaxy itself, then the Ursa Minor dwarf spheroidal is probably as old as the Milky Way.
Author

Dwarf Galaxies; Main Sequence Stars; Milky Way Galaxy; Globular Clusters; Star Formation; Local Group (Astronomy); Early Stars

19990046718 National Optical Astronomy Observatories, Tucson, AZ USA

Standard Giant Branches in the Washington Photometric System

Geisler, Doug, Kitt Peak National Observatory, USA; Sarajedini, Ata, San Francisco State Univ., USA; October 1998; 82p; In English

Contract(s)/Grant(s): NAS5-26555; GO-07265.01-96A; HF-01077.01-94A

Report No.(s): NOAO-Preprint-815; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

We have obtained CCD photometry in the Washington system C, T(sub 1) filters for some 850,000 objects associated with 10 Galactic globular clusters and 2 old open clusters. These clusters have well-known metal abundances, spanning a metallicity range of 2.5 dex from [Fe/H] approx -2.25 to +0.25 at a spacing of approx. 0.2 dex. Two independent observations were obtained for each cluster and internal checks, as well as external comparisons with existing photoelectric photometry, indicate that the final colors and magnitudes have overall uncertainties of 0.03 mag. Analogous to the method employed by Da Costa and Armandroff for V, I photometry , we then proceed to construct standard ((M(sub T),(C - T(sub 1))(sub 0)) giant branches for these clusters adopting the Lee et distance scale, using some 350 stars per globular cluster to define the giant branch. We then determine the metallicity sensitivity of the ((C - T(sub 1))(sub 0) color at a given M((sub T)(sub 1)) value. The Washington system technique is found to have three times the metallicity sensitivity of the V, I technique. At M((sub T)(sub 1)) = -2 (about a magnitude below the tip of the giant branch, roughly equivalent to M(sub I) = -3), the giant branches of 47 Tuc and M15 are separated by 1.16 magnitudes in (V - l)(sub 0) and only 0.38 magnitudes in (V - I)(sub 0). Thus, for a given photometric accuracy, metallicities can be determined three times more precisely with the Washington technique. We find a linear relationship between (C - T(sub l)(sub 0) (at M(sub T)(sub 1) = -2) and metallicity exists over the full metallicity range, with an rms of only 0.04 dex. We also derive metallicity calibrations for M(sub T)(sub 1) = -2.5 and -1.5, as well as for two other metallicity scales. The Washington technique retains almost the same metallicity sensitivity at faint magnitudes , and indeed the standard giant branches are still well separated even below the horizontal branch. The photometry is used to set upper limits in the range 0.03 - 0.09 dex for any intrinsic metallicity dispersion in the calibrating clusters. The calibrations are applicable to objects with ages approx. greater than 5 Gyr - any age effects are small or negligible for such objects. This new technique is found to have many advantages over the old two-color diagram technique for deriving metallicities from Washington photometry. In addition to only requiring 2 filters instead of 3 or 4, the new technique is generally much less sensitive to reddening and photometric errors, and the metallicity sensitivity is many times higher. The new technique is especially advantageous for metal-poor objects. The five metal-poor clusters determined by Geisler et al., using the old technique, to be much more metal-poor than previous indications, yield metallicities using the new technique which are in excellent agreement with the Zinn scale.
Author

Photometry; Calibrating; Globular Clusters; Metallicity; Open Clusters; Sensitivity

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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.

19990045915 Imperial Coll. of Science and Technology, London, UK
Dark Matter Experiments
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 65-70; In English; See also 19990045908
Report No.(s): Proposal-270; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11, 0QX, UK), Hardcopy, Microfiche

A major unresolved problem at the interface of particle physics and cosmology is the identity of the non-luminous matter which is known to comprise 90% of the Mass of Our own Galaxy and upto 99% of the Universe as a whole. There is also evidence that much of the dark matter may be non-baryonic, and thus could consist of relic stable elementary particles. Candidate particles include low-mass neutrinos, axions. or weakly interacting massive particles (WIMPS) such as the neutralino. An experimental programme to search for WIMPs. funded jointly, from particle physics and astronomy budgets, has been in progress since 1991. These experiments search for nuclear recoil events from elastic scattering of dark matter particles and are based on scintillator targets. In particular NaI and liquid Xe.
Derived from text
Cosmology; Dark Matter; Elementary Particles; Weak Interactions (Field Theory)

19990045925 Laboratori Nazionali del Gran SASso, Assergi, Italy
CRESST Dark Matter Search
Particle Physics Experiments Report, 1997; Feb. 1998, pp. 121-124; In English; See also 19990045908
Report No.(s): Proposal-296; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

We are preparing the Cryogenic Rare Event Search with Superconducting Thermometers (CRESST) experiment in the Gran SASso National Laboratory, Italy, to search for dark Matter Weakly Interacting Massive Particles (WIMPs) using cryogenic detectors with superconducting phase transition thermometers. In the first stage of the experiment we plan to use four 262g sapphire detectors with thresholds of 0.5 keV and resolutions of .2 keV at 1 keV. This will provide sensitivity to WIMP masses below 10 GEV making our experiment complementary to other dark matter searches. In 1997 the installation in Gran SASso was completed and first detector tests were made. Preparation of the low-background cold box is in progress.
Author
Dark Matter; Weak Interactions (Field Theory); Missing Mass (Astrophysics); Experiment Design

19990046049 National Optical Astronomy Observatories, Tucson, AZ USA
The Andromeda Dwarf Spheroidal Galaxies
Armandroff, Taft E., Kitt Peak National Observatory, USA; DaCosta, Gary S., Australian National Univ., Australia; December 1998; 16p; In English
Report No.(s): NOAO-Preprint-824; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our current knowledge of M31's dwarf spheroidal companions is reviewed. Two topics of recent interest constitute the bulk of this review. First, color-magnitude diagrams reaching below the horizontal branch have been constructed for two M31 dwarf spheroidals based on images from HST/WFPC2. The horizontal branches are predominantly red in both galaxies, redder than expected for their metallicity based on Galactic globular clusters. Thus, the second parameter effect is seen in the M31 halo. Second, recent surveys have revealed three new dwarf spheroidal companions to M31. Thus, dwarf spheroidal galaxies are not as rare around M31 as previously thought and as a result, some properties of the M31 companion system have changed.
Author
Andromeda Galaxy; Andromeda Constellation; Local Group (Astronomy); Dwarf Galaxies; Astrophysics

19990046320 Smithsonian Astrophysical Observatory, Cambridge, MA USA
The Spectral Energy Distribution of z = 4.7 Quasar: BR1202-0727
Wilkes, Belinda, Smithsonian Astrophysical Observatory, USA; 1998; In English; Quasars as Standard Candles for Cosmology, 16-22 May 1998, La Serena, Chile
Contract(s)/Grant(s): NAS8-39073; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

BR 1202-0721 is a z = 4.1 quasar which is a 4” double source in the mm, possibly lensed, and has a Lyman alpha emission companion 2” away. The mm spectrum shows a large mass of cool dust (l0Ell Msun). We report on ground based optical and near-infrared (IR) and space-based, Infrared Space Observatory (ISO) mid-IR observations of this source, combined with data from the literature. The resulting spectral energy distribution show the source to be about two orders-of-magnitude over luminous in the rest-frame near-IR in comparison with typical low-redshift quasars.
Author
Spectral Energy Distribution; Quasars; Infrared Astronomy

19990046421 NASA Goddard Space Flight Center, Greenbelt, MD USA
Granularity of the Diffuse Background Observed
Gruber, D. E., California Univ., San Diego, USA; MacDonald, D., California Univ., San Diego, USA; Rothschild, R. E., California Univ., San Diego, USA; Boldt, E., NASA Goddard Space Flight Center, USA; Mushotzky, R. F., NASA Goddard Space Flight Center, USA; Fabian, A. C., Institute of Astronomy, UK; [1995]; 6p; In English
Contract(s)/Grant(s): NAG5-3450; NAG5-4798; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
First results are reported from a program for measuring the field-to-field fluctuation level of the cosmic diffuse background by using differences between the two background positions of each deep exposure with the High Energy X-ray Timing Experiment (HEXTE) instrument on the Remote X Ray Timing Explorer (RXTE). With 8 million live seconds accumulated to date a fluctuation level on the 15-25 keV band is observed which is consistent with extrapolations from the High Energy Astrophysical Observatory-1 (HEAO-1) measurements. Positive results are expected eventually at higher energies. Models of (active galactic nuclei) AGN origin will eventually be constrained by this program.
Author
Active Galactic Nuclei; Astronomical Models; X Ray Astronomy; Background Radiation; X Ray Sources; Cosmic X Rays

19990046486 Smithsonian Astrophysical Observatory, Cambridge, MA USA
Very Low Mass Objects in the Belt of Orion
Wolk, S. J., Smithsonian Astrophysical Observatory, USA; Walter, F. M., Smithsonian Astrophysical Observatory, USA; Sherry, W., Smithsonian Astrophysical Observatory, USA; 1998; In English; Very Low-Mass Stars and Brown Dwarfs in Stellar Clusters and Associations, 11-16 May 1998, La Palma, Spain
Contract(s)/Grant(s): NAS8-39073; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche
We have photometry of several thousand stars near the belt of Orion. Colors have been combined with X-ray and spectral data to select out about 250 probable Pre-main sequence stars. The stars range in mass from about 2 Msun to about 0.05 Msun. Although we have yet to unambiguously verify the existence of brown dwarfs in the data set, their existence is likely. We can also use the data to infer the characteristics of the Interplanetary Magnetic Field (IMF) for this sample.
Author
Asteroid Belts; Orion (Radio Interferometry Network); Stellar Mass

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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.

19990045757 Department of Energy, Washington, DC USA
Mapping the elemental composition of the moon: Current results of the Lunar Prospector gamma ray spectrometer
Lawrence, D. J.; Feldman, W. C.; Barraclough, B. L.; Elphic, R. C.; Binder, A. B.; Dec. 31, 1998; 2p; In English; Meteoritical Society meeting
Report No.(s): DE99-000661; LA-UR-98-1990; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
One of the instruments on board the recently launched Lunar Prospector spacecraft is a Gamma-Ray Spectrometer (GRS) designed to map the surface elemental composition of the Moon. Specifically, the objectives of the GRS are to map abundances of Fe, Ti, U, Th, K, Si, O and if possible Mg, Al, and Ca. The GRS consists of a bismuth germanate (BGO) crystal placed within a well shaped borated plastic scintillator anti-coincidence (ACS) shield. Events triggering only the BGO are labeled as accepted

events; events triggering both the BGO and ACS are labeled as rejected events. BGO spectra for both accepted and rejected events are telemetered to the ground for later analysis. Results of the study are given.
NTIS
Gamma Ray Spectrometers; Moon; Mapping; Chemical Composition; Lunar Prospector

19990045946 Monash Univ., CRC-Southern Hemisphere Meteorology, Clayton, Australia
Deep Convection in the Interior of Major Planets: A Review
Yano, Jun-Ichi, Monash Univ., Australia; Australian Journal of Physics; 1998; Volume 51, No. 5, pp. 875-889; In English; See also 19990045940; Copyright; Avail: Issuing Activity (Australian Journal of Physics, P.O. Box 1139 (150 Oxford St.), Collingwood, Victoria 3066, Australia), Hardcopy, Microfiche

Theories for deep convection in the interior of major planets are reviewed. The focus is on Busse's theory, whose problems are critically analyzed the importance of the analogy and differences with the Earth's mantle convection and oceanographic convection are emphasized.
Author
Convection; Planetary Cores; Gas Giant Planets

19990046115 Lunar and Planetary Inst., Houston, TX USA
Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets
Jolliff, Brad L., Editor, Washington Univ., USA; Ryder, Graham, Editor, Lunar and Planetary Inst., USA; 1998; 94p; In English, 18-20 Sep. 1998, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA; See also 19990046116 through 19990046166
Contract(s)/Grant(s): NASw-4574
Report No.(s): LPI-Contrib-958; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche; Abstracts Only; Abstracts Only

It has been more than 25 years since Apollo 17 returned the last of the Apollo lunar samples. Since then, a vast amount of data has been obtained from the study of rocks and soils from the Apollo and Luna sample collections and, more recently, on a set of about a dozen lunar meteorites collected on Earth. Based on direct studies of the samples, many constraints have been established for the age, early differentiation, crust and mantle structure, and subsequent impact modification of the Moon. In addition, geophysical experiments at the surface, as well as remote sensing from orbit and Earth-based telescopic studies, have provided additional datasets about the Moon that constrain the nature of its surface and internal structure. Some might be tempted to say that we know all there is to know about the Moon and that it is time to move on from this simple satellite to more complex objects. However, the ongoing Lunar Prospector mission and the highly successful Clementine mission have provided important clues to the real geological complexity of the Moon, and have shown us that we still do not yet adequately understand the geologic history of Earth's companion. These missions, like Galileo during its lunar flyby, are providing global information viewed through new kinds of windows, and providing a fresh context for models of lunar origin, evolution, and resources, and perhaps even some grist for new questions and new hypotheses. The probable detection and characterization of water ice at the poles, the extreme concentration of Th and other radioactive elements in the Procellarum-Imbrium-Frigon's resurfaced areas of the nearside of the Moon, and the high-resolution gravity modeling enabled by these missions are examples of the kinds of exciting new results that must be integrated with the extant body of knowledge based on sample studies, in situ experiments, and remote-sensing missions to bring about the best possible understanding of the Moon and its history.
Author
Lunar Evolution; Lunar Geology; Lunar Maria; Lunar Rocks; Lunar Soil; Meteorites; Moon; Conferences

19990046116 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Prospecting for Lunar Oxygen with Gamma-Ray Spectrometry and Multispectral Imaging
Allen, Carlton C., Lockheed Martin Engineering and Science Services, USA; Weitz, Catherine M., Jet Propulsion Lab., California Inst. of Tech., USA; McKay, David S., NASA Johnson Space Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 19-20; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Oxygen is a potentially abundant lunar resource that could be used for life support and spacecraft propulsion. The recent identification by Prospector of ice at the lunar poles has renewed interest in the use of in situ 0 production to supply a future base. Siting a lunar base at any significant distance from the poles, however, would require costly transport of 0 or its extraction from the local regolith. More than 20 different processes have been proposed for regolith 0 extraction. Among the simplest and best studied of

these processes is the reduction of oxides in lunar minerals and glass using H gas. Oxides, predominantly those containing FeO, are first reduced; 0 is then liberated to form water. The water is then electrolyzed to yield 0, and the H is recycled to the reactor. Author

Extraction; Lunar Bases; Oxygen; Water; Iron Oxides; Life Support Systems

19990046117 Indiana Univ., Dept. of Geological Sciences, Bloomington, IN USA

Reliability of Calculating Average Soil Composition of Apollo Landing Sites

Basu, Abhijit, Indiana Univ., USA; Riegsecker, Sue E., Indiana Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 20-21; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Lunar soil, i.e., the fine fraction of the lunar regolith, is the ground truth available for calibrating remotely sensed properties of virtually atmosphere-free planetary bodies. Such properties include albedo, IR-VIS-UV spectra, and secondary XRF, which are used to characterize the chemical and mineralogical compositions of planetary crusts. The quality of calibration, however, is dependent on the degree to which the ground truth is represented in the remotely sensed properties. The footprints and spatial resolution of orbital and Earth-based observations are much larger than the sampling areas at the landing sites. Yet an average composition of soils at each landing site is our best approximation for testing calibration. Previously, we have compiled chemical compositions of lunar soils and estimated the best average composition (CC) for each landing site. We have now compiled and estimated the best average mineralogical composition (MC) of soils (9 150-p n fraction) at each Apollo landing site. In this paper, we examine how these two estimates (Tables 1 and 2) compare and how representative they may be. For the purpose of comparison, we have calculated the normative mineralogy of each site (from Table 1) and recast them on a quartz-apatite-pyrite-free basis, i.e., in terms of feldspar, pyroxene, olivine, and ilmenite + chromite (Table 3).

Author

Chemical Composition; Lunar Soil; Mineralogy; Minerals; Soils; Lunar Resources; Lunar Surface

19990046118 Oregon L-5 Society, Oregon City, OR USA

Probing Lunar Lava-Tube Caves by Radar Illumination

Billings, T., Oregon L-5 Society, USA; Godshalk, E., Oregon L-5 Society, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 21-22; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A Radar Flashbulb on the Moon: Lava-tube caves under the lunar surface may be very useful as lunar base sites. They have left surface indicators that can be found in computerized searches of the Clementine data. Such a search is being put together by the Lunar Base Research Team (LBRT) of the Oregon L-5 Society, Portland's local chapter of the National Space Society. Lava-tube sites that are located will need to undergo further investigation before committment to a lunar base can be made. Ground-penetrating radar images of actual voids at particular sites would seem to be the next step, if images can be obtained cheaply. This paper describes what LBRT believes is the cheapest combination of technologies that can obtain such images of lava-tube voids on the Moon. As early as the Apollo Lunar Sounder Experiment, radar has penetrated the Moon to substantial depths. Only soundings were possible, given the combination of penetrating wavelengths (1-20 m) and the aperture of any antenna that could be carried by the Apollo Service Module. Now, operation of the Very Long Baseline Array (VLBA) by NRAO provides an aperture that, even from the Earth, could provide a resolution of 25-50 m at the lunar surface with wavelengths of 0.5-1 m. The Lunar Sourcebook notes that much of the lunar surface is rather transparent to radio waves, because of its low conductivity and lack of water. Lava-tube surface indicators have been found in Apollo photos for caves up to 1100 m across. But where is the radar energy reflecting off the walls of these lava-tube voids to come from?

Author

Caves; Lava; Lunar Bases; Lunar Surface; Underground Structures; Lunar Shelters; Tunnels

19990046119 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands

Lunar Impact Basins: Probes into the Lunar Crust

Bussey, D. Ben J., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Spudis, Paul D., Lunar and Planetary Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 22-23; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Impact basins excavate large regions of the lunar crust, bringing rocks from great depths up to the surface for examination. Clementine's UVVIS camera mapped the Moon globally in five different wavelengths (415, 750, 900, 950, and 1000 mm). We have used the full resolution data (250 m/pixel) to undertake a systematic study of the Moon's impact basins. Analysis of the eject

a blankets of basins on both the lunar nearside and farside has allowed us to map the compositionally distinct units associated with the basins. We have constructed both multispectral images and quantitative Fe and Ti maps. Thus, we can use basins as probes into the lunar crust and build up a 3-D reconstruction of the crust. The basins covered so far are Orientale, Humboldtianum, Humorum, Nectaris, Crisium, and parts of the Imbrium Basin. The 900-km-diameter Orientale Basin was chosen for study as it is the youngest, best-preserved large basin on the Moon. Our research has shown that the basin ejecta units are largely homogeneous and feldspathic in composition with the Montes Rook Formation being slightly more mafic than both the Maunder and Hevelius Formations. The presence of outcrops of pure anorthosite, associated with the scarps of the Inner Rook mountain ring, has been confirmed, and the amount of anorthosite present is far more than previously suspected. These appear as dark blue regions in the multispectral image and as places with very low (is less than 2 wt%) FeO concentrations in the Fe map.
Author
Ejecta; Lunar Crust; Lunar Maria; Meteorite Craters; Lunar Craters; Selenography; Mineralogy

19990046120 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Integrating Radar, Multispectral, and Landing Site Data for Analysis of the Lunar Surface
Campbell, B. A., Smithsonian Institution, USA; Campbell, D. B., Cornell Univ., USA; Thompson, T. W., Jet Propulsion Lab., California Inst. of Tech., USA; Hawke, B. R., Hawaii Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 23-24; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Radar maps of the Moon have been produced since the late 1960s, and have been used by a number of authors to study the surface roughness, subsurface rock abundance, and dielectric properties of the lunar surface. These studies focused on a range of topics, including the depth and rock population of the regolith, crater ejecta blankets, pyroclastic mantling layers, and cryptomare deposits. Limited radar sounding data from the Apollo missions identified layering in some regions of the maria. As radar datasets have improved in resolution and calibration, it has become more possible to make quantitative comparisons between the backscatter properties of the Moon, other remote-sensing observations, and the ground truth provided by Surveyor photos and Apollo traverses. This presentation will focus on the results of recent studies of the lunar regolith that make use of these diverse sources of information, and discuss research directions that will be possible with radar data to be collected in the near future.
Author
Lunar Maps; Lunar Rocks; Lunar Surface; Moon; Regolith; Lunar Landing Sites; Lunar Geology

19990046121 Charleston Coll., Geology Dept., Charleston, SC USA
Another Look at Taurus Littrow: An Interactive Geographic Information System DataBase
Coombs, Cassandra R., Charleston Coll., USA; Meisburger, J. L., Charleston Coll., USA; Nettles, J. W., Charleston Coll., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 24-25; In English; See also 19990046115
Contract(s)/Grant(s): NAG9-8; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A variety of data has been amassed for the Apollo 17 landing site, including topography, sample locations, and imagery. These data were compiled into a Geographic Information System (GIS) to analyze their interrelationships more easily. The database will allow the evaluation of the resource potential of the Taurus Littrow region pyroclastic deposits. The database also serves as a catalog for the returned lunar samples. This catalog includes rock type, size, and location. While this project specifically targets the Taurus Littrow region, it is applicable to other regions as well.
Author
Data Bases; Geographic Information Systems; Lunar Geology; Lunar Rocks; Lunar Soil; Lunar Surface; Lunar Topography

19990046122 NASA Johnson Space Center, Houston, TX USA
Exploration of the Moon with Remote Sensing, Ground-Penetrating Radar, and the Regolith-Evolved Gas Analyzer (REGA)
Cooper, B. L., Oceaneering Space Systems, USA; Hoffman, J. H., Texas Univ. at Dallas, USA; Allen, Carlton C., Lockheed Martin Engineering and Science Services, USA; McKay, David S., NASA Johnson Space Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 25-26; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

There are two important reasons to explore the Moon. First, we would like to know more about the Moon itself: its history, its geology, its chemistry, and its diversity. Second, we would like to apply this knowledge to a useful purpose. namely finding and using lunar resources. As a result of the recent Clementine and Lunar Prospector missions, we now have global data on the regional surface mineralogy of the Moon, and we have good reason to believe that water exists in the lunar polar regions. However,

there is still very little information about the subsurface. If we wish to go to the lunar polar regions to extract water, or if we wish to go anywhere else on the Moon and extract (or learn) anything at all, we need information in three dimensions an understanding of what lies below the surface, both shallow and deep. The terrestrial mining industry provides an example of the logical steps that lead to an understanding of where resources are located and their economic significance. Surface maps are examined to determine likely locations for detailed study. Geochemical soil sample surveys, using broad or narrow grid patterns, are then used to gather additional data. Next, a detailed surface map is developed for a selected area, along with an interpretation of the subsurface structure that would give rise to the observed features. After that, further sampling and geophysical exploration are used to validate and refine the original interpretation, as well as to make further exploration/ mining decisions. Integrating remotely sensed, geophysical, and sample datasets gives the maximum likelihood of a correct interpretation of the subsurface geology and surface morphology. Apollo-era geophysical and automated sampling experiments sought to look beyond the upper few microns of the lunar surface. These experiments, including ground-penetrating radar and spectrometry, proved the usefulness of these methods for determining the best sites for lunar bases and lunar mining operations.
Author
Lunar Mining; Lunar Resources; Lunar Surface; Lunar Composition; Selenology; Lunar Exploration

19990046123 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Multispectral Mapping of the Moon by Clementine
Eliason, Eric M., Geological Survey, USA; McEwen, Alfred S., Arizona Univ., USA; Robinson, M., Northwestern Univ., USA; Lucey, Paul G., Hawaii Univ., USA; Duxbury, T., Jet Propulsion Lab., California Inst. of Tech., USA; Malaret, E., Applied Coherent Technology Corp., USA; Pieters, Carle, Brown Univ., USA; Becker, T., Geological Survey, USA; Isbell, C., Geological Survey, USA; Lee, E., Geological Survey, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 26-27; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

One of the chief scientific objectives of the Clementine mission at the Moon was to acquire global multispectral mapping. A global digital map of the Moon in 11 spectral bandpasses and at a scale of 100 m/pixel is being produced at the U.S. Geological Survey in Flagstaff Arizona Near-global coverage was acquired with the UVVIS camera (central wavelengths of 415, 750, 900, 950, and 1000 nm) and the NIR camera (1102, 1248, 1499, 1996, 2620, and 2792 nary). We expect to complete processing of the UVVIS mosaics before the fall of 1998, and to complete the NIR mosaics a year later. The purpose of this poster is to provide an update on the processing and to show examples of the products or perhaps even a wall-sized display of color products from the UVVIS mosaics.
Author
Mosaics; Photomapping; Lunar Geology; Lunar Maps; Lunar Surface; Selenology

19990046124 Los Alamos National Lab., Space and Atmospheric Sciences, NM USA
Lunar Prospector Neutron Measurements Compared to Clementine Iron and Titanium Abundances
Elphic, Rick C., Los Alamos National Lab., USA; Maurice, Sylvestre, Observatoire de Midi-Pyresnees, France; Lawrence, David J., Los Alamos National Lab., USA; Feldman, William C., Los Alamos National Lab., USA; Barraclough, B. L., Los Alamos National Lab., USA; Binder, Alan B., Lunar Research Inst., USA; Lucey, Paul G., Hawaii Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 27-28; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Knowledge of the distribution of Fe and Ti within the principal lunar terranes can help us understand the bulk composition of the Moon. Materials on the surface that carry information about the interior include: (1) the maria, with varying Fe and Ti concentrations, (2) deep impact basins that may have exposed material from the lower crust and upper mantle, and (3) regions rich in KREEP basalts. Consequently, data that provide a global and/or high-spatial resolution assessment of lunar Fe and Ti are especially valuable in studies of lunar geochemistry. The Clementine spectral reflectance (CSR) data have been used to derive maps of FeO and TiO2. Because CSR spatial resolution approaches 100 m, such maps are potentially invaluable in lunar studies. The CSR technique depends on mineralogy, and while it has been constrained by returned lunar sample geochemistry, the question remains whether the results are accurate far from the Apollo and Luna landing sites. In this paper we discuss some of the results of a comparison of the Lunar Prospector neutron spectrometer (LPNS) observations and the CSR Fe and Ti maps.
Author
Iron Oxides; Lunar Geology; Lunar Soil; Mineralogy; Titanium; Titanium Oxides; Lunar Maria

19990046125 Los Alamos National Lab., NM USA

Deposits of Hydrogen on the Moon

Feldman, William C., Los Alamos National Lab., USA; Maurice, Sylvestre, Observatoire de Midi-Pyresnees, France; Lawrence, David J., Los Alamos National Lab., USA; Barraclough, B. L., Los Alamos National Lab., USA; Elphic, Rick C., Los Alamos National Lab., USA; Binder, Alan B., Lunar Research Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 29; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Although several theories have been proposed to explain the origin of the Moon, the present consensus favors birth initiated by a giant impact of the proto-Earth by a Mars-sized planetoid. If correct, the Moon was born depleted in volatiles, including H. Hydrogen embedded in regolith grains has been found in returned samples. This observation has been explained in terms of solar wind implantation, thereby providing one of several indicators of soil maturity. It has also long been speculated that H has been delivered to the Moon in the form of water ice by comets and asteroids. If the amount delivered in any one impact is sufficiently small so that a thick atmosphere does not form, then a sizable fraction (about 20%) will migrate to both poles through an exospheric transport process. In this case, if water molecules encounter spots that are sufficiently cold (primarily within permanently shaded craters near both poles), they will plate the surface where they can remain stably trapped for eons if the rate of loss due to a variety of processes does not overwhelm the rate of deposition. However, many comets are sufficiently large that a collisionally thick atmosphere should form. The migration of water molecules for these events has not been modeled, so the efficiency of deposition and the structure of the resultant deposits are not known. Many searches for deposits of water ice near both lunar poles have been conducted using radar backscatter data. to date, no such deposits have been found. A recent analysis of epithermal neutron data measured using the Lunar Prospector neutron spectrometer has provided a positive identification of enhanced deposits of H near both poles. Although a likely interpretation of these deposits is in terms of water-ice trapped within permanently shaded craters, other interpretations that of the migration of solar wind H cannot be ruled out at this time. A preliminary analysis of fast neutron data, also measured using the Lunar Prospector neutron spectrometer, provides only an upper limit to the signature expected for surface deposits of H near the poles. A consistent interpretation of all three datasets (epithermal neutrons, radar backscatter, and fast neutrons) is possible if water ice does indeed reside in permanently shaded craters near both poles, but is buried beneath a few tens of centimeters of dry regolith. We will discuss the neutron measurements and their interpretation. We will also discuss advances that can be made by correlating Lunar Prospector data with information returned using other techniques to define the total area contained within permanently shaded craters near both poles.

Author

Craters; Hydrogen; Ice; Water; Lunar Crust; Lunar Composition; Lunar Geology; Lunar Resources; Lunar Surface

19990046126 Geological Survey, Branch of Astrogeology, Flagstaff, AZ USA

Integrated Multispectral and Geophysical Datasets: A Global View of Lunar Pyroclastic Deposits

Gaddis, Lisa R., Geological Survey, USA; Rosanova, C., Geological Survey, USA; Hawke, B. R., Hawaii Univ., USA; Coombs, Cassandra, Charleston Coll., USA; Robinson, M., Northwestern Univ., USA; Sable, J., Amherst Coll., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 29-31; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

We are integrating multispectral Clementine UVVIS data with crustal thickness data to examine the composition and distribution of lunar pyroclastic deposits. Examples are the large deposits of Apollo 17/Taurus Littrow and Aristarchus and the small deposits (or endogenic ”dark-halo” craters) located along fractures in the floors of Alphonsus , Atlas, and Schrodinger craters. Our early efforts focus on the small pyroclastic deposits because of their relative youth (about 1 Ga in some cases), their broad global distribution, and the fact that their small sizes may have inhibited early Earth-based (about 500 m spectral spot size at best) spectral analyses. We are now studying a variety of small deposits, including those of the Atlas Crater, Franklin Crater, Eastern Frigoris highlands, Oppenheimer Crater, Lavoisier Crater. and Orientale Crater regions. Our goals are to: (1) understand the full extent of interdeposit compositional variations among small lunar pyroclastic deposits; (2) evaluate the possible effects of soil maturation and lateral mixing on the ”true” compositions of these deposits; (3) determine the prevalence and nature of intradeposit compositional variations; (4) identify and characterize the juvenile components of these deposits; and (5) understand the implications of these results for studying lunar eruption mechanisms.

Author

Lunar Maria; Volcanology; Lunar Craters; Selenology; Lunar Composition; Lunar Surface

19990046127 Lunar and Planetary Inst., Houston, TX USA

Differences Observed in Iron Content between Crater Ejecta and Surrounding Mare Basalt Surfaces: Implications for Sample Remote Sensing Integration

Gillis, Jeffrey J., Lunar and Planetary Inst., USA; Spudis, Paul D., Lunar and Planetary Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 31-32; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Remote sensing techniques are utilized to extend sample data to regional and global scales. Equally important is knowledge of rock types not represented in the current sample collection. Before either of these questions can be addressed, one question must first be answered: How does remote analysis of a planet's surface relate to the uncompromised composition of bedrock? The paucity of exposed rocks on the lunar surface means that remote chemical and mineralogical analysis records direct information about the soils. In this work we examine ways to evaluate how and if the composition of the surface material is representative of the bedrock material below. Processing of Clementine images was performed using ISIS software developed by the USGS, in Flagstaff. Images were converted to absolute reflectance using photometric equations. Maps displaying the distribution of Fe were constructed using Clementine 750- and 950- nm images. The technique for calculating Fe abundance is shown to have eliminated the effects of surface brightness and albedo, thus yielding accurate Fe concentrations for the Apollo and Luna landing sites.
Author

Basalt; Bedrock; Iron; Lunar Surface; Mineralogy; Lunar Craters; Lunar Maria; Ejecta

19990046128 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

Use of a Geographic Information System Database of Bright Lunar Craters in Determining Crater Chronologies

Grier, Jennifer A., Arizona Univ., USA; McEwen, Alfred S., Arizona Univ., USA; Strom, R., Arizona Univ., USA; Lucey, Paul G., Hawaii Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 33; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

To determine the flux of impactors onto the lunar and the terrestrial surface in recent (about 600 Ma) time, believable, absolute ages for a vast number of bright-rayed craters on the lunar surface are needed. Ideally, absolute ages can be determined by obtaining samples from each crater, radiometrially dating them, and then extrapolating an impactor flux. Realistically, it is clear that only a small number of the larger lunar craters can and will be radiometrically dated. The smaller craters are also of interest, since they will reflect the bulk of any very recent impactor population. Thus, large numbers of dates cannot be generated solely by this method. On the other hand, a large number of relative ages can conceiveably be generated by examination of lunar spacecraft spectral data with near global coverage. The Clementine color dataset provides global lunar coverage and appropriate spatial resolution to undertake such a survey. The Optical Maturity Parameter (OMAT) appears to be a possible tool for assisting in the determination of the relative ages of bright-rayed craters, but the limitations and applicability of this tool for such a survey need to be determined. An extensive survey of bright-rayed craters down to small sizes (1 km or less) will be conducted using the Clementine color data. A relative crater chronology will be generated using several tools, including super positioning of rays, OMAT images, current age estimates for craters, current estimates for the rates of soil maturization, etc. The radiometric ages from known craters included in the survey will allow this relative chronology to be constrained absolutely and a crater flux to be generated. Such an endeavor, if successfully carried out, would have far-reaching significance in understanding recent/ future cratering on the Earth and Moon, and in the interpretation of cratered surfaces and crater chronologies. Toward this end, initially, we conducted a survey of bright lunar craters in the 750-nm UVVIS in order to take a preliminary look at the size-frequency distribution of bright craters down to very small sizes, and to explore possible biases such as phase angle and background terrain.
Author

Color; Lunar Craters; Lunar Surface; Time Measurement; Geochronology; Selenology; Lunar Geology

19990046129 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA

Lunar Prospector Data Archives

Guinness, Edward A., Washington Univ., USA; Binder, Alan B., Lunar Research Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 33-34; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Lunar Prospector (LP) is operating in a 100-km circular polar orbit around the Moon. The LP project's one-year primary mission began in January 1998. A six-month extended mission in a lower orbit is also possible. LP has five science instruments, housed on three booms: a gamma-ray spectrometer, a neutron spectrometer, an alpha-particle spectrometer, a magnetometer, and an electron reflectometer. In addition, a gravity experiment uses Doppler tracking data to derive gravity measurements. The major science objectives of LP are to determine the Moon's surface abundance of selected elements, to map the gravity and magnetic

fields, to search for surface ice deposits, and to determine the locations of gas release events. The Geosciences Node of the NASA's Planetary Data System (PDS) is providing a lead role in working with the Lunar Prospector project to produce and distribute a series of archives of LP data. The Geosciences Node is developing a Web-based system to provide services for searching and browsing through the LP data archives, and for distributing the data electronically or on CDs. This system will also provide links to other relevant lunar datasets, such as Clementine image mosaics and telescopic and laboratory spectral reflectance data.
Author
Lunar Prospector; Lunar Surface; Data Bases; Data Retrieval; World Wide Web

19990046130 Pittsburgh Univ., Dept. of Geology and Planetary Science, Pittsburgh, PA USA
The Vapor Deposition Model of Space Weathering: A Strawman Paradigm for the Moon
Hapke, Bruce W., Pittsburgh Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 34-35; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Understanding space weathering on the lunar surface is essential to solving a number of major problems, including correctly interpreting lunar remote-sensing observations, understanding physical and chemical processes in the lunar regolith, and extrapolating to other bodies, especially Mercury, the asteroids, and the parent bodies of the ordinary chondrites. Hence, it is of great importance to correctly identify the process or processes that dominate lunar space weathering. The vapor deposition model postulates that lunar space weathering occurs as a result of the production of submicrscopic metallic iron (SMFe, also called superparamagnetic iron and nanophase iron) particles in the regolith by the intrinsic differentiation that accompanies the deposition of silicate vapor produced by both solar wind sputtering and micrometeorite impacts. This is the only process that has been demonstrated repeatedly by laboratory experiments to be capable of selectively producing SMFe. Hence, at present, it must be regarded as the leading contender for the correct model of lunar space weathering. This paper reviews the features of the vapor deposition model. The basic mechanism of the model relies on the fact that the porous microrelief of the lunar regolith allows most of the vapor produced by sputtering and impacts to be retained in the soil, rather than escaping from the Moon. As the individual vapor atoms impact the soil grain surfaces, they are first weakly bound by physical adsorption processes, and so have a finite probability of desorbing and escaping. Since the O is the most volatile, it escapes preferentially. The remaining atoms become chemically bound and form amorphous coatings on lunar soil grains. Because Fe is the most easily reduced of the major cations in the soil, the O deficiency manifests itself in the form of interstitial Fe0 in the glass deposits. Subsequent heating by impacts allows the Feo atoms to congregate together by solid-state diffusion to form SMFe grains. The impacts dislodge some of the coatings, which form an additional component of the soil, and also shock-weld the mineral grains, impact-vitrified glass, and vapor-deposited glass into agglutinates. Glass generated by impact vitrification probably plays a negligible role in lunar optical properties.
Author
Lunar Rocks; Lunar Soil; Lunar Surface; Meteorite Collisions; Micrometeorites; Solar Wind; Vapor Deposition; Weathering

19990046131 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
On Estimating Provenances of Lunar Highland Materials
Haskin, Larry A., Washington Univ., USA; Jolliff, Brad L., Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 35-36; In English; See also 19990046115
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That even relatively small impacts can spread material across the face of the Moon is evident from the rays of Tycho. Tycho ejecta triggered the landslide that produced the light mantle deposit at Apollo 17 and perhaps excavated the Central Valley craters there. Basin-sized impacts appear to follow the same scaling laws as smaller impacts, as indicated by the satisfaction of a geophysical model. These giant impacts rearranged huge amounts of premare material, complicating the determination of provenance of materials collected from the highlands. We have developed a model to estimate the probability that material at a particular location might derive from a given basin or large crater. This model is based on crater scaling laws, and effects of secondary cratering. Because it accounts for the volume of primary ejecta from the basin-forming transient craters and the excavating and mixing effects of these ejecta with the substrate onto which they fall, it gives much thicker deposits than an early work. Our modeling takes into account the distribution of sizes of primary ejecta fragments (PriFrags) to obtain the probability at a given site for a deposit of a particular thickness and with a fraction of PriFrags.
Author
Ejecta; Lunar Rocks; Scaling Laws; Lunar Craters; Mathematical Models; Estimating

19990046132 Hawaii Univ., Inst. of Geophysics and Planetology, Honolulu, HI USA

Multidisciplinary Studies of Ancient Mare Basalt Deposits

Hawke, B. R., Hawaii Univ., USA; Giguere, T. A., Hawaii Univ., USA; Lucey, Paul G., Hawaii Univ., USA; Peterson, Chris A., Hawaii Univ., USA; Taylor, G. J., Hawaii Univ., USA; Spudis, Paul D., Lunar and Planetary Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 37-38; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Cryptomaria are ancient (>3.8 Ga) mare basalt deposits that are hidden or obscured by superposed higher albedo material. As such, they represent a record of the earliest mare volcanism and may be a significant volumetric contribution to the lunar crust. Interdisciplinary studies have resulted in major advances in our of ancient lunar lunar volcanism. Since the aim of this workshop is to promote integrated approaches to key problems of lunar science using multiple datasets, it seems appropriate to review the investigations that produced major advances in our understanding of ancient mare volcanism. The purposes of this report are to examine the way that multiple datasets were used to investigate ancient lunar volcanism and to present the most recent results of our studies of cryptomare using Galileo and Clementine multispectral imagery.

Author

Lunar Crust; Volcanology; Selenology; Basalt; Lunar Maria; Lunar Geology

19990046133 Brown Univ., Dept. of Geological Sciences, Providence, RI USA

Lunar Mare Basalt Volcanism: Stratigraphy, Flux, and Implications for Petrogenetic Evolution

Head, Jim W., III, Brown Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 38-40; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Lunar mare basalt deposits are an example of a vertically accreting secondary crust (derived from partial melting of planetary mantles) superposed on a platform of primary crust (derived from accretional and related heating). The small total area covered by mare deposits (about 17% of the surface) and the small volume (about 1 x 107 km3) are such that the stratigraphy, fluxes, and modes of emplacement can be documented and studied, particularly with the availability of Clementine multispectral imaging, complementary Apollo and Luna sample collections [e.g., 4-6], and Lunar Prospector data. These data can then be used to test models for the origin, ascent, and eruption of basaltic magmas, and to document the early stages of secondary crustal formation and evolution. The topic of this contribution is a synthesis of the emerging new stratigraphy, estimates of flux, an analysis of outstanding problems, and emerging constraints on petrogenetic models for generation and emplacement of secondary crustal magmas.

Author

Basalt; Lunar Maria; Magma; Lunar Crust; Selenology; Lunar Evolution; Lunar Mantle; Volcanology; Stratigraphy

19990046134 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. of Planetary Exploration, Berlin, Germany

The Lunar Source Disk: Old Lunar Datasets on a New CD-ROM

Hiesinger, H., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 40-41; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A compilation of previously published datasets on CD-ROM is presented. This Lunar Source Disk is intended to be a first step in the improvement/expansion of the Lunar Consortium Disk, in order to create an ”image-cube”-like data pool that can be easily accessed and might be useful for a variety of future lunar investigations. All datasets were transformed to a standard map projection that allows direct comparison of different types of information on a pixel-by pixel basis. Lunar observations have a long history and have been important to mankind for centuries, notably since the work of Plutarch and Galileo. As a consequence of centuries of lunar investigations, knowledge of the characteristics and properties of the Moon has accumulated over time. However, a side effect of this accumulation is that it has become more and more complicated for scientists to review all the datasets obtained through different techniques, to interpret them properly, to recognize their weaknesses and strengths in detail, and to combine them synoptically in geologic interpretations. Such synoptic geologic interpretations are crucial for the study of planetary bodies through remote-sensing data in order to avoid misinterpretation. In addition, many of the modem datasets, derived from Earth-based telescopes as well as from spacecraft missions, are acquired at different geometric and radiometric conditions. These differences make it challenging to compare or combine datasets directly or to extract information from different datasets on a pixel-by-pixel basis. Also, as there is no convention for the presentation of lunar datasets, different authors choose different map projections, depending on the location of the investigated areas and their personal interests. Insufficient or incomplete information on the map parameters used by different authors further complicates the reprojection of these datasets to a standard geometry. The goal of our efforts was to transfer previously published lunar datasets to a selected standard geometry in order to create an ”image-

cube”-like data pool for further interpretation. The starting point was a number of datasets on a CD-ROM published by the Lunar Consortium. The task of creating an uniform data pool was further complicated by some missing or wrong references and keys on the Lunar Consortium CD as well as erroneous reproduction of some datasets in the literature.
Author
CD-ROM; Extraction; Moon; Data Recording; Lunar Geology; Lunar Maps

19990046135 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Investigation of Lunar Mare Basalts: An Integrated Approach
Hiesinger, H., Brown Univ., USA; Jaumann, Ralf, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Neukum, G., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Head, Jim W., III, Brown Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 41-42; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

From previous studies we know that 17% of the lunar surface is covered by mare basalts, most of them exposed in the large impact basins of the lunar nearside. From these investigations we also know that lunar mare basalts exhibit a broad variety of ages as well as geochemical compositions. Here we present ages that are based on crater size-frequency distributions for spectrally defined lunar nearside mare basalts that are exposed in the Australe, Tranquillitatis, Humboldtianum, Serenitatis, and Imbrium Basins. We also present geochemical data for the Ti concentrations of mare basalts in Mare Tranquillitatis, Mare Humorum, Mare Serenitatis, and Mare Imbrium. From the lunar sample collection it is known that Ti-poor basalts are generally younger than Ti-rich basalts. On the other hand, we learned from remote-sensing data that there are also young basalts with high TiO2 concentrations. Therefore, in this study, we investigate the relations up ages and TiO2 concentrations, and we also stress the question of whether there is a correlation between these two parameters and what kind of correlation it is. Additionally, we discuss the influence of topography and crustal thickness on basalt eruptions on the lunar surface.
Author
Basalt; Lunar Maria; Titanium Oxides; Volcanology; Selenology; Lunar Geology; Lunar Crust

19990046136 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Integrated Studies of Impact-Basin Ejecta as Probes of the Lunar Crust: Imbrium and Serenitatis
Jolliff, Brad L., Washington Univ., USA; Haskin, Larry A., Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 42-44; In English; See also 19990046115
Contract(s)/Grant(s): NAGw-4906; NAG5-4172; NAG5-6784; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The large, late, basin impacts on the Earth side of the Moon fundamentally reshaped the structure of the crust, its surface morphology, and the composition of the megaregolith and surface soils. The latest (except for Orientale on the western limb) and largest was the Imbrium impact, which produced massive ejecta deposits over much of the Procellarum region and beyond, and ejected material that mixed with surface regolith nearly Moonwide. The basins serve as natural probes into the lunar crust; therefore, understanding the nature and composition of ejecta produced by them provides information about the crust at depth. Gravity data allow modeling of the structure of the crust beneath the basins, and from such models one can infer depths of excavation and the nature of crustal response following impact.
Author
Lunar Crust; Lunar Maria; Regolith; Ejecta; Lunar Craters; Lunar Geology; Lunar Topography; Selenology; Meteorite Craters

19990046137 NASA Johnson Space Center, Houston, TX USA
Surface-Correlated Nanophase Iron Metal in Lunar Soils: Petrography and Space Weathering Effects
Keller, Lindsay P., MVA, Inc., USA; Wentworth, Susan J., Lockheed Martin Engineering and Sciences Co., USA; McKay, David S., NASA Johnson Space Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 44-45; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Space weathering is a term used to include all of the processes that act on material exposed at the surface of a planetary or small body. In the case of the Moon, it includes a variety of processes that formed the lunar regolith, caused the maturation of lunar soils, and formed patina on rock surfaces. The processes include micrometeorite impact and reworking, implantation of solar wind and flare particles, radiation damage and chemical effects from solar particles and cosmic rays, interactions with the lunar atmosphere, and sputtering erosion and deposition. Space weathering effects collectively result in a reddened continuum slope, lowered albedo, and attenuated absorption features in reflectance spectra of lunar soils as compared to finely comminuted rocks from the same Apollo sites. Understanding these effects is critical in order to fully integrate the lunar sample collection with remotely

sensed data from recent robotic missions (e.g., Lunar Prospector, Clementine, Galileo). Our objective is to determine the origin of space weathering effects in lunar soils through combined electron microscopy and microspectrophotometry techniques applied to individual soil particles from is less than 20 pm size factions (dry-sieved) of mature lunar soils. It has been demonstrated that it is the finest size fraction (is less than 25 pm) of lunar soils that dominates the optical properties of the bulk soils.
Author
Iron; Lunar Rocks; Lunar Soil; Lunar Crust; Lunar Composition; Selenology; Lunar Geology; Lunar Maria; Regolith

19990046138 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Compositional Variation in Lunar Regolith Samples: Lateral
Korotev, Randy L., Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 45-46; In English; See also 19990046115
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The composition of samples of lunar regolith collected on the Apollo and Luna missions are highly variable; the lunar meteorites, most of which are breccias of lithified regolith from unknown locations on the Moon, extend the compositional range. Some aspects of regolith composition as inferred from studies of samples that are relevant for interpretation of data obtained remotely are discussed.
Author
Lunar Rocks; Regolith; Breccia; Lunar Geology; Selenology; Lunar Composition; Lunar Crust; Lunar Surface

19990046139 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
Compositional Variation in Lunar Regolith Samples: Vertical
Korotev, Randy L., Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 46-47; In English; See also 19990046115
Contract(s)/Grant(s): NAG5-4172; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only
Some techniques for measuring composition and mineralogy remotely detect only the upper few micrometers to millimeters of material. Is this a serious concern for lunar regolith studies? Here it is shown the centimeter-scale variation with depth in the composition of lunar regolith based on results of the studies of regolith cores taken on the Apollo missions. In short, the compositional variation of lunar regolith with depth over tens of centimeters is equivalent to that observed laterally at the surface over kilometers. On average, however, the composition of material in the upper half centimeter is probably reasonably representative of the upper half meter or more (the depth of most Apollo cores), particularly for measurements made from orbit that integrate over a large surface area.
Author
Lunar Rocks; Mineralogy; Regolith; Lunar Crust; Lunar Soil; Ferrous Metals; Titanium

19990046140 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA
On the History and Origin of LKFM
Korotev, Randy L., Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 47-49; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only
Fra Mauro is the name of a geologic formation surrounding the Imbrium Basin of the Moon as well as the name of the region of the Apollo 14 lunar landing site. The formation was named for a 16th century Italian geographer and cartographer. In its original invocation in 1971 by the Apollo Soil Survey (ASS), Fra Mauro basalt was not a crystalline basalt, but the designation of a ”compositional group” of impact glasses found in the Apollo 14 soil that were basaltic in composition. The ASS noted the similarity between the Fra Mauro basalt glass composition and sample 14310, an unbrecciated, crystalline Apollo 14 rock that would now be designated an impact melt rock. In 1972 the term Fra Mauro basalt was first applied to a rock, sample 14310, although in related papers, Fra Mauro basaltic glass was equated with KREEP. In 1973 the ASS noted that a wide range of K concentrations occurred among glasses of Fra Mauro basaltic composition in the Apollo 15 regolith. The terms high-K, moderate-K and low-K Fra Mauro first occurred in that context, but always as an adjective. Lock Fra Mauro glasses were those with 0.12 +/- 0.07% K2O, compared with 0.47 +/- 0.17% and 1.1 +/- 0.4% for moderate and high-K Fra Mauro glasses and 0.6% for Apollo 15 KREEP basalt. An important evolutionary step in the concept of low Fra Mauro basalt occurred in 1973 when the composition was first used as a component in a mass-balance (mixing) model for Apollo 16 soils [8,9] and later average highlands crust, despite that the term had

not yet been applied to an actual rock sample. The first use of the acronym LKFM occurred in a 1973 paper describing glass compositions in Apollo 16 soil.
Author
Impact Melts; Kreep; Lunar Maria; Moon; Regolith; Lunar Rocks; Lunar Geology; Lunar Soil; Selenology

19990046141 NASA Johnson Space Center, Houston, TX USA
On the Maturity of Lunar Regolith
Korotev, Randy L., Washington Univ., USA; Morris, R. V., NASA Johnson Space Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 49-50; In English; See also 19990046115
Contract(s)/Grant(s): NAG5-4172; RTOP 344-31-10-21; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Spectral reflectance properties of the lunar regolith change as the regolith ”matures” with exposure to the space environment; a regolith composed of fragments from freshly disaggregated rock is lighter, is less red, and has more spectral contrast than the same regolith after it has received lengthy exposure to the solar wind, cosmic charged particles, and micrometeorite impact. In this work we discuss some aspects of lunar regolith maturity based on the study of Apollo regolith samples that may be important to interpretation of data obtained remotely.
Author
Aerospace Environments; Charged Particles; Lunar Rocks; Micrometeorites; Regolith; Solar Wind

19990046142 Los Alamos National Lab., NM USA
Early Results from the Lunar Prospector Gamma-Ray Spectrometer
Lawrence, David J., Los Alamos National Lab., USA; Feldman, William C., Los Alamos National Lab., USA; Binder, Alan B., Lunar Research Inst., USA; Maurice, Sylvestre, Observatoire de Midi-Pyresnees, France; Barraclough, B. L., Los Alamos National Lab., USA; Elphic, Rick C., Los Alamos National Lab., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 50-51; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

One of the instruments onboard the recently launched Lunar Prospector spacecraft is a Gamma-Ray Spectrometer (GRS) designed to map the surface elemental composition of the Moon. Specifically, the objectives of the GRS are to map abundances of Fe, Ti, U, Th, K, Si, O, Mg, Al, and Ca The GRS consists of a bismuthn germanate (BGO) crystal placed within a well-shape borated plastic scintillator anti-coincidence (ACS) shield. Events triggering only the BGO and ACS are labeled as rejected events. BGO spectra for both accepted and rejected events are telemetered to the ground for later analysis. These spectra have integration periods of 32 s and are continuously collected throughout the mission.
Author
Lunar Composition; Selenology; Lunar Geology; Lunar Surface; Chemical Elements; Geochemistry; Cosmochemistry

19990046143 Colorado Univ., Lab. for Atmospheric and Space Physics, Boulder, CO USA
The Clementine Long-Wave Infrared Dataset: Brightness Temperatures of the Lunar Surface
Lawson, Stefanie, Colorado Univ., USA; Jakosky, B. M., Colorado Univ., USA; Park, H.-S., Lawrence Livermore National Lab., USA; Mellon, M. T., Colorado Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 51-53; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The scientific payload on the Clementine spacecraft included a Long-Wave Infrared (LWIR) camera with a single passband of width 1.5 micron centered at a wavelength of 8.75 micron. The LWIR camera had a 128 x 128 mercury cadmium telluride focal plane array and used a catadioptric lens. The field of view of the instrument was 1 degree x 1 degree. The Clementine orbit deviated +/-30 degrees from sun synchronous, and for two lunar months, dayside nadir-looking images were obtained near local noon. The LWIR spatial resolution ranged from 200 m near the poles to 55 m at the equator. Contiguous pole-to-pole imaging strips were obtained with about 10% overlap between adjacent frames. However, significant longitude gaps exist between successive orbital passes. During the systematic mapping phase of the Clementine mission, approximately 220,000 thermal-infrared images of the lunar surface were obtained. Observed LWIR radiances can be converted to brightness temperatures that provide information on various physical properties of the lunar surface. Topography, albedo, and latitude are dominant factors in determining dayside lunar thermal emission. We have completed the calibration of the LWIR camera using both preflight and in-flight data Preflight calibration was performed at Lawrence Livermore National Laboratory in an effort to measure camera characteristics such as radiometric sensitivity, gain and offset scale factors, temporal/spatial noise, and dark-noise dependence on focal-plane array temperatures. The several steps involved in the calibration routine include: converting measured DN values to radiance values; identi-

fying and eliminating bad pixels; correcting for pixel response variation across the detector array; determining the zero-flux background of the instrument; comparing LWIR measured radiances of the Apollo 17 landing site to in situ temperature measurements in order to derive absolute calibration adjustments; and finally, converting measured radiance values to temperatures via the Planck function.
Author
Brightness Temperature; Clementine Spacecraft; Infrared Radiation; Lunar Surface; Calibrating

19990046144 Hawaii Univ., Inst. of Geophysics and Planetology, Honolulu, HI USA
Quantitative Mineralogic and Elemental Abundance from Spectroscopy of the Moon: Status, Prospects, Limits, and a Plea
Lucey, Paul G., Hawaii Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 53-54; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The methods developed recently for derivation of Fe and Ti from multispectral imaging of the Moon are empirical, but were guided in their development by a qualitative model of the lunar surface spectral properties enunciated by Rava and Hapke. Their development also critically depended on a dataset for lunar soils where both reflectance spectra and the elemental abundance methods have known (at least upper) limits on their accuracy and precision by comparing abundance measurements of the soils used to develop and test these techniques. Some of the uncertainty observed in the deviations between measured and predicted element concentrations are likely due to shortcomings in the assumptions in the methods. These include that particle size or size distribution is constant or a smooth function of composition, that Ti is primarily partitioned into ilmenite and that ilmenite, is the sole opaque, or that the ratio of ilmenite to other opaques is constant or a smooth function of TiO2 content, and that the specific mineral in which ferrous Fe resides is unimportant. In the list above the phrase ”smooth function of composition” is often repeated. Because the methods are empirical, that is, they are calibrated against known compositions, certain types of these assumption violations do not give rise to errors. The types are those where important parameters such as grain size are highly correlated with composition. Any parameter that ordinarily might be a profound source of error will be compensated if its variations are primarily correlated with the relevant elemental concentration. Limitations in accuracy and precision due to mineralogic variations have not been sufficiently explored. The major mafic minerals all possess absorption bands near I pm and to first order they have similar strengths at the same concentration of Fe, but this has not been quantified. Any differences in band strengths at constant FeO among the different minerals will give rise to mineralogy-dependent systematic errors. We have made preliminary measurements that suggested that this effect is minor, but more work is necessary. Also, mineralogy can affect the distribution of Fe. Do two soils with identical FeO values but greatly different Mg numbers give rise to the same FeO content predicted from spectra? Again,we have made preliminary measurements that suggested this effect is minor, but more work in this area is necessary. These dependencies will be presented at the workshop.
Author
Lunar Soil; Lunar Surface; Mineralogy; Reflectance; Surface Properties; Geochemistry; Lunar Geology; Selenology; Lunar Composition

19990046145 Observatoire de Midi-Pyresnees, Toulouse, France
The Lunar Prospector Neutron Spectrometer Dataset
Maurice, Sylvestre, Observatoire de Midi-Pyresnees, France; Feldman, William C., Los Alamos National Lab., USA; Barraclough, B. L., Los Alamos National Lab., USA; Elphic, Rick C., Los Alamos National Lab., USA; Lawrence, David J., Los Alamos National Lab., USA; Binder, Alan B., Lunar Research Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 54; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Lunar Prospector carries a Neutron Spectrometer (NS) whose purpose is: (1) to search for H, perhaps in the form of buried water ice at the lunar poles and/or in the form of solar wind implanted in mature regolith, and (2) to map the surface composition in Ti, Fe, and KREEP. Initial analysis of the data has shown that NS measurements may also (3) provide valuable clues to the sub-surface temperature and, perhaps, surface thermal heat flow. The NS consists of two 5.7-cm diameter by 20-cm long 3He gas proportional counters. One is covered with Cd and so responds only to epithermal neutrons (0.3 eV is less than E is less than.SMeV). The other is covered with Sn and so responds to both thermal and epithermal neutrons. The difference in their counting rates provides a measure of the flux of thermal neutrons (E is less than 0.3 eV). Results: Since it was powered up (Jan. 8, 1998), the NS has operated flawlessly, returning data of excellent quality. Pulse height spectra over 32 channels in both energy ranges are gathered every 32 s. During this accumulation time, typically 600 neutrons are counted (for a spacecraft altitude of 100 km). Measurements during the cruise phase showed that most, if not all, of these neutrons originate from the Moon. As of late June 1998, 12 full map-cycle coverages of the Moon have been completed. The presentation will explain how the NS dataset was

obtained and processed. Counts integrated over portions of pulse height spectra that are low in background counts will be presented as a function of the surface content in Fe and Ti. In addition to these spectra, we shall detail the data of different origins that support the NS analysis: quantities that are proxies for the rate of cosmic rays, as well as data that give spacecraft location and housekeeping information. The main steps of the data processing (integrity of the 32-s frames, gain drifts, latitude and altitude corrections) will be discussed. We will specify the stages of the analysis that have been completed and the ones that are planned to obtain more elaborate data products. Naturally, early science results on the science objectives mentioned above will be reviewed.
Author
Kreep; Neutrons; Regolith; Surface Temperature; Thermal Neutrons; Lunar Composition; Lunar Environment; Lunar Temperature

19990046146 Washington Univ., Dept. of Geological Sciences, Seattle, WA USA
The Stratigraphy and Evolution of the Lunar Crust
McCallum, I. Stewart, Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 54-55; In English; See also 19990046115
Contract(s)/Grant(s): NAG5-4540; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Reconstruction of stratigraphic relationships in the ancient lunar crust has proved to be a formidable task. The intense bombardment during the first 700 m.y. of lunar history has severely perturbed the original stratigraphy and destroyed the primary textures of all but a few nonmare rocks. However, a knowledge of the crustal stratigraphy as it existed prior to the cataclysmic bombardment about 3.9 Ga is essential to test the major models proposed for crustal origin, i.e., crystal fractionation in a global magmasphere or serial magmatism in a large number of smaller bodies. Despite the large difference in scale implicit in these two models, both require an efficient separation of plagioclase and mafic minerals to form the anorthositic crust and the mafic mantle. Despite the havoc wreaked by the large body impactors, these same impact processes have brought to the lunar surface crystalline samples derived from at least the upper half of the lunar crust, thereby providing an opportunity to reconstruct the stratigraphy in areas sampled by the Apollo missions. As noted, ejecta from the large multiring basins are dominantly, or even exclusively, of crustal origin. Given the most recent determinations of crustal thicknesses, this implies an upper limit to the depth of excavation of about 60 km. of all the lunar samples studied, a small set has been recognized as ”pristine”, and within this pristine group, a small fraction have retained some vestiges of primary features formed during the earliest stages of crystallization or recrystallization prior to 4.0 Ga. We have examined a number of these samples that have retained some record of primary crystallization to deduce thermal histories from an analysis of structural, textural, and compositional features in minerals from these samples. Specifically, by quantitative modeling of (1) the growth rate and development of compositional profiles of exsolution lamellae in pyroxenes and (2) the rate of Fe-Mg ordering in orthopyroxenes, we can constrain the cooling rates of appropriate lunar samples. These cooling rates are used to compute depths of burial at the time of crystallization, which enable us to reconstruct parts of the crustal stratigraphy as it existed during the earliest stages of lunar history.
Author
Crystallization; Ejecta; Lunar Crust; Lunar Geology; Lunar Surface; Mineralogy; Minerals; Stratigraphy; Selenology; Lunar Evolution

19990046147 Kyushu Univ., Dept. of Earth and Planetary Sciences, Fukuoka, Japan
Measurements of the Lunar Gravity Field using a Relay Subsatellite
Namiki, Noriyuki, Kyushu Univ., Japan; Hanada, H., National Astronomical Observatory, Japan; Kawano, N., National Astronomical Observatory, Japan; Heki, K., National Astronomical Observatory, Japan; Iwata, T., National Space Development Agency, Japan; Ogawa, M., National Space Development Agency, Japan; Takano, T., Tokyo Univ., Japan; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 55-57; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Estimating spherical harmonic coefficients of the lunar gravity field has been a focus in selenodesy since the late 1960s when Doppler tracking data from lunar orbiters were first analyzed. Early analyses were limited by the low degree and order of the spherical harmonic solutions, mostly due to the slow speed and low memory of the then-available computers. However, rapid development of the computational ability has increased the resolution of the lunar gravity models significantly. Doppler tracking data from lunar orbiters 1-5 and Apollo subsatellites up to degree and order 60 (Lun60d) have been analyzed. Further, the tracking data from the Clementine spacecraft launched in 1994 has been incorporated, and a model complete to degree and order 70 (GLGM-2) has been developed. These high-resolution gravity models have been used for studies of internal structure and tectonics of the Moon. Interestingly, Lun60d and GLGM-2 show significant differences in the spherical harmonic coefficients for degree greater than 20. Because the semimajor axis of Clementine’s orbit is nearly twice as large as the radius of the Moon, the contribution of the

new tracking data is prevailed in the low-degree field. Methodologically, the differences in the high-degree field arise from the different weighting of the tracking data and gravity model, but, in principle, these are caused by a lack of tracking data over the farside. While the current Lunar Prospector mission is expected to improve the spatial resolution over the mid- to high-latitude regions of the nearside significantly, the absence of Doppler tracking data over the farside remains unresolved. to complete the coverage of tracking over the farside, we are developing a satellite-to-satellite (four-way) Doppler tracking experiment in SELENE (the SELenological and ENgineering Explorer) project of Japan. Outline of the Mission: The SELENE is a joint project by the National Space Development Agency of Japan (NASDA) and the Institute of Space and Astronautical Science (ISAS). Two spacecraft, a main orbiter and a relay subsatellite, constitute the SELENE. The SELENE is scheduled to be launched in 2003. After the SELENE is injected into an elliptical polar orbit of 1 00-km periapsis altitude and 2424-km apoapsis altitude, the relay subsatellite is separated from the main orbiter. Then the main orbiter gradually decreases the eccentricity to a circular orbit in which altitude and inclination are 100 km and 950, respectively. When the mission instruments, including a relay subsatellite transponder for the gravity measurement (RSAT), complete global mapping after a nominal I -year period, the propulsion module of the main orbiter is deorbited to land on the Moon. A differential VLBI experiment by two radio sources on the relay subsatellite and the propulsion module (VRAD-1 and 2) continues until the relay subsatellite will fall on to the lunar surface approximately two months later [6]. RSAT Mission: RSAT is a communication subsystem on the relay subsatellite [7] for four-way Doppler tracking among the main orbiter, the relay subsatellite, and the Usuda Deep Space Center of ISAS (UDSC) [8], as well as two-way range and Doppler measurements, between the relay subsatellite and UDSC (Fig. 1). At the same time, the Tracking and Communication Stations (TACS) of NASDA conduct conventional two-way ranging and Doppler observations of the main orbiter when the main orbiter is visible from Earth.
Author
Gravitational Fields; Lunar Gravitation; Lunar Surface; Selenology; Moon; Lunar Geology; Lunar Exploration; Lunar Far Side

19990046148 Notre Dame Univ., Dept. of Civil Engineering and Geological Sciences, IN USA
Mare Basalts as Mantle Probes: Dichotomies Between Remotely Gathered and Sample Data
Neal, Clive R., Notre Dame Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 57-59; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Mare basalts and pyroclastic glasses allow our only petrologic look at the lunar mantle, as bonafide mantle xenoliths are not present in the existing lunar sample collection. Knowledge thus gleaned demonstrates that the there was an early ”lunar magma ocean” (LMO), the cooling of which produced an igneous cumulate mantle forming source regions for mare basalts. More sophisticated models demonstrated that late-stage ilmenite-rich cumulates would be denser than early cumulates and sink, or cause limited to full-scale overturn of the cumulate pile. Still under debate is the scale of the LMO: Was this whole Moon melting or only the outer about 400 km? If whole Moon melting is invoked, then differentiation of the Moon into a flotation plagioclase-rich crust, a mafic mineral cumulate mantle, and an Fe-rich core is more easily facilitated. Some have suggested that the lunar core is made up of the dense, ilmenite-rich late-stage cumulates from the lunar magma ocean because the material that formed the Moon came primarily from already differentiated Earth mantle, so it would not contain enough Fe to form a metallic Fe core. How can mare volcanism be used to constrain such models?
Author
Basalt; Igneous Rocks; Lunar Core; Lunar Mantle; Lunar Rocks; Magma; Lunar Evolution; Lunar Crust

19990046149 NASA Goddard Space Flight Center, Greenbelt, MD USA
Lunar Basins: New Evidence from Gravity for Impact-Formed Mascons
Neumann, Gregory A., Massachusetts Inst. of Tech., USA; Lemoine, F. G., NASA Goddard Space Flight Center, USA; Smith, D. E., NASA Goddard Space Flight Center, USA; Zuber, M. T., NASA Goddard Space Flight Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 59-60; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The prominent gravity highs (mascons) associated with uncompensated mass anomalies in lunar mare basins are a dramatic expression of the present-day rigidity of the lunar lithosphere. First discovered in Lunar Orbiter tracking data, these about 350-mGal gravity highs have been redetermined from the analysis of Clementine and historical tracking. These highs coincide with topographic lows, indicating nonisostatic support. One of the rediscoveries of this analysis is the encirclement of the highs by substantial negative anomalies over topographic highs. Recent gravity fields are providing the increased resolution necessary to determine the causes of this unique mascon signature. The compensation of the basin anomalies remains controversial. The mascon highs have long been interpreted as the result of mare loading, subsequent to the decay of residual stresses resulting from the impact. Substantially more mare fill is required to produce mascon highs than has been inferred on geological grounds, and

the amount of near-surface mass deficit required to produce a gravity most exceeds bounds inferred from terrestrial examples. This problem is most acute for the youngest basin, Orientale. Recent gravity fields from Lunar Prospector have suggested mascon highs associated with nonmare basins such as Mendel-Rydberg, or minimally filled basins like Humboldtianum, further calling this explanation into question. We suggest that the mascon gravity signal is produced by a combination of crustal thickness changes, manifested by central mantle uplift, outward displacement of crust, and downward flexure of the lithosphere under mare loading. The mantle uplift is superisostatic, maintained by residual stresses resulting from the process of impact cratering and modification. In particular, the process of crater collapse and mantle rebound terminates abruptly, leaving the mantle plug in a non-equilibrium state, surrounded by a ring of thickened crust. Viscous relaxation over geological timescales has erased some but not all of the signature of the impact process. Mantle uplift inferred from gravity modeling is inversely correlated with age. While the oldest basins such as South Pole Aitken are mainly compensated isotatically, the younger basins appear to have been in a state of superisostatic loading prior to mare emplacement. If this is true, this places an important constraint on the impact process at basin scales. The idea that rebound of the transient crater via acoustic fluidization may freeze substantial stresses imcomplete to this day, may be tested by examining the gravity signatures of major basins on terrestrial bodies. The moon provides the clearest resolved examples to date, but uncertainty in gravity knowledge remains problematic.
Author
Gravitational Fields; Lunar Maria; Mascons; Structural Basins; Topography; Gravity Anomalies; Lunar Craters; Selenology; Lunar Gravitation; Lunar Geology; Lunar Rocks

19990046150 Lawrence Livermore National Lab., Livermore, CA USA
Comments on "Radar Search for Ice at the Lunar South Pole" by R. Simpson and G. L. Tyler
Nozette, Stewart D., Lawrence Livermore National Lab., USA; Lichtenberg, C. L., Naval Research Lab., USA; Bonner, R., Naval Research Lab., USA; Spudis, Paul, Lunar and Planetary Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 60-61; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

This paper is a good start to providing a second analysis of the original Clementine bistatic radar data. However, the paper does not replicate the analysis contained therein, and omits several key points that call the conclusions of this paper into question. There are also a number of misunderstandings concerning the previous work in that require correction. It appears the author's primary objective is to refute those findings with an incomplete analysis, not to perform a thorough search for evidence of ice in the data. Specific points are discussed in the paper.
Author
Ice; Radar Data; Multistatic Radar; Lunar Radar Echoes; Selenology

19990046151 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Constraints on Our View of the Moon, 1, Convergence of Scale and Context
Pieters, Carle M., Brown Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 61-62; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Perhaps the greatest challenge to using remotely acquired compositional information to resolve fundamental planetary science questions is realistically understanding the difference between information gathered with remote detectors and that obtained with sophisticated instruments in the laboratory. Small-scale processes associated with space weathering are discussed in a companion abstract. Outlined here are issues associated with interpreting data from different scales and context.
Author
Moon; Remote Sensing; Lunar Geology; Lunar Rocks; Regolith; Lunar Mantle

19990046152 Brown Univ., Dept. of Geological Sciences, Providence, RI USA
Constraints on Our View of the Moon, 2, Space Weathering
Pieters, Carle M., Brown Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 62-63; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A variety of processes set limits on how closely remote sensing data can be coupled to science issues requiring detailed compositional analyses. Issues related to small-scale regolith processes, and space weathering in particular, are outlined here. Larger-

scale issues are discussed in a companion abstract. This outline is presented to provoke discussion and is not assumed to be comprehensive.
Author
Moon; Weathering; Lunar Composition; Lunar Geology; Selenology; Meteoritic Damage; Solar Wind; Cosmic Rays

19990046153 Indiana Univ., Dept. of Geological Sciences, Bloomington, IN USA
Average Mineral Composition of Apollo Landing Site Soils
Riegsecker, Sue E., Indiana Univ., USA; Tieman, A., Indiana Univ., USA; Basu, Abhijit, Indiana Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 63-64; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The purpose of this paper is to express the average composition of lunar soils at Apollo landing sites in terms of four principal mineral groups, i.e., plagioclase, pyroxene, olivine and opaque (mostly ilmenite) Several studies have shown that lunar soil predominantly consists of lithic fragments of mare and highland rocks, glass fragments, fused soil particles, and the single grains of minerals. to achieve this goal, we have compiled modal data from the literature and recast them in terms of these minerals. The distribution of percentages for the lithic and mineral components of the lunar soil samples (90-150 pm) was compiled from the modal data in the Handbook of Lunar Soils and checked against primary sources. We used our own analyses for soils 14141, 15271, 15401, 15431, 67941, and 72161. The population of glass, regolith breccia, and fused soil was neglected on the assumption that they approximately represented the modal distribution of the minerals in the soil. Grains classified as anorthosites, gabbronorite, crystalline breccias, and highland basalt were grouped as ”higuand rocks”; those classified as mare basalt and KREEP basalt were grouped as ”mare rocks.”
Author
Basalt; Kreep; Lunar Soil; Minerals; Regolith; Lunar Maria; Mineralogy; Moon; Lunar Composition

19990046154 National Space Development Agency, Advanced Mission Research Center, Tsukuba, Japan
Conceptual Design of the Ground-Data Processing System for the Lunar Imager/Spectrometer Onboard the SELENE Mission
Shiraishi, Atsushi, National Space Development Agency, Japan; Haruyama, J., National Space Development Agency, Japan; Otake, H., National Space Development Agency, Japan; Ohtake, M., National Space Development Agency, Japan; Hirata, N., National Space Development Agency, Japan; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 64-66; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The lunar orbiter and lander system SELENE (Selenological and Engineering Explorer) is now in preliminary design phase toward an expected launch day in 2003. Along with the hardware design, we have started the conceptual discussion of a ground-data processing facility with other SELENE members. We are also constructing related databases for the ground-control experiments, such as spectral research on Earth, lunar, and meteoritic minerals. In our poster, we will introduce the current status of the development of the ground-data processing and database system for one of the SELENE mission instruments, LISM, the Lunar Imager/ Spectrometer.
Author
Lunar Orbiter; Spectra; Spectrometers; Data Bases; Data Retrieval

19990046155 Stanford Univ., Center for Radar Astronomy, Stanford, CA USA
Radar Search for Water Ice at the Lunar Poles
Simpson, Richard A., Stanford Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 66-67; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Unusual signatures were discovered in radar backscatter data from Europa, Ganymede, and Callisto 20 years ago and have since been widely interpreted as arising from electromagnetic interactions with inhomogeneities in low-loss materials such as water ice Radar echoes from Mars, Mercury, and Titan also appear to exhibit some of the same features and are consistent with the water ice interpretation. During April 1994, the Clementine spacecraft high-gain antenna was aimed toward the Moon’s surface and the resulting 13-cm wavelength radio echoes were received on Earth. Using those data, researchers have claimed detection of an enhancement in echoes with right circular polarization from regions near the south pole in a near-backscatter geometry and have inferred the presence of water ice. We have reanalyzed the same data and have reached a different conclusion.
Author
Ice; Lunar Surface; Water; Radar Data

19990046156 Tennessee Univ., Planetary Geosciences Inst., Knoxville, TN USA

Geochronologic and Isotropic Constraints on Thermal and Mechanical Models of Lunar Evolution

Snyder, Gregory A., Tennessee Univ., USA; Taylor, Lawrence A., Tennessee Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 67-69; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Both short-lived and long-lived geochronometers are key to our understanding of the thermal and mechanical evolution of planets and satellites. These isotopic studies not only allow us to set time constraints on various processes (core formation, melting, crystallization, impact), but also allow us to determine the chemical and mineralogic characteristics of plausible sources. Thermal and mechanical models derived from remote spectroscopy and geophysical data must be tempered by such studies. We present three case studies where the ground truth afforded by radiogenic isotopic studies and geochronology have drastically changed (or should change) prevailing models determined from remote sensing and geophysics: (1) ferroan anorthosites (FANs) and the magma ocean hypothesis, (2) highlands plutonic-suite rocks and late KREEP formation from a magma ocean, and (3) high-Ti basalt sources and ilmenite-sinking in the lunar mantle In addition, we will mention several other outstanding problems in lunar petrology and geochemistry where remote sensing and geophysics could prove useful in cutting the Gordian knot.
Author

Geochemistry; Geochronology; Lunar Evolution; Lunar Mantle; Magma; Moon; Lunar Composition; Lunar Geology; Lunar Surface; Selenology

19990046157 Lunar and Planetary Inst., Houston, TX USA

Topography of the South Polar Region from Clementine Stereo Imaging

Spudis, Paul D., Lunar and Planetary Inst., USA; Cook, A., National Air and Space Museum, USA; Robinson, M., Northwestern Univ., USA; Bussey, B., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Fessler, B., Lunar and Planetary Inst., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 69-70; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Clementine spacecraft made the first near-global topographic map (referenced to a mean lunar radius of 1738 km) of the Moon from laser altimetry (LA). Because the spacecraft was in an elliptical orbit and the laser ranger could not detect returns when the spacecraft was farther than 600 km from the Moon, we do not possess ranging data for latitudes within 15 degrees of the poles. However, the UVVIS imager on Clementine obtained images from different perspectives in space from which stereo information may be derived and topographic models produced. The poles were especially well covered in stereo and we have used images of the south polar area to infer topographic information in areas not sampled by the laser altimeter. We here describe preliminary results in our construction of a Digital Elevation Model (DEM) of the south polar area of the Moon.
Author

Moon; Polar Regions; Relief Maps; Lunar Surface; Surface Properties; Selenology; Lunar Topography; Lunar Geology; Selenography

19990046158 Pacific Univ., Mathematics Dept., Forest Grove, OR USA

Automated Search for Lunar Lava Tubes in the Clementine Dataset

Taylor, Allen G., Pacific Univ., USA; Gibbs, A., Lewis and Clark Coll., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 70-71; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A significant problem in computer science, which has become increasingly acute recently, is the automatic extraction and cataloging of desired features from large sets of complex images. Solution of this problem could potentially have broad applicability. As a prototype of this kind of problem, our group has chosen to attempt the automatic retrieval of lava tubes from the Clementine dataset. Lunar lava tubes have long been recognized as desirable locations for the placement of manned lunar bases. Advantages include that (1) little construction is needed; (2) building materials need not be lifted out of Earth's gravity well; (3) the tubes provide natural environmental control; and (4) the tubes provide natural protection from cosmic rays, meteorites, micrometeorites, and impact crater ejecta. Coombs and Hawke identified about 100 probable lava tubes associated with sinuous rilles in the Lunar Orbiter and Apollo photos, primarily in the nearside maria. The lava tubes that are visible to Earth-based telescopes might be too large to provide good candidates for lunar bases. Such lava tubes of large diameter need a great depth of overlying rock to keep from collapsing. Any intact large tubes would lie inconveniently far underground. Most useful would be lava tubes that are too small to be discerned from Earth. The Clementine spacecraft, which mapped the entire surface of the Moon to an unprecedented level of detail in 1994, gives us a view of these smaller lava tubes. Over 1.9 million images in the visible, near infrared, and mid-infrared portions of the spectrum were captured. Our task is to find and catalog the small lava tubes in the Cle-

mentine dataset. of particular interest are small sinuous rifles that contain interruptions, which represent uncollapsed portions of a tube that has partially collapsed. Once cataloged, the candidate base locations can be examined more closely for suitability. Considerations would be proximity to resources, sites of scientific interest, or favorable locations for siting of a railgun satellite launcher.
Author
Lava; Lunar Bases; Moon; Lunar Exploration; Lunar Geology; Ground Truth

19990046159 NASA Johnson Space Center, Houston, TX USA
Reflectance Spectroscopy and Lunar Sample Science: Finally a Marriage After Far Too Long an Engagement
Taylor, Lawrence A., Tennessee Univ., USA; Pieters, Carle, Brown Univ., USA; McKay, David S., NASA Johnson Space Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 71-72; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Inferences about the igneous and impact evolution of planetary bodies are based upon spectral remote sensing of their surfaces. However, it is not the rocks of a body that are seen by the remote sensing, but rather the regolith, that may contain small pieces of rock but also many other phases as well. Indeed, recent flybys of objects even as small as asteroid Ida have shown that these objects are covered by a regolith. Thus, spectral properties cannot be directly converted into information about the igneous history of the object. It is imperative to fully understand the nature of the regolith, particularly its finer fraction termed ”soil,” to appreciate the possible effects of ”space weathering” on the reflectance spectra. We have initiated a study of our nearest, regolith-bearing body, the Moon, as ”ground truth” for further probes of planetary and asteroidal surfaces. the foundation for remote chemical and mineralogical analyses lies in the physics underlying optical absorption and the linking of spectral properties of materials measured in the laboratory to well understood mineral species and their mixtures. From this statement, it is obvious that there should be a thorough integration of the material science of lunar rocks and soils with the remote-sensing observations. That is, the lunar samples returned by the Apollo missions provide a direct means for evaluation of spectral characteristics of the Moon. However, this marriage of the remote-sensing and lunar sample communities has suffered from a prolonged unconsummated betrothal, nurtured by an obvious complacency by both parties. To make more direct and quantitative links between soil chemistry/mineralogy and spectral properties, we have initiated a program to (1) obtain accurate characterization of the petrography of lunar soils (in terms relevant to remote analyses), coupled with (2) measurement of precise reflectance spectra, with testing and use of appropriate analytical tools that identify and characterize individual mineral and glass components. It is the finest-sized fractions of the bulk lunar soil that dominate the observed spectral signatures.
Author
Lunar Geology; Lunar Rocks; Lunar Soil; Moon; Petrography; Regolith; Remote Sensing; Ground Truth; Reflectance; Astronomical Spectroscopy

19990046160 Science Applications International Corp., Chantilly, VA USA
Composition and Structure of the Lunar Crust
Tompkins, Stefanie, Science Applications International Corp., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 72-73; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A multispectral-based survey of the central peaks of lunar impact craters has suggested intriguing compositional trends in the lunar crust. More detailed studies are necessary to refine the results of the survey, however, regarding the maturity of central peak surfaces, and the depth of origin of central peak rocks with respect to the original structure of the lunar crust. These studies will rely upon a combination data, including geophysical predictions of crustal thickness, impact cratering predictions, laboratory spectra of lunar samples, and both telescopic and space-based spectral measurements of lunar surface.
Author
Lunar Crust; Lunar Geology; Lunar Soil; Lunar Surface; Selenology; Lunar Composition; Lunar Craters

19990046161 NASA Johnson Space Center, Houston, TX USA
Evidence for Phyllosilicates near the Lunar South Pole
Vilas, Faith, NASA Johnson Space Center, USA; Jensen, E., Texas A&M Univ., USA; Domingue, Deborah, Johns Hopkins Univ., USA; McFadden, L., Maryland Univ., USA; Coombs, Cassandraa, Charleston Coll., USA; Mendell, Wendell, NASA Johnson Space Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 73-74; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

While theoretically water ice could be stable in permanently shadowed areas near the lunar poles, there is conflicting observational evidence for the existence of water ice at either pole. Clementine's bistatic radar resumed a weak signal commensurate with water ice in the South Pole Aitken Basin; however, groundbased radar searches have not detected such a signal at either pole. Lunar Prospector measured large amounts of H (attributed to water) at both poles; however, Galileo near-infrared spectral measurements of the north polar region did not detect the prominent 3.0 micron absorption feature due to interlayer and adsorbed water in phyllosilicates. Evidence for the existence of water at the lunar poles is still ambiguous and controversial. We present evidence, based on the analysis of Galileo SSI images, for the presence of phyllosilicates near the lunar south pole. Using the color image sequence (560 nm, 670 nm, 756 nm, and 889 nm) of Lunmap 14 taken during the Galileo Earth-Moon pass I, we have identified areas that show evidence for a 0.7 microns absorption feature present in Fe-bearing phyllosilicates.
Author
Ice; Silicates; Water; Lunar Composition; Lunar Environment; Lunar Exploration; Weathering; Solar Wind

19990046162 California Univ., Inst. of Geophysics, Los Angeles, CA USA
A Brief Review of the Scientific Importance of Lunar Meteorites
Warren, Paul H., California Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 74-75; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The lunar meteorites (lunaites) represent a valuable extension to the Apollo/Luna sampling of the Moon's surface debris. In this abstract, I briefly review the insights that have been gained from studies of these meteorites.
Author
Lunar Surface; Meteorites; Regolith; Meteoritic Composition; Lunar Rocks; Lunar Composition; Selenology; Lunar Geology

19990046163 California Univ., Inst. of Geophysics, Los Angeles, CA USA
Pristine Rocks, Remote Sensing, and the Lunar Magmasphere Hypothesis
Warren, Paul H., California Univ., USA; Kallemeyn, G. W., California Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 75-76; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The strongest evidence for the lunar magmasphere hypothesis is still the pronounced geochemical bimodality among pristine nonmare rocks. Magnesium-suite (MgS) rocks have a distinctly higher mg ratio than ferroan anorthositic suite (FAS) cumulates of otherwise similar geochemistry (e.g., Na/Ca, REE, and especially Eu/AI). Well-sampled FAS rocks are uniformly anorthositic, and must have been buoyant over their FeO-rich parent melts. Well-sampled MgS rocks have consistently moderate play contents' and must have been negatively buoyant in relation to their parent melts. Ferroan chemistry is an expected outcome of magmasphere fractionation. MgS chemistry is consistent with origin by localized "serial magmatism," where the primary magmas were prone to assimilate magma ocean residuum (urKREEP) on the way from mantle to crust.
Author
Geochemistry; Magma; Lunar Exploration; Lunar Surface; Regolith; Kreep

19990046164 NASA Johnson Space Center, Houston, TX USA
Effects of Space Weathering on Lunar Rocks: Scanning Electron Microscope Petrography
Wentworth, Susan J., Lockheed Martin Engineering and Sciences Co., USA; Keller, Lindsay P., MVA, Inc., USA; McKay, David S., NASA Johnson Space Center, USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 76-77; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Lunar rocks that have undergone direct exposure to the space weathering environment at the surface of the Moon commonly have patinas on their surfaces. Patinas are characterized by visible darkening and other changes in spectral properties of rocks. They form as a result of bombardment by micrometeorites, solar wind, and solar flares. Processes of space weathering and patina production have clearly been significant in the formation and history of the lunar regolith. It is very likely that other planetary bodies without atmospheres have undergone similar alteration processes; therefore, it is critical to determine the relationship between patinas and their host rocks in view of future robotic and remote-sensing missions to the Moon and other planetary bodies.
Author
Aerospace Environments; Darkening; Lunar Rocks; Micrometeorites; Petrography; Solar Wind; Weathering; Selenology; Extraterrestrial Environments; Lunar Environment

19990046165 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA

Integrating Geophysics with Remotely Sensed Data and the Apollo Samples

Wieczorek, Mark A., Washington Univ., USA; Phillips, R. J., Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 77-78; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Our understanding of the gravity and topography field of the Moon has improved dramatically with data collected from the recent Clementine mission. Near-global spectroscopic observations of the surface from this mission have also given us a vast dataset that is only beginning to be fully explored. Additionally, even though the expansive Apollo sample collection has been analyzed for more than 20 yr, there are many questions that have not been resolved regarding their origin and original provenance. We ask, from a geophysical perspective, what is the best way to integrate these three seemingly disparate disciplines to address lunar problems? This is a timely question, for as this is being written, Lunar Prospector is orbiting the Moon collecting global gamma-ray data, as well as improved gravity tracking. Within a year or two, we will have an order of magnitude better understanding of both the gravity field, as well as the near-surface composition. Elemental concentration maps should be made available for most major rock-forming elements (e.g., Fe, Mg, Ca, Si, and Ti), as well as some trace elements (e.g., K, Th, U, and H). When these compositional maps are finally released, how will they be used to improve our understanding of the geology of the Moon? Although there are many ways in which geophysical studies could be integrated with either the sample data or remote-sensing data, we suggest that the most fruitful synthesis will come from investigating both the lateral and vertical variability in the structure and composition of the lunar crust. by investigating the nature of material ejected from large impact basins, the stratigraphy of the preimpact crust can be inferred. Specifically, using a model of the crustal thickness from geophysical studies, it should be possible to predict the radial variation of ejecta mineralogy using impact-cratering scaling relations. Furthermore, elemental concentration maps should be able to independently assess the radial variation in ejecta mineralogy. Since the geophysical models of crustal structure are not unique, the remote sensing observations will enable us to determine which models of crustal structure are plausible. Additionally, since we have samples that are believed to have come from large impact basins, these samples will provide ground truth for both the remote-sensing data and impact-cratering models.

Author

Ejecta; Geophysics; Mineralogy; Moon; Lunar Geology; Lunar Topography; Lunar Composition; Lunar Maps; Minerals; Lunar Rocks

19990046166 Washington Univ., Dept. of Earth and Planetology, Saint Louis, MO USA

The Imbrium and Serenitatis Basins: Impacts in an Anomalous Lunar Province

Wieczorek, Mark A., Washington Univ., USA; Haskin, Larry A., Washington Univ., USA; Korotev, Randy L., Washington Univ., USA; Jolliff, Brad L., Washington Univ., USA; Phillips, R. J., Washington Univ., USA; Workshop on New Views of the Moon: Integrated Remotely Sensed, Geophysical, and Sample Datasets; 1998, pp. 78-79; In English; See also 19990046115; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Recent geophysical analyses of the Imbrium and Serenitatis Basins suggest that the crustal structure beneath these basins is highly anomalous. Specifically, Imbrium and Serenitatis appear to have only excavated material from shallow crustal depths, whereas proportional scaling laws (valid for basins at least as large as Crisium) predict that the entire crustal column, as well as a small fraction of mantle material, should have been excavated during these events. Gamma-ray data from the Apollo and Lunar Prospector missions suggest that the Imbrium and Serenitatis Basins lie within (or on the boundary of) an anomalous nearside high-Th geochemical province. We believe that the anomalous crustal structure associated with the Imbrium and Serenitatis Basins is directly related to these impacts occurring within this anomalous region of the lunar crust. We postulate that the high-Th geochemical province is a manifestation of the final stages of cooling of a global ”magma ocean” and that a residual KREEP-rich magma body was located beneath the crust in this region approximately 3.9 Ga. An impact into this province at this time would have led to voluminous KREEP-basalt volcanism (filling in the excavation cavity of these basins), and the dispersal of KREEP-rich ejecta (the Th-rich mafic impact melt breccias). The next two sections discuss our motivation for postulating such a scenario from both the geophysical and geochemical perspective. Following this discussion we expand the hypothesis presented above and end with a list of testable predictions. .

Author

Geochemistry; Geophysics; Kreep; Lunar Crust; Lunar Maria; Selenology; Lunar Craters

19990046293 NASA Marshall Space Flight Center, Huntsville, AL USA

High Performance Materials Applications to Moon/Mars Missions and Bases

Noever, David A., NASA Marshall Space Flight Center, USA; Smith, David D., NASA Marshall Space Flight Center, USA; Sibille, Laurent, Universities Space Research Association, USA; Brown, Scott C., Southern Research Inst., USA; Cronise, Ray-

mond J., NASA Marshall Space Flight Center, USA; Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; 1998; In English; Engineering, Construction and Operations in Space, 26-30 Apr. 1998, Albuquerque, NM, USA; Sponsored by American Society of Civil Engineers, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Two classes of material processing scenarios will feature prominently in future interplanetary exploration: in situ production using locally available materials in lunar or planetary landings and high performance structural materials which carve out a set of properties for uniquely hostile space environments. to be competitive, high performance materials must typically offer orders of magnitude improvements in thermal conductivity or insulation, deliver high strength-to-weight ratios, or provide superior durability (low corrosion and/or ablative character, e.g., in heat shields). The space-related environmental parameters of high radiation flux, low weight, and superior reliability limits many typical aerospace materials to a short list comprising high performance alloys, nanocomposites and thin-layer metal laminates (Al-Cu, Al-Ag) with typical dimensions less than the Frank-Reed-type dislocation source. Extremely light weight carbon-carbon composites and carbon aerogels will be presented as novel examples which define broadened material parameters, particularly owing to their extreme thermal insulation (R-32-64) and low densities (is less than 0.01 g/cu cm) approaching that of air itself. Even with these low-weight payload additions, rocket thrust limits and transport costs will always place a premium on assembling as much structural and life support resources upon interplanetary, lunar, or asteroid arrival. As an example, for in situ lunar glass manufacture, solar furnaces reaching 1700 C for pure silica glass manufacture in situ are compared with sol-gel technology and acid-leached ultrapure (is less than 0.1% FeO) silica aerogel precursors.
Author

Moon; Mars (Planet); Mars Missions; Aircraft Construction Materials; Spacecraft Construction Materials; Mars Bases

19990046556 Kitt Peak National Observatory, Tucson, AZ USA

Chemical Abundances of Planetary Nebulae in the Bulge and Disk of M31

Jacoby, George H., Kitt Peak National Observatory, USA; Ciardullo, Robin, Pennsylvania State Univ., USA; December 1998; 50p; In English

Contract(s)/Grant(s): NSF 92-57822; NAG5-3403

Report No.(s): NOAO-Preprint-828; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We derive abundances and central star parameters for 15 planetary nebulae (PNe) in M31: 12 in the bulge and 3 in a disk field 14 kpc from the nucleus. No single abundance value characterizes the bulge stars: although the median abundances of the sample are similar to those seen for PNe in the LMC, the distribution of abundances is several times broader, spanning over 1 decade. None of the PNe in our sample approach the super metal-rich ([Fe/H] approximately 0.25) expectations for the bulge of M31, although a few PNe in the sample of Stasinska, Richer, & Mc Call (1998) come close. This [O/H] vs [Fe/H] discrepancy is likely due to a combination of factors, including an inability of metal-rich stars to produce bright PNe, a luminosity selection effect, and an abundance gradient in the bulge of M31. We show that PNe that are near the bright limit of the [O III] lambda.5007 planetary nebula luminosity function (PNLF) span nearly a decade in oxygen abundance, and thus, support the use of the PNLF for deriving distances to galaxies (Jacoby 1996) with differing metallicities. We also identify a correlation between central star mass and PN dust formation that partially alleviates any dependence of the PNLF maximum magnitude on population age. Additionally, we identify a spatially compact group of 5 PNe having unusually high O/H; this subgroup may arise from a recent merger, but velocity information is needed to assess the true nature of the objects.
Author

Andromeda Galaxy; Planetary Nebulae; Local Group (Astronomy); Star Formation; Disk Galaxies; Galactic Bulge

19990046606 NASA Goddard Space Flight Center, Greenbelt, MD USA

Lunar Prospector Extended Mission

Folta, David, NASA Goddard Space Flight Center, USA; Beckman, Mark, NASA Goddard Space Flight Center, USA; Lozier, David, NASA Ames Research Center, USA; Galal, Ken, NASA Ames Research Center, USA; 1999; In English; Flight Mechanics, 18 May 1999, Greenbelt, MD, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The National Aeronautics and Space Administration (NASA) selected Lunar Prospector as one of the discovery missions to conduct solar system exploration science investigations. The mission is NASA's first lunar voyage to investigate key science objectives since Apollo and was launched in January 1998. In keeping with discovery program requirements to reduce total mission cost and utilize new technology, Lunar Prospector's mission design and control focused on the use of innovative and proven trajectory analysis programs. As part of this effort, the Ames Research Center and the Goddard Space Flight Center have become partners in the Lunar Prospector trajectory team to provide the trajectory analysis, maneuver planning, orbit determination support, and product generation. At the end of 1998, Lunar Prospector completed its one-year primary mission at 100 km altitude above the lunar surface. On December 19, 1998, Lunar Prospector entered the extended mission phase. Initially the mission orbit was lowered from 100 km to a mean altitude of 40 km. The altitude of Lunar Prospector varied between 25 and 55 km above the

mean lunar geode due to lunar potential effects. After one month, the lunar potential model was updated based upon the new tracking data at 40 km. On January 29, 1999, the altitude was lowered again to a mean altitude of 30 km. This altitude varies between 12 and 48 km above the mean lunar geode. Since the minimum altitude is very close to the mean geode, various approaches were employed to get accurate lunar surface elevation including Clementine altimetry and line of sight analysis. Based upon the best available terrain maps, Lunar Prospector will reach altitudes of 8 km above lunar mountains in the southern polar and far side regions. This extended mission phase of six months will enable LP to obtain science data up to 3 orders of magnitude better than at the mission orbit. This paper details the trajectory design and orbit determination planning, and actual results of the the Lunar Prospector extended mission including maneuver design, eccentricity & argument of perigee evolution, and lunar potential modeling.
Author
Lunar Prospector; Lunar Surface; NASA Programs; Altitude; Lunar Exploration; Lunar Programs; Clementine Spacecraft; Altimetry

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SOLAR PHYSICS

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

19990045902 Alabama Univ., Dept. of Mechanical and Aerospace Engineering, Huntsville, AL USA
On Wave Processes in the Solar Atmosphere ***Final Report***
Musielak, Z. E., Alabama Univ., USA; December 1998; 7p; In English
Contract(s)/Grant(s): NAG8-1084; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This grant was awarded by NASA/MSFC to The University of Alabama in Huntsville (UAH) to investigate the physical processes responsible for heating and wind acceleration in the solar atmosphere, and to construct theoretical, self-consistent and time-dependent solar wind models based on the momentum deposition by finite amplitude and nonlinear Alfven waves. In summary, there are three main goals of the proposed research: (1) Calculate the wave energy spectra and wave energy fluxes carried by magnetic non- magnetic waves. (2) Find out which mechanism dominates in supplying the wave energy to different parts of the solar atmosphere. (3) Use the results obtained in (1) and (2) to construct theoretical, self-consistent and time- dependent models of the solar wind. We have completed the first goal by calculating the amount of non-radiative energy generated in the solar convection zone as acoustic waves and as magnetic tube waves. to calculate the amount of wave energy carried by acoustic waves, we have used the Lighthill-Stein theory for sound generation modified by Musielak, Rosner, Stein & Ulmschneider (1994). The acoustic wave energy fluxes for stars located in different regions of the Hertzsprung-Russell (H-R) diagram have also been computed. The wave energy fluxes carried by longitudinal and transverse waves along magnetic flux tubes have been calculated by using both analytical and numerical methods. Our analytical approach is based a theory developed by Musielak, Rosner & Ulmschnelder and Musielak, Rosner, Gall & Ulmschneider, which allows computing the wave energy fluxes for linear tube waves. A numerical approach has been developed by Huang, Musielak & Ulmschneider and Ulmschneider & Musielak to compute the energy fluxes for nonlinear tube waves. Both methods have been used to calculate the wave energy fluxes for stars located in different regions of the HR diagram (Musielak, Rosner & Ulmschneider 1998; Ulmschneider, Musielak & Fawzy 1998). Having obtained the wave energy fluxes for acoustic and magnetic tube waves, we have investigated the behavior of these waves in the solar and stellar atmospheres. The results of our extensive studies have been published in many papers and presented at numerous scientific meetings. In these studies we have investigated different aspects of propagation of acoustic and magnetic waves, the efficiency of energy transfer along magnetic structures in the solar atmosphere, and behavior of Alfven waves in stgeady and expanding solar and stellar atmospheres. Recently, we have used some of these results to construct first purely theoretical, two component and time-dependent models of solar and stellar chromospheres. Finally, to address the third goal, we have constructed first fully theoretical, self-consistent and time dependent wind models based on the momentum deposition by non-linear Alfven waves. The full set of single-fluid MHD equations with the background flow has been solved by using a modified version of the ZEUS MHD code. The constructed wind models are radially symmetric with the magnetic field decreasing radially and the initial outflow is described by the standard Parker wind solution. In contrast to previous studies, no assumptions regarding wave linearity, wave damping, and wave-flow interaction are made; the models thus naturally account for the backreaction of the wind on the waves as well as for the nonlinear interaction between different types of MHD waves. The models have been used to explain the origin of fast speed streams in solar coronal holes. The obtained results clearly demonstrate that the momentum deposition by Alfven waves in the

solar wind can be sufficient to explain the origin of fast stream components of the solar wind. The range of wave amplitudes required to obtain the desired results seems to be in good agreement with recent observations.
Author
Magnetic Field Configurations; Magnetic Flux; Solar Atmosphere; Solar Wind; Energetic Particles; Stellar Atmospheres; Magnetohydrodynamic Waves; Energy Spectra; Solar Convection (Astronomy)

19990045960 National Optical Astronomy Observatories, Tucson, AZ USA
Estimation of Seeing Quality Using Low-Resolution Solar Image Data
Bell, Eric F., National Optical Astronomy Observatories, USA; Hill, Frank, National Optical Astronomy Observatories, USA; Harvey, John W., National Optical Astronomy Observatories, USA; December 1998; 24p; In English
Report No.(s): NOAO-Preprint-827; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modulation transfer functions (MTFs), generated as a by-product of the analysis of low-resolution solar images taken for the Global Oscillation Network Group, were used to estimate the quality of seeing at its six sites. These MTFs, after approximate correction for the effects of the instrumental point spread function, were fitted with physically-motivated functional forms representing the effects of seeing and scattering. It was found that the estimates of seeing quality were relatively robust to the effects of scattering, but were severely biased by effects caused by changes in instrumental focus. Relative trends in seeing quality are preserved on timescales shorter than a few months and it is found that local topography dominates the observed trends in daytime seeing quality.
Author
Modulation Transfer Function; Helioseismology; Global Tracking Network; Data Acquisition; Trend Analysis; Scattering

19990046075 National Optical Astronomy Observatories, Tucson, AZ USA
SOLIS: A Modern Facility for Synoptic Solar Observations
Keller, C. U., National Solar Observatory, USA; Mar. 1998; 11p; In English; Conference 3352: Astronomical Telescopes and Instrumentation, 20-28 Mar. 1998, Kona, HI, USA; Sponsored by International Society for Optical Engineering, USA
Report No.(s): NOAO-Preprint-786; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

SOLIS (Synoptic Optical Long-term Investigations of the Sun) is a suite of instruments that will modernize and greatly improve synoptic solar observations carried out by the National Solar Observatory. It will provide fundamental data necessary to understand the solar activity cycle, sudden energy releases in the solar atmosphere, and solar spectral irradiance changes. State-of-the-art instrumentation and data collection techniques will be employed to enhance both the quality and quantity of data. A high degree of automation and remote control will provide faster user access to data and flexible interaction with the data-collection process. The instruments include a vector spectromagnetograph that will measure the magnetic field strength and direction over the full solar disk in 15 minutes, a full disk patrol delivering digital images in various spectral lines at a high cadence, and a Sun-as-a-star precision spectrometer to measure changes in many spectral lines.
Author
Solar Observatories; Syncope; Sun

19990046246 National Optical Astronomy Observatories, Tucson, AZ USA
Scattering Polarization in the Chromosphere
Keller, C. U., National Solar Observatory, USA; Sheeley, N. R., Jr., Naval Research Lab., USA; February 1999; 30p; In English; Solar Polarization, 12-16 Oct. 1998, Bangalore, India
Report No.(s): NOAO-Preprint-832; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Scattering polarization from the photosphere observed close to the solar limb has recently become of interest to study turbulent magnetic fields, abundances, and radiative transfer effects. We extend these studies by measuring the scattering polarization off the limb, i.e. in the chromosphere. However, instrumental effects are much more pronounced and more complicated than those affecting on-disk measurements. In particular, scattered light from the telescope mirrors leads to a new type of instrumental polarization that we describe in detail. The differences between the linearly polarized spectra on the disk and off the limb are often very substantial. Here we show the profiles of HeI D(sub 3), the OI triplet at 777 nm, and the NaI D lines. The change in the latter is in reasonable agreement with the recent modeling efforts of atomic polarization in the lower level by Landi Degl'Innocenti (1998).
Author
Scattering; Chromosphere; Photosphere; Solar Limb; Planetary Limb; Polarized Radiation; Solar Spectra

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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.

19990045971 Los Alamos National Lab., NM USA
Innovative method for extracting isotopic information from low-resolution gamma spectra
Miko, D.; Estep, R. J.; Rawool-Sullivan, M. W.; Dec. 31, 1998; 5p; In English; Symposium on radiation measurements and applications
Report No.(s): DE99-000666; LA-UR-98-1899; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A method is described for the extraction of isotopic information from attenuated gamma ray spectra using the gross-count material basis set (GC-MBS) model. This method solves for the isotopic composition of an unknown mixture of isotopes attenuated through an absorber of unknown material. For binary isotopic combinations the problem is nonlinear in only one variable and is easily solved using standard line optimization techniques. Results are presented for NaI spectrum analyses of various binary combinations of enriched uranium, depleted uranium, low burnup Pu, Cs-137, and Ba-133 attenuated through a suite of absorbers ranging in Z from polyethylene through lead. The GC-MBS method results are compared to those computed using ordinary response function fitting and with a simple net peak area method. The GC-MBS method was found to be significantly more accurate than the other methods over the range of absorbers and isotopic blends studied.
NTIS
Isotopes; Extraction; Gamma Ray Spectra

19990045976 Oxford Univ., Oxford Astrophysics, Oxford, UK
The Mass of X-Ray Nova Scorpii 1994 (=GRO J1655-40)
Shahbaz, T., Oxford Univ., UK; vanderHooft, F., Astronomical Inst., Netherlands; Casares, J., Universidad de La Laguna (Spain)., Spain; Charles, P. A., Oxford Univ., UK; vanParadijs, J., Astronomical Inst., Netherlands; Jan. 26, 1999; In English
Report No.(s): OUAST/99/2; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We have obtained high and intermediate resolution optical spectra of the black-hole candidate Nova Sco 1994 in May/June 1998, when the source was in complete (X-ray) quiescence. We measure the radial velocity curve of the secondary star and obtain a semi-amplitude of K(sub 2) = 215.5 +/- 2.4 km/ s, which is 6 per cent lower than the only previously determined value. This new value for K(sub 2) thus reduces the binary mass function to f(M) = 2.73 +/- 0.09 solar mass. Using only the high resolution spectra we constrain the rotational broadening of the secondary star, v sin i, to lie in the range 82.9 - 94.9 km/s (95 per cent confidence) and thus constrain the binary mass ratio to lie in the range 0.337 - 0.436 (95 per cent confidence). We can also combine our results with published limits for the binary inclination to constrain the mass of the compact object and secondary star to the ranges 5.5 - 7.9 and 1.7 - 3.3 solar mass respectively (95 per cent confidence). Finally, we report on the detection of the Lithium resonance line at 6707.8 A, with an equivalent width of 55 +/- 8 mA.
Author
Scorpius Constellation; Stellar Mass; Observation; Spectra

19990046292 NASA Marshall Space Flight Center, Huntsville, AL USA
Discovery of Correlated Behavior Between the Hard X-Ray and the Radio Bands in Cygnus X-3
McCollough, M. L., Universities Space Research Association, USA; Robinson, C. R., Universities Space Research Association, USA; Zhang, S. N., Universities Space Research Association, USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Hjellming, R. M., National Radio Astronomy Observatory, USA; Waltman, E. B., Naval Research Lab., USA; Foster, R. S., Naval Research Lab., USA; Ghigo, F. D., National Radio Astronomy Observatory, USA; Johnston, K. J., Naval Observatory, USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Using CGRO/BATSE hard X-ray data and GHz radio monitoring data from the Green Bank Interferometer (GBI), we have performed a long term study (approximately 1800 days) of the unusual X-ray binary Cygnus X-3 resulting in the discovery of a remarkable relationship between the two wavelength bands. We find that quiescent radio states are strongly anticorrelated with the intensity of the hard X-ray emission. With the onset of a flaring state the relationship switches to a correlation. This is most

easily seen in the larger (> or = 1 Jy) flares where the preflare quenched radio emission is accompanied by a very low hard X-ray intensity, and recovery of the hard X-ray flux during the radio flare. The injection of plasma into the radio jets, associated with Cyg X-3, can be directly related to changes in the hard X-ray emission, and suggests the possibility of accretion-related and jet-related components of the high energy emission.
Author
X Rays; Radio Emission; X Ray Binaries; Correlation; Extraterrestrial Radiation

19990046319 NASA Marshall Space Flight Center, Huntsville, AL USA
Identification of the Periodic Hard X-Ray Transient GRO J1849-03 with the X-Ray Pulsar GS 1843-02 = X1845-024: A New Be/X-Ray Binary
Soffitta, P., NASA Marshall Space Flight Center, USA; Tomsick, J. A., NASA Marshall Space Flight Center, USA; Harmon, B. A., NASA Marshall Space Flight Center, USA; Costa, E., NASA Marshall Space Flight Center, USA; Ford, E. C., NASA Marshall Space Flight Center, USA; Tavani, M., NASA Marshall Space Flight Center, USA; Zhang, S. N., NASA Marshall Space Flight Center, USA; Kaaret, P., NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

We identify the periodic transient hard X-ray source GRO J1849-03 with the transient x-ray pulsar GS 1843-02 = X1845-024 based on the detection of x-ray outbursts from X1845-024 coincident with hard x-ray outbursts of GRO J1849-03. Based on its spin period of 94.8 s and its orbital period of 241 days, we classify the system as a Be/X-ray binary.
Author
X Ray Binaries; Pulsars; Stars; X Ray Astronomy

19990046322 NASA Marshall Space Flight Center, Huntsville, AL USA
Monte Carlo Simulations of Background Spectra in Integral Imager Detectors
Armstrong, T. W., NASA Marshall Space Flight Center, USA; Colborn, B. L., NASA Marshall Space Flight Center, USA; Dietz, K. L., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Weisskopf, M. C., NASA Marshall Space Flight Center, USA; 1998; In English; Internat, Gamma-Ray Astrophysics Lab., 14-18 Aug. 1998, Taormina, Italy; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Predictions of the expected gamma-ray backgrounds in the ISGRI (CdTe) and PiCsIT (Csl) detectors on INTEGRAL due to cosmic-ray interactions and the diffuse gamma-ray background have been made using a coupled set of Monte Carlo radiation transport codes (HETC, FLUKA, EGS4, and MORSE) and a detailed, 3-D mass model of the spacecraft and detector assemblies. The simulations include both the prompt background component from induced hadronic and electromagnetic cascades and the delayed component due to emissions from induced radioactivity. Background spectra have been obtained with and without the use of active (BGO) shielding and charged particle rejection to evaluate the effectiveness of anticoincidence counting on background rejection.
Author
Monte Carlo Method; Computerized Simulation; Background Radiation; Computer Programs; Radiation Detectors

99
GENERAL

19990043944 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Technology Reports of Kyushu University, Volume 71
Mar. 1998; ISSN 0023-2718; 78p; In Japanese; See also 19990043945 through 19990043946; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: characteristics of discharge in plasma jet emitter, and on errors of pulsating flow measurement by a Yawmeter with spherical head and a numerical flow analysis.
CASI
Flow Measurement; Numerical Analysis; Plasmas (Physics)

19990046093 National Inst. of Standards and Technology, Gaithersburg, MD USA

Journal of Research of the National Institute of Standards and Technology, November/December 1998. Volume 103, Number 6

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Contents include the following: Calculating the Effects of Longitudinal Resistance in Multi-Series-Connected Quantum Hall Effect Devices; A Problem in AC Quantized Hall Resistance Measurements and a Proposed Solution; Development of a Bolometer Detector System for the NIST High Accuracy Infrared Spectrophotometer; Spectral Response Based Calibration Method of Tristimulus Colorimeters; Aperture Proximity Effects in High Heat Flux Sensors Calibration; Calculation of Measurement Uncertainty Using Prior Information; Least-Squares Fitting Algorithms of the NIST Algorithm Testing System.

NTIS

Calibrating; Algorithms; Hall Effect

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